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Report of the Design Team for the Northwest Frontier Province Agricultural University

PAKISTAN AGRICULTURAL EDUCATION, RESEARCH AND EXTENSION

Project Number 391-0488

Submitted to The U. S. Agency for International Development Mission to Pakistan

Submitted by The University of Illinois at Urbana-Champaign in Collaboration with Southern Illinois University at Carbondale

June 28, 1983

REPORT OF THE DESIGN TEAM
FOR THE
NORTHWEST FRONTIER PROVINCE AGRICULTURAL UNIVERSITY

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CHAPTER 1

THE NWFP AGRICULTURAL UNIVERSITY: AN OVERVIEW

The Northwest Frontier Province Agricultural University was established under the provisions of NWFP Ordinance No. 1 of 1981 (notification date 4 February, 1981). It was established as an outgrowth of the Faculty of Agriculture of the University of Peshawar with "an autonomous status for its further growth, and for the purpose of improving teaching, research and administration." This action culminated more than 50 years of efforts to improve higher education in agriculture in the NWFP.

In 1930, agriculture was introduced into the curriculum of Islamia College located at Peshawar. With the establishment of the University of Peshawar in 1951, Islamia College was made a constituent College of the University. There were also Colleges of Engineering, Law and Education. Khyber Medical College was added in 1955 and the College of Agriculture was formed in 1957, followed by Colleges of Home Economics and Commerce in 1962. The College of Agriculture was upgraded to a Faculty of Agriculture of the University of Peshawar in 1970.

With the establishment of the College of Agriculture in 1957, the three-year B.Sc. degree program based on ten years of public education (matriculation) was discontinued. A revised curriculum was started in 1958 into which students were admitted who had completed matriculation. The curriculum consisted of two years of pre-agriculture studies and a three-year undergraduate program. Upon completion of this five-year program, the student was awarded a B.Sc. (Hons.) degree and was qualified for National

Pay Scale (NPS) grade 16. Beginning in 1962 options or specializations were introduced into the last year. Since the B.Sc. (Hons.) program qualified a graduate for only NPS 16 employment and most professional positions in agriculture required NPS 17 qualifications, most students continued for an M.Sc. degree in order to meet that qualification. Two types of M.Sc. programs were offered: B.Sc. plus one year of graduate study, resulting in an M.Sc. (Ordinary); or a B.Sc. plus two years of graduate study, the latter year devoted to research and thesis, culminating in M.Sc. (Hons.). Both M.Sc. degrees commanded NPS 17 positions, but the M.Sc. (Hons.) degree qualified one for more prestigious positions, or positions with greater perquisites, for example a faculty position at the University. Admission to this curriculum was discontinued after the 1978-80 academic year and the last class will complete the program in 1985.

Beginning with the 1980-81 academic year, students were admitted to a "new" curriculum with the requirement of an F.Sc. (pre-medicine) certificate. This certificate represents two years of preparation beyond the ten years matriculation, with a concentration in biological science. The F.Sc. (pre-med) is so named because it is a requirement for entrance into medicine, the most prestigious course of studies for which one is qualified. Other high school curricula culminate in F.Sc. (pre-engineering) or F.A. (Arts or Humanities) certificates. Neither the F.Sc. (pre-eng) nor F.A. certificates currently qualify one for admission to the Agricultural University.

The University program for the "new" curriculum consists of four years, the first two of which are a common core for all

students, the third year is approximately 80% common and 20% elective, and the fourth year is devoted to an elective specialization. Upon successful completion of the four-year program the student is awarded the B.Sc. (Hons.) degree and will qualify for NPS grade 17. B.Sc. (Hons) graduates may pursue a two-year graduate program for an M.Sc. (Hons.) degree and still be qualified for NPS grade 17.

An enrollment of 683 students is projected for the year beginning in September 1983, approximately the same as the 1982-83 enrollment.

Degrees Granted

The Faculty of Agriculture of the University of Peshawar and the NWFP Agricultural University granted 757 B.Sc. degrees and 552 M.Sc. degrees during the 11-year period from 1970-71 to 1980-81 (Table 1.1). The degrees were concentrated in the soil and plant sciences.

Table 1.1. B.Sc. and M.Sc. Degrees Granted by the Faculty of Agriculture, University of Peshawar and the NWFP-AU, 1970-71 to 1980-81 by Specialization.

Specialization	B.Sc.	M.Sc.
Agronomy	163	138
Entomology	84	56
Horticulture	82	53
Plant Breeding and Genetics	93	73
Soil Science	135	100
Food Technology	61	46
Agricultural Chemistry	67	39
Agricultural Economics, Rural Sociology and Extension Education	45	23
Animal Husbandry	27	24
TOTAL	757	552

The Academic and Administrative Faculty

There are 94 academic and administrative faculty members in the NWFP Agricultural University (Table 1.2). Sixty-five percent have their highest degree from inside Pakistan and 35% have their highest degree from outside. Of those who received their highest degree outside Pakistan, 48% were from U.S. universities. Ten of the twelve Department Heads have M.S. or Ph.D. degrees from a U.S. university, most of them received during the time that USAID provided assistance to the University of Peshawar from 1954 to 1965. Only 14 staff members (15%) have earned Ph.D. degrees. The low proportion with Ph.D. degrees hampers effort in guidance of work at the M.Sc. level and in faculty-planned and conducted research.

The faculty is more provincial than is desirable because most of them have had their training at Peshawar colleges and universities, and most of their experience is in the NWFP. One faculty member is on leave, serving in Saudia Arabia; six are away for Ph.D. degrees, three at Pakistan universities, one in the U.S., and two in Wales. Two more are scheduled to go to the U.S. soon. In addition, it is expected that seven faculty members will attend U.S. universities for non-degree, M.Sc., or Ph.D. training beginning in 1983-84.

The average age of the faculty is 39. Many were appointed to the staff of the Agricultural University or its predecessor institutions at an early age so have relatively long years of service. With the exception of five or six faculty members, most current staff members have 10 to 20 years of service to give to the University prior to retirement at age 60.

Table 1.2. Academic staff numbers by department, rank, and training at the NWFP Agricultural University, June 1983

Department	Degree source*	Mean age 1983	NPS 21 V.C.	NPS 20 Professor		NPS 19 Assoc. Prof.		NPS 18 Asst. Prof.		NPS 17 Lecturer			NPS 16	Sub-total	Total
			Ph.D.	Ph.D.	M.Sc.	Ph.D.	M.Sc.	Ph.D.	M.Sc.	Ph.D.	M.Sc.	B.Sc.	Dip.		
Vice Chancellor	0		1											1	1
Agronomy	I	31							1		1			2	
	0	45			2		1	1	1					5	7
Plant Breeding	I	37					1		3		4			8	
	0	50		1		2								3	11
Entomology	I	33							1		1			2	
	0	39			1	2		1		1	1			6	8
Horticulture	I	37					2				1	1		4	
	0	49		1	1									2	6
Soil Science	I	34					1		3		2			6	
	0	41			1				1					2	8
Animal Husbandry	I	35									4			4	
	0	43			1	1	1		2					5	9
Agr. Mechanization	I	34									1	1		2	
	0	44					1		1					2	4
Food Technology	I	41							1		1			2	
	0	43					1		1					2	4
Agr. Econ. and Extension	I	32							1					1	
	0	49		1					1					2	3
Inst. of Devel. Std.	I	35					1		2		8			11	
	0	52		1										1	12
Agr. Chemistry	I	35							4		2			6	
	0	42				1	1							2	8
English**	I	32							2		2			4	4
Islamic Studies**	I	41							1					1	1

Table 1.2. Continued

Department	Degree source*	Mean age 1983	NPS 21 V.C. Ph.D.	NPS 20 Professor Ph.D.	NPS 20 Professor M.Sc.	NPS 19 Assoc. Prof. Ph.D.	NPS 19 Assoc. Prof. M.Sc.	NPS 18 Asst. Prof. Ph.D.	NPS 18 Asst. Prof. M.Sc.	NPS 17 Lecturer Ph.D.	NPS 17 Lecturer M.Sc.	NPS 17 Lecturer B.Sc.	NPS 16 Dip.	Sub-total	Total
Math., Stat., and Physics	I	42					1		2		1			4	4
Library**	I	37									1		1	2	2
Experimental Farm	I	39	—	—	—	—	—	—	1	—	1	—	—	2	2
Subtotal	I	36					6		22		30	2	1	61	
	0	44	1	4	6	6	5	2	7	1	1			33	
	All		1	10		17		31		34			1		94
Percent	I													64.9	
	0													35.1	
	All		1.1	10.6		18.1		33.0		36.1			1.1		100.0

* Source of highest degree: I = Inside Pakistan, NWFP; O = Outside Pakistan, of which 48.5% were from universities in the U.S.A.

** Staff members in the English and Islamic Departments and Library have M.A. degrees instead of M.Sc. degrees.

Current Administrative Structure

The administrative structure of the NWFP Agricultural University is in transition. The Departments from the Faculty of Agriculture, University of Peshawar were retained in the NWFP-AU. The Ordinance creating the new Agricultural University did not provide for Faculties; but it was later amended to create three Faculties. There are Deans of the three Faculties, each of whom also serves as Department Head. The roles of Deans and Department Heads are not clearly delineated; the Faculties are not yet functional.

The numbers of faculty members are not now sufficiently large to justify the current number of departments and both departmental and faculty administration. Department Heads and staff administrators report directly to the Vice Chancellor. The current administrative structure and its operation is adequate, particularly with the Vice Chancellor's participatory style of administration; however, as the University program grows to carry out its expanded missions, it will be necessary to have a more definite organizational structure with the roles of faculty, departmental, and staff administrators more clearly defined.

The Current Mission

In the past and recently, the primary mission of the NWFP-AU has been to educate young men to assume professional-level positions, primarily in the Provincial government. Nearly all the professional agricultural positions in the Province are filled by those who have completed B.Sc. (Hons.) and/or M.Sc. (Hons.)

degrees at the University or its predecessor agricultural components of Islamia College or the University of Peshawar.

Like other colleges and universities in Pakistan, the doctrine and mission have been centered around teaching only; universities have not been expected to, or financed so they could, have an organized research program. The necessity to have research to have a strong teaching program, particularly at the graduate level, has not been recognized. The orientation has been toward teaching courses leading to a degree and a government job; getting a government position seems to have been more important than performance in the position. In the teaching/learning process, emphasis has been on the lecture method on the part of the teacher and memorization on the part of the student. The annual examination has discouraged continuity of learning throughout the year and has not provided feedback from student to teacher on the effectiveness of the learning process.

The Mission of the New Agricultural University

The mission of the new University can be briefly stated as follows:

(1) to serve as the lead institution in agricultural development of the Province by education of professional manpower.

(2) to link instruction, research, and outreach functions to gain their complementarities.

(3) to develop an agricultural science-based University with a problem-solving approach in instruction, research, and outreach.

(4) to provide constructive leadership and cooperative participation with all agricultural organizations of the Province, other provinces, and the federal agricultural research and education system.

(5) to serve as a model for the role to be played by agricultural universities on a national basis.

(6) to serve both the public and private sectors of the economy.

(7) to educate both men and women to serve the agricultural sector of the Province and Nation.

(8) to improve the quality of education so the NWFP-AU has stature nationally and internationally.

(9) to institute an efficient teaching-learning process in the University that gives teachers incentives to teach and students incentives to learn.

(10) to conduct problem-solving research to solve the problems of farmers, rural households, and the agri-business interests of agriculture to increase production and productivity of human, physical, and financial resources and thereby improve the welfare of the rural people and consumers generally.

(11) to lead and collaborate in a unified research system of the Province.

(12) to conduct an outreach program in collaboration with other organizations to make the results of research useful to people of the Province and Nation.

To attain the goals suggested by this outline of missions will require major changes in the NWFP Agricultural University. The instruction program will require major reorientation and strengthening. There will be need for a strong, organized program of research with emphasis on adaptive research that is multidisciplinary in nature. This will require cooperation of a high degree between individuals, departments, faculty and students. It will require more emphasis on service to the Agricultural University to meet the developmental needs of the Province. The outreach program must be developed to demonstrate to the Province the service orientation of the University; it must be outward-looking instead of inward-looking. A program for women

must be established commensurate with the importance of women as agricultural producers and their key role in rural households.

Student Enrollment Projections

The student enrollment projections for the Agricultural University are shown in Table 1.3. The project design emphasizes the importance of improvement of the quality of the graduates, not the numbers, particularly in the early years of development of the new University when the missions will be broadened to include research and outreach. Enrollment will also be constrained by lack of hostel facilities until the new hostels can be completed. Beginning in 1987-88 enrollment is projected to increase at an annual rate of approximately 10% through 1990-91.

The University's Institute of Development Studies is currently conducting an analysis of the agricultural manpower needs of Pakistan. Data have been collected at the provincial and national levels, and largely reflect the needs of the public sector. Analysis for the NWFF indicates that, for the period from 1970-71 to 1982-83, there has been an annual increase in employment of B.Sc. and M.Sc. holders of 5% and 14%, respectively. The higher growth rate for M.Sc. holders is explained by the high ratio of M.Sc. to B.Sc. degrees awarded by the Faculty of Agriculture of the University of Peshawar responding to the requirement of the M.Sc. to obtain an N.P.S. 17 position. With the recent approval to permit B.Sc. graduates under the revised curriculum at the Agricultural University to obtain an N.P.S. 17 position, it is anticipated that fewer B.Sc. holders will want to pursue the M.Sc. Therefore a major change in the ratio of B.Sc.

Table 1.3. NWFP-AU projection of student enrollment 1983/84-1990/91

Class	83/84	84/85	85/86	86/87	87/88	88/89	89/90	90/91
B.Sc. Year I	114	132[2/]	167	181	219	222	242	266
B.Sc. Year II	161[1/]	112	130	164	178	215	218	238
B.Sc. Year III	211[1/]	160	111	129	162	176	212	215
B.Sc. Year IV	-	18	63	108	128	161	175	211
M.Sc.	195	275	224	106	71	61	66	71
	681	697	695	688	753	835	911	1,001
Baluchistan Reserved Seats	2	20	40	60	80	80	80	80
TOTAL	683	717	735	748	833	915	991	1,081

[1/] For 1983/84 B.Sc. Year II the figure includes 98 students under the "old" curriculum and 63 in the "new" curriculum. The B.Sc. Year III figure includes 193 in the "old" and 18 in the "new."

[2/] Year I students begin with the newly designed B.Sc. curriculum.

to M.Sc. students is projected. The smaller number of M.Sc. students is consistent with the need to greatly improve the quality of the M.Sc. graduates to meet the needs of positions in the research system, and in the Agricultural University itself.

The needs for degree-level trained manpower are difficult to project; however there are a number of forces underway that suggest that the expanding needs will be substantial. Graduates of the Agricultural University are now employed. The provincial research and extension system is understaffed with well-trained personnel, relative to the needs. The federal research system is expanding and there are insufficient numbers of M.Sc. and Ph.D. holders to meet the needs. An improvement of the quality of graduates will make them more attractive to employers, both in the public and private sectors.

Continuing studies of educational manpower needs will be made to ensure that the supply of B.Sc. and M.Sc. holders does not exceed the demand.

The chapters that follow report on the analysis of current programs and plans for the newly designed Agricultural University. The programs of instruction, research, and outreach are followed by the needs for faculty strengthening and development of physical facilities and equipment. The new organizational structure, leadership requirements, and needs for organizational linkage management are presented. The financial requirements and technical assistance needs conclude the report. Appendices include supporting materials in more detail than advisable to include in the body of this volume.

CHAPTER 2

STRENGTHENING THE INSTRUCTION PROGRAM

A. EVALUATION OF THE B.SC. PROGRAM

In this chapter the currently offered curricula of the North-West Frontier Province Agricultural University (NWFP-AU), are evaluated and, in light of that evaluation, recommendations are made for expanding and strengthening both the B.Sc. and M.Sc. curricula.[2-1] To provide a basis for evaluating the B.Sc. curricula, the following is a generalized description of the content of a B.Sc. curriculum in agriculture.

Any B.Sc. curriculum in Agriculture includes:

1. Basic discipline courses: agricultural chemistry, biology, mathematics, economics, etc.

[2-1]Because this report is intended for reading by both U.S. and Pakistani audiences, and because different words and phrases are used in the two cultures to express the same concept, the following is offered as U.S.-Pakistan equivalents, as understood by the writers. Since the writing was done by U.S. personnel, generally the U.S. term is used; for clarity, the reader may substitute the following equivalents:

U.S. Term	Pakistani Term
B.S. or B.Sc. (degree)	B.Sc. (Hons.)
M.S. or M.Sc. (degree)	M.Sc. (Hons.)
Major	Specialization
Course	Paper
grade	marks
take a course	read a paper
take an examination	sit for an examination
dormitory	hostel
President (Chief Adm. Officer of University)	Vice Chancellor
Vice President (for Academic Affairs)	Director for Teaching
An administrative division of common academic interest with possible sub-units or departments	A Faculty
Graduate study	Post-graduate study

2. Agriculture courses which teach:
   a. basic science applications to agricultural problems
   b. state of the art solutions to agricultural problems
   c. the inter-relatedness of agricultural problems
   d. moderate specialization in relation to student interest, abilities, career plans, etc.

3. Basic communication skills courses: e.g. writing and speaking

4. Communication skills for special needs
   a. teaching/extension skills
   b. data collection, organization and analysis skills

5. Culture-orienting courses: e.g. humanities, social sciences

With this philosophical description as a background, the following points are a summary and a critical evaluation of the current NWFP-AU admissions policies and B.Sc. curricula:

1. Only males who have completed an F.Sc. (pre-med) program are admitted. The F.Sc. (pre-med) is an 11th and 12th grade program, following the 10 year matriculation program, which emphasizes chemistry, physics and biology in addition to the required English and Urdu. The F.Sc. (pre-med) program is so named because the prestigious college training, and career choice, of the students in this program is medicine. Agriculture is typically a second or third choice for those who are unsuccessful in gaining admission to a school of medicine. This admission policy is too narrow.

2. The required core is heavily oriented toward agronomy in keeping with the locally traditional definition of agriculture as being limited to crop production or more specifically to food crop production. The current core curriculum does not give adequate attention to animal husbandry, the rural social sciences, and communication skills nor to the interrelationships of

the agricultural disciplines in seeking solutions to agricultural problems.

3. Some of the existing B.Sc. curriculum specializations are too narrow in their applied specializations (Plant Breeding and Genetics, Entomology and Soils); some are inappropriate for an agricultural university (Chemistry); and some need extensive strengthening to be considered legitimate B.Sc. programs (e.g., Agricultural Mechanization, Agricultural Economics, Agricultural Extension Education).

4. The current daily class schedule consists of 8 consecutive periods of 45 minutes each, without breaks between periods, for six days each week. During 1982-83 some students were scheduled to sit in the same lecture hall for six consecutive periods (4 1/2 hours) on each of two days per week with only a change of teachers between periods.

B. RECOMMENDED B.SC. PROGRAM

In light of the above evaluation, and of other analyses presented elsewhere in this report, the following are recommended changes in the admissions policy, the B.Sc. curricula, and the daily schedule of classes.

1. Admissions

a. The University should admit both male and female students, without discrimination because of sex, to all its programs.

b. The University should admit students who have either the F.Sc. (pre-med) or F.Sc. (pre-engineering) certificate and

should consider admitting other students whose 11th and 12th year programs included, in addition to the required English and Urdu, any three of the following four subjects: mathematics; chemistry; physics; and biology.

c. To provide equality of opportunity for persons of various ethnic, geographic, or parental-occupation sub-groups; to insure a more universal student body; and to assist in the agricultural development of other areas of national interest, the University should continue the policy of reserved admissions for specified categories of students. Special emphasis should be given to admitting students of Baluchistan. If Baluchi students with adequate academic preparation cannot be identified to fulfill the quota, the University should sponsor a remedial program for academically talented, but inadequately educated, Baluchi students to prepare them for admission into the B.Sc. curriculum. The latter recommendation is made in light of the lack of an agricultural university and the need for agricultural development in Baluchistan.

d. Students whose education is being sponsored by a third party, under an agreement between the student and the third party as to the student's required program of study, etc., should be admitted to the specialization which is specified by the sponsor. All other students should be admitted to the general program, and they should continue in the core program until the second term of the third year (see academic advisement in a later section.)

2. Core Requirements

The recommended curricula for the B.Sc. are all based on a core of required courses which is uniform for all students during the first two years, allows some branching in the third year and is almost totally devoted to the specialization in the fourth year. The recommended curriculum for the first three years (with indicated electives during Year III) are in Appendix A. Specific comments about the core requirements, by years, follow.

a. In year one, eight of the recommended courses are the same or are modifications of courses currently offered, but, in some cases now offered in a different year.

b. There are three new courses. They are:

(1) Orientation to Agricultural Professions. An orientation to: current agricultural problems in NWFP; the programs and curricula at NWFP-AU which prepare students to help solve these problems; and the agricultural careers which NWFP-AU graduates pursue.

(2) Introduction to Computers. Basic instruction in the use and application of microcomputers in agriculture. One hour of lecture and two hours of practice in the computer lab each week. This course is scheduled for Year I, but if the recommended curriculum is initiated before the computer lab and equipment are available, the computer course can be exchanged with another course in Year III. When the properly equipped lab is available, the computer course should be included in Year I.

(3) Biology I. A course offered as an alternate to Mathematics I for students admitted with F.Sc. (pre-engineering) qualifications. Pre-engineering does not include biology; it does include mathematics through calculus.

c. In the second year there are also eight courses which are similar to or are slight modifications of existing courses. The five new courses are:

(1) Microbiology. In light of the many microbiology-related problems concerning human health, food processing and preservation, animal health, ruminant nutrition, soil-plant relationships, feed and seed storage and water

quality, microbiology is a fundamental discipline on which to build appropriate agricultural technology.

(2) Agricultural Program Development and Implementation. An introductory course in the principles and practices of developing programs to create change.

(3) Animal Hygiene and Disease Control. Content and rationale self-evident from the title especially in light of 40% of the farm income in NWFP being from animals and animal products.

(4) Farming Systems Management. The typical small farm in NWFP has a large number of enterprises including agronomic crops for cash, feed and food, horticultural crops and livestock. This course teaches the students management principles and practices for successfully integrating these multi-enterprise farming units.

(5) Seminar. This course during the second term of Year II (the last term in which all students are in common core classes) has these objectives:

(a) to acquaint the students with some of the advantages and disadvantages of typical agricultural professions and with the required skills, abilities and interests needed for one to be successful in the respective career. This orientation will come through direct presentations by professionals representing various occupations.

(b) to review the specializations which a student may pursue in Year III and IV and relate the specialization to career opportunities.

(c) to provide group counseling and academic advisement as the students select a specialization and the elective courses to be taken in the first term of Year III.

3. Specializations

Beginning with the third year (except for sponsored students previously admitted to a specialization to fulfill the sponsor's requirement) all students will be identified by specialization and will pursue the respective curriculum. The recommended names of the B.Sc. specializations and sub-specializations are:

Agriculture (Ag. Chemistry)
Animal Husbandry
Plant Science (Agronomy or Horticulture)
Social Science (Agricultural Economics/Rural Sociology or Agricultural Extension/Agricultural Communications)
Engineering Applications and Food Technology (Agricultural Mechanization or Food Technology)

During the third year a special separation is permitted in the Food Technology specialization. Since this specialization is less dependent on knowledge of plant and animal production, but needs extensive work in post-harvest or post-production science and technology, these respective alternates are offered instead of the normally required courses:

For Soil Fertility and Water Management, substitute Raw Material Handling

For Farm Forestry Practices, substitute Food Safety and Environment Sanitation

In addition to these alternates for Food Technology, all third year students are permitted one limited-choice elective in the second term.

The fourth year program has no common or core courses. The programs were developed by the respective faculties following these broad guidelines.

a. Each specialization should provide two options, one for students who plan to enter career employment upon completion of the B.Sc. degree and one for students who desire, and have the academic talent, to enter graduate study or research.

b. For either option, the faculty could specify (require) no less than 12 nor more than 24 credits in upper-level courses from among those courses taught by the respective faculty, thus leaving 18 to 6 (so the total number of credits is 30) credits in upper-level courses offered by other faculties.

The recommended fourth year program for each specialization is presented in Appendix A.

4. The Rationale for and Special Considerations in the Content and Structure of the Recommended B.Sc. Basic Curriculum

a. The solution to agricultural problems usually is not limited to applying concepts from a single discipline or narrow field of disciplines. Resolving a problem in livestock production may require the understanding or application of concepts from agronomy, agricultural mechanization, forestry, agricultural economics, rural sociology, and food technology - as well as the basic social, natural and biological sciences and even the humanities. The desirability of a wide breadth of agricultural knowledge is particularly important in Pakistan and especially the NWFP where geographic and climatic features present opportunities for such a wide variety of agricultural enterprises, not only in the Province in general but even on an individual farm. Thus, the educated agriculturalist, in addition to specialization training in a chosen discipline, needs broad training to have a general understanding of the whole range of agricultural knowledge and technology and how discipline-oriented concepts are inter-related and intra-active within the system.

b. There are some courses that have implied or specifically stated prerequisites and thus must follow a logical sequence. For example: mathematics precedes chemistry; chemistry precedes soils and animal nutrition; soils precedes crop production; biochemistry precedes animal hygiene and disease prevention and introduction to food technology.

c. The specified curriculum should include only a reasonable credit load per semester. The Design Team has limited the number of separate courses per semester to 6 and, in most semesters, the number of credit hours to 15. This per-semester limitation then limits the total B.Sc. curriculum.

d. Some faculties have requested to have more courses from their respective disciplines included among the courses which are required of all students. The only way to increase the courses of one discipline is to decrease the requirements in another discipline. Item a above gives the rationale for a balance among the disciplines in the initial two years, before specialization begins.

The Design Team's suggestion to those faculties which desire greater representation in the required courses is to gain that greater emphasis through quality of presentation rather than through additional quantity. For example, Plant Breeding and Genetics has requested to have included, among the required courses, a course in plant breeding so that all students "might have a proper appreciation of the importance of plant breeding in agricultural development." It is recommended that the Faculty of Plant Sciences, particularly the teachers assigned to the four courses Introduction to Plant Sciences; Animal and Plant Genetics; Field Crop Production and Improvement; and Introduction to Crop Protection, all of which are required in the first two years, cooperate in planning the respective course syllabus to insure that a proper appreciation for plant breeding, as well as all other important introductory level concepts, is given

adequate and balanced coverage, and to avoid unnecessary duplication and repetition. A similar recommendation is implied to other faculties and teachers of courses which contain interrelated subject matter.

e. A student should not be forced or enticed into making a choice of specialization which literally becomes a single track without opportunity to change, until: (1) the student has had a general introduction to all the specializations through course work, through academic advancement, and through personal investigation; and (2) the student has attained adequate maturity to understand the implications of the choice. The University has the responsibility to present the opportunity for choice; it is the student's prerogative to exercise that choice.

f. To provide a basis for reasonably unbiased advisement prior to the time a student must make a choice of specialization, two 1-credit courses are offered - one in Year I and one in Year II. These courses will provide information on agricultural career opportunities and on the specializations which the University offers as a choice to the student. They will also, through personal presentations of persons in representative professions, give the students an opportunity to interact with potential role models before making a career choice and, in turn, the implied choice(s) of academic specialization.

g. In the past, the National Pay Scale regulations specified an M.Sc. degree (of the type then granted in the NWFP-AU) for an agriculturalist to qualify for grade 17, the lowest professional grade. Thus under the University's "old" curriculum (the only curriculum which has thus far produced graduates) all

students aspired to the M.Sc. degree and very little selection occurred between the undergraduate program and the graduate program.

The "new" curriculum which the University is now using (but which will not produce B.Sc. graduates until 1985) and also the curriculum recommended herein will culminate in a B.Sc. degree which will qualify the graduate for NPS grade 17 employment.

Thus there will be a reduced compulsion for students to pursue an M.Sc. and less reason for a liberal policy on admission to graduate study. This provides the basis for offering the two options in the fourth year: one for those students who anticipate entering career employment upon completion of the B.Sc. degree; one for those students who desire, and have the academic ability, to enter graduate study or research.

h. A question was raised about the restricted electives in Year III. "Why not simply say: 'choose any 3 of the following 13 electives'?" The answer is: to avoid further complications in the scheduling of classes. In a 36 period per week academic schedule, it would be impossible to offer 13 3-hour elective courses, in addition to two required courses, so as to have no conflicts in the schedule and thus permit a student to freely choose three of the 13. As the electives were grouped (latter 2 groups), an attempt was made to include at least one course per group which is relevant to students pursuing each of the broad specializations as represented by faculty areas.

i. The required internship was included as a part of a more complete solution to the charge (by, among others, the Director of the Extension Department, a major employer of the AU graduates) that the graduates "don't know how to do anything." One of the primary objectives of the internship is to give the student an opportunity to perform in an agricultural job or position. It will also give the student experience to which he/she can relate the past and future academic training. (See the special report on women in the NWFP-AU, specifically that portion of the report which relates to internships, and the section on Experiential Learning.) To further counter the charge of insufficient practical experience in the curriculum it is recommended that the "practicals" of all classes be, as the name implies, practical or real-life oriented and that opportunities for additional practical experience be provided through student employment programs, through special project electives, etc.

5. Length of Class Period

The recommended normal length of class period is 50 minutes, beginning on the hour and ending at 50 minutes past the hour. This would be the normal period for each lecture or discussion session. "Practicals" in laboratory, shop and field will normally be a double period, beginning on the hour and ending one hour and fifty minutes later, normally without a break.

6. Schedule of Classes

A schedule of classes by term and by class year for all classes included in the recommended B.Sc. curriculum has been prepared. A room utilization program illustrating how each lecture hall, classroom, teaching laboratory, and teaching shop

supplements the class schedule. Finally, a program has been prepared indicating the schedule of classes for each of the four faculties for the fall and spring terms.

These useful schedules are not incorporated into this Volume; however, they will be available to the faculty and staff of the NWFP-AU and to the implementation team as the new academic program is initiated.

C. Evaluating the M.Sc. Program

To provide a basis for evaluating the M.Sc. curriculum, the following is presented as a generalized description of an M.Sc. program in agriculture.

Any M.Sc. program in agriculture includes:

(1) Relevant base-discipline courses (chemistry, biology, economics, sociology, etc.)

(2) Courses in the specialization

(3) Tools courses, e.g. statistics, research methods, computers, etc.

(4) Related agricultural courses

(5) Research and thesis

In light of this description, and of the agricultural development problems of NWFP, and of the need for better trained professionals to confront or resolve these problems, the following evaluative comments are offered concerning the current M.Sc. program at the NWFP-AU.

1. Currently there is little selection in admitting students to graduate study. It is now assumed that almost all B.Sc. graduates will continue their education for the M.Sc. degree in order to meet NPS hiring requirements.

2. The M.Sc. program is influenced more by the NPS regulations than by the minimum competency requirements for entering a profession.

3. The thesis research of graduate students is often narrow in scope, repetitive in nature, and of little relevance to the solution of critical problems which currently hamper agricultural production in NWFP.

4. The research and thesis of graduate students is sometimes directed by a single professor.

5. The extremely meager library holdings and library services at NWFP-AU seriously limit the review of relevant literature before initiating one's thesis research.

6. In some cases students receive excessive assistance from their professors in conducting the student's research and in the preparation of the thesis. Examples include a professor harvesting research plots and collecting data in the absence of the student; and professors writing the thesis, or providing a model thesis and permitting the student to do repetitive research so that the resulting new thesis is practically a duplicate of the original with slight changes for the current data.

One of the competency criteria for persons having completed an M.Sc. program is the ability to plan, conduct and report research. This should be a demonstrated competency on the part of the student, under the guidance of a graduate committee, rather that the demonstrated competence of the professor.

7. The University's program is sometimes disrupted by protests, strikes, ad hoc holidays, etc. For example, the final-year undergraduate class in 1981-82 did not take the final exams until March 1983 (9 months late) and results were not posted until May 10, 1983. Thus no new graduate class was admitted to the University for the academic year 1982-83. This is an unusual occurrence at the NWFP-AU.

D. Recommended M.Sc. Program

1. Admission

Admission to graduate study should be restricted. Suggested admissions guidelines for consideration and formal adoption by the appropriate governing body might include:

a. Having obtained a B.Sc. degree in the same, or a closely allied discipline as the proposed M.Sc. prgram or to have a B.Sc. degree in another area and otherwise present evidence of adequate undergraduate-level attainment in the proposed M.Sc. discipline to assure normal competence for admission to graduate study.

b. To be of above average to superior academic ability by having ranked in the upper division (perhaps 40th percentile) of the respective undergraduate class or to have obtained an overall grade point average, in all collegiate work taken prior to the granting of the B.Sc. degree, of a certain minimum value, for example 2.75 on a 4.0 scale.

c. For those students who, for one reason or another, interrupted their academic careers for a few years to seek employment, the work experience might be considered as an indicator

of academic performance. This would be especially useful where the student has been working in the agricultural sector.

Having positive letters of recommendation from referees who are professionally qualified to evaluate and recommend concerning the applicant's abilities and potential as a graduate student. These would be especially useful in evaluating students referenced in c. above.

2. Suggested Curricula

Suggested M.Sc. curricula as developed by the respective NWFP-AU faculty and their counterparts from the design team are included in Appendix A. In some cases, especially where the existing faculty has adequate strength and has previously conducted an M.Sc. program with a moderate to large number of students enrolled, the proposed M.Sc. curriculum is well delineated with specific requirements, course names, and course descriptions. In other cases the proposed program is more general in nature and must await program and faculty strengthening before further elaboration of the program requirements.

3. Schedule of Classes

It is recommended that the schedule of classes, length of class period, and other items pertaining to the academic schedule and calendar be the same for both undergraduate and graduate students.

E. DEGREE OFFERINGS OF THE NWFP-AU

Because of existing regulations, policies and practices within the Province and Nation in stating qualifications for applying for positions, it is very important that a graduate's credentials

offer him proper support in seeking employment. It is also important that the degrees granted by an institution reflect standards which are generally recognized in collegiate and professional environments. In light of these conditions the following recommendations are made concerning the degrees to be offered by the NWFP-AU.

1. The degrees which are granted must be appropriate to permit graduates to apply for all positions for which their technical expertise qualifies them.

2. The University should continue to work with individuals and agencies who set qualifications for positions, especially those positions in government, to allow greater flexibility in the degree requirement for a position. For example, a position which is open to one possessing a B.Sc. in Animal Science or B.Sc. in Animal Husbandry should also be open to graduates who have similar preparations as represented by the transcript, but whose degree is B.Sc. in Agriculture (Animal Husbandry specialization).

3. Until a more liberal policy concerning degree qualifications for certian positions is achieved, the University might consider alternate degree titles. For example, the same degree might be called:

B.Sc. (Hons) in Agriculture (Animal Husbandry specialization)

B.Sc. (Hons) Animal Husbandry

4. The specific recommendation of the design team is that the authorized B.Sc. degrees be limited to:

B.Sc. in Animal Husbandry

B.Sc. in Plant Science (specialization in either Agronomy or Horticulture)

B.Sc. in Rural Social Sciences (specialization in either Agricultural Economics/Rural Sociology or Extension Education/Agricultural Communication)

B.Sc. in Engineering Applications and Food Technology (specialization in either Agricultural Mechanization or Food Technology)

5. The recommended degrees and specializations at the M.Sc. level are:

M.Sc. in Animal Husbandry

M.Sc. in Plant Science (specializations in Agronomy, Soils, Plant Breeding, Horticulture, or Crop Protection)

M.Sc. in Rural Social Sciences (specialization same as at B.Sc. level)

M.Sc. in Engineering Applications and Food Technology (only food technology currently recommended as a specialization. Agricutural Mechanization should be added after adequate program and faculty strengthening have occurred.)

F. PRESENT LENGTH OF TERM, EXAMINATION PROCEDURE AND GRADING

Currently the University operates on an academic-year basis with students pursuing as many as 12 courses at once. The academic term extends from September until early May with a single examination, through an external examination system, in May/June. Some of the perceived or reported weaknesses of the current system are:

1. The "exams are not until June" philosophy invites procrastination of study. Some of the University professors have reported that "students only study one month of the year - the month before exams."

2. The external examination system specifies that 40% of the possible total marks is passing. But the test usually consists of ten questions with students required to write on only five. As one department chairman explained, "40% score on 5 questions is only 20% of the total of ten questions. A student can pass the examination by studying two chapters out of ten."

3. During the time of the academic term, the professor has no formal feedback of the effectiveness of his teaching and the student has no evaluation and report on his progress in learning.

4. The authority and responsibility for setting and maintaining the academic standards of the University are assigned an outside agency. A university, by its nature, should be self regulating in determining and adhering to acceptable academic standards. An external agency should only have the responsibility of verifying that irregularities or laxness in maintaining proper academic standards are not permitted.

5. It is difficult for a student who is enrolled in 12 courses, especially in the absence of intermediate achievement goals as set by periodic examination, to maintain a proper balance in devoting time to study all the various subjects.

6. The lack of motivation for study because of no perceived immediate need to learn invites a sense of indifference about attending classes, thus contributing to the student's willingness to participate in protests, strikes, ad hoc holidays, and skipped classes. Only about one-half of the scheduled lectures for academic year 1982-83 were actually delivered.

7. Although no such charges or admissions were made by faculty who were interviewed, it seems reasonable to assume that irregular attendance by the students invites indifference or laxness on the part of teachers. As one professor reported, "sometimes one prepares a lecture and no students show up for classes."

In partial defense of the students one should point out that there are a number of conditions that contribute to poor attitude: sitting in the same lecture hall for 4 1/2 hours without a break, especially in a lecture hall with extremely poor accoustical qualities and where there is little provision or opportunity to use audio visual aids other than a chalkboard; the lack of motivation which might be provided by periodic tests or examination; the lack of adequate library collections and facilities; and an inadequately prepared lecturer.

8. Although classes are scheduled to begin on a certain day in September, it is sometimes two weeks later before all students arrive on campus, get settled into their hostels and are ready to attend classes.

G. RECOMMENDATIONS PERTAINING TO LENGTH OF TERM, THE ACADEMIC ENVIRONMENT, AND THE EXAMINATION PROCEDURE AND GRADING

In light of the above cited weaknesses, the following are the Design Team's recommendations concerning the length of academic term, the general academic environment (as it effects the curriculum), the examination procedure and grading.

1. The academic year should be divided into two terms. The regularly scheduled December/January vacation (2 weeks) provides a natural division between the proponed two terms. Since the

word semester has acquired a negative connotation in some areas of the country, this report has adopted the word "term" to identify each of the proposed segments.

2. It is further recommended that each term consist of 16 weeks, 15 for instruction and one for the final examinations. Preliminary registration, orientation, text book procurement, moving into the hostel and similar preparations should be completed during the week before classes are scheduled to begin and actual class meetings should start at the normal hour which begins the University work-day on Saturday of the first scheduled week of classes.

3. The academic calendar showing the beginning and ending dates of each term, the scheduled official holidays or vacation periods and the dates of final examinations should be established at least two years in advance and appropriately publicized.

4. A university catalog should be published and distributed to all faculty, students and other interested individuals. The catalog should include, among other items, the academic calendar, the policies and procedures related to academic and student affairs, and the curricula and courses which are offered. The catalog should be revised at no greater than 2-year intervals.

5. Substantial improvement must be made in the academic environment, especially in the library, the classrooms, the hostels, and in the quality of teaching. Specific recommendations for improving the various segments of the teaching environment are included

elsewhere in the report, and are mentioned here simply to emphasize the necessity of the improved environment if the desired outcome of the teaching program is to be attained.

6. Each teacher should announce on the first day of the respective course, perhaps through a printed syllabus, the grading procedure for the course and the exact or approximate dates of major examinations.

7. The grading procedure should provide for at least one major examination during the course (midterm): some professor may prefer two exams at approximately 5 week intervals; there should also be a final exam. To supplement examinations as a basis for student evaluation, the teachers may use short tests or quizzes (either on an announced or unannounced basis) and assigned problems, reports, or projects. All work for evaluation should be graded (corrected) and expeditiously returned to the student so he may be appraised of his progress.

8. If societal conditions make it necessary, (to legitimize the student's credentials) the University should conduct an external audit and confirmation of the final examinations.

9. Any teacher may adopt any system of grading he wishes, such as percent of right answers, total marks (points) right, etc. and may use that system in evaluating and reporting to the student his achievement on individual works. However, at the end of the course, an overall grade for the course must be determined, in accordance with the procedure announced on the first day, and the final grade translated into an equivalent letter grade. Only the

letter grade for the course is transmitted to the registrar for recording on the student's permanent record.

10. It is recommended that the following be acceptable letter grades and their corresponding meaning and equivalent points for use in calculating averages.

A	-	excellent or superior	- 4.0
B	-	good	- 3.0
C	-	satisfactory	- 2.0
D	-	poor, but passing	- 1.0
E	-	failure	- 0.0
ABS	-	unauthorized absence, course not completed. Counts as failure.	
INC	-	authorized incomplete work in some portion of the course with permission to make-up the deficiency within a specific time. If the incomplete work is not completed within the specified time, it is graded as 0, the resulting average calculated and equivalent grade reported to the registrar.	

11. To calculate a student's grade point average, the respective letter grade point value for each course is multiplied by the credit hours of the course and the sum of the resulting grade points is divided by the total hours calculated.

Example:

grade	point value	credits	grade points
A	4.0	3	12
B	3.0	3	9
B	3.0	3	9
C	2.0	2	4
C	2.0	4	8
		---	---
		15	42

grade point average (GPA) = 42/15 = 2.80

12. All required courses must be passed with a grade of D or better.

13. For B.Sc. degree the minimum GPA for graduation is 2.0.

14. For M.Sc., the minimum GPA for graduation is 3.00 for all graduate work taken.

15. The credits of failed courses are counted (with 0 grade points) in calculating GPA.

16. A student whose overall grade point average falls below 2.0 is placed on academic probation.

17. While on academic probation, a student must make a term average of at least 2.0. Failure to make a 2.0 in any term while on academic probation will result in academic suspension.

H. ACADEMIC ADVISEMENT

Academic advisement and career counselling are important components of the teaching function of any faculty of agriculture. The faculty advisor serves many roles in the student's life, including: teacher; advisor; counselor; friend; role model (often, but not always); and at the advanced level, a professional colleague.

An overzealous advisor or one who is so enamored with his own field of specialization that he attempts to proselyte all students, especially the more academically talented, to become fellow disciples may exert undue influence on young students who have not yet had an opportunity to investigate all branches of agricultural subjects and careers before making a decision on academic specialization and career.

To limit the possibility of the latter and yet provide the advantages of personal advisement, the following are recommended as desirable features of an academic advisement system for the NWFP-AU.

1. Only those students who are receiving sponsored scholarships and who have agreed with their sponsors to pursue a specified curriculum should, as first year students, be admitted to a specialization.

2. All other undergraduate students should be admitted to the University as "general agriculture" or "undecided major" students. Since all students in the first two years pursue the same curriculum, the academic advisement function may be accomplished through the two special courses which are included, one in the first year and one in the second year, and whose primary objectives are to provide academic advisement and career counselling, in a relatively unbiased and unthreatening environment. During the first two years personal advisement on non-academic matters will be provided on a small group basis by persons attached to the Student Welfare section of the Director of Instruction. The groups will usually consist of about ten students; however, individual students having serious problems outside the classroom will always have access to advisement from the Student Welfare section.

During the final sessions of the second year Seminar, after representatives of each specialization offered at the University have made a presentation on the merits of the respective specialization and after the students have been exposed to various

subject matter fields in their courses, each student will choose the specialization in which he will complete his degree program.

In an academic system and culture which does not provide for easy change from one specialization to another, because the specializations tend to be single-track systems with little opportunity to switch to another track, it is important that students not be forced to make such an important decision before they have adequate information so that the choice can be a rea ɔned rather than an impulsive one.

3. After selecting a specialization, each Year III student will select or be assigned an advisor from among the faculty members in the respective specialization. Should personality conflicts arise between the student and the advisor, either party may request that a new faculty advisor be selected or assigned.

I. FACULTY STRENGTHENING

A logical part of expanding and strengthening the curriculum of a university is to expand and strengthen its faculty and thus one would anticipate the inclusion in this report of a section on faculty strengthening. However, since teaching is only one of the functions of a faculty and since similar reports on expanding and strengthening the other functions of an agricultural faculty are included elsewhere, the recommendations concerning faculty strengthening are separate from this section and are presented as composite strengthening to bolster all three functions of the faculty: teaching, research, and outreach.

Only one recommendation concerning faculty strengthening is included here. It is highly recommended that one of the first

on-site long-term members of the implementation team be someone who will be assigned the following responsibilities:

1. To be a counterpart to the Director of Instruction to assist him in implementing the explicit and implied recommendations concerning all facets of undergraduate and graduate teaching and of student affairs.

2. To assist and advise the Director of Instruction in scheduling and conducting special seminars and workshops to help the faculty prepare for the implementation of the new curriculum. Workshops or seminars might be devoted to such topics as: developing syllabi for courses; coordinating the syllabi of related courses to avoid duplication and omissions; the development and use of audio visual instructional aids; test construction and grading; academic advisement and career counselling.

This implementation team member, might serve as a consultant in some or all of the suggested workshops. Other team members with special expertise in these areas, for example one associated with the development of the Library and the Continuing Education Center as well as available local specialists should be utilized as consultants, assistants or leaders of these workshops.

J. EXTRACURRICULAR ACTIVITIES

While the new academic program will be more rigorous and demand more of the student's time, provisions must be made for outside activities that will enhance their academic work.

Sports are a natural outlet for students around the world. The NWFP Agricultural University now fields teams in hockey,

football, and track and field. Teams compete in inter-university competition with other institutions in the Province and, occasionally, from other provinces. A real need exists for a system of intramural competitions, perhaps organizated by hostels, in a number of sports in addition to the ones noted above. Volleyball, badminton, and basketball are examples of sports where investment in equipment is not great, and in which small groups can develop a sense of teamwork and accomplishment.

Professional and social clubs are another excellent way in which students may find constructive outlets. Each academic department should sponsor a professional club, supply a faculty advisor, and help the students develop a social and educational program. This would be especially useful to the students in the first two years of the program as they are considering what their specialization in the final two years will be. Clubs would also be an excellent means of linking the students to graduates of the University and others in the Provincial agricultural sector to give them an appreciation of the "real"world in which they will spend the greater part of their professional lives. Outside speakers from government and the private sector would provide balance to the lectures received in the classroom. Clubs could also be useful to those students who have opted for the "career" B.Sc. and who plan to seek employment upon completion of their degree. Knowledge of the current situation in the student's area of specialization will be beneficial when seeking employment. Conversely, knowledge of the quality of students by potential employers gained from visits to the University to address student groups should be mutually beneficial.

Opportunities exist to make use of students, on a for pay basis, to do many types of jobs in laboratories, on the University Farm, in the Library and in other areas. Students have indicated that they would like the chance to earn some spending money, and would be willing to work for the University. This would provide good quality help and provide to many some professional experience that will be useful in later years. Combined with internships being recommended in the new curricula, students should have a broad range of options to get some practical experience prior to graduation.

CHAPTER 3

THE RESEARCH PROGRAM

Teaching has been the primary function of the NWFP Agricultural University. This restricted focus has resulted in narrowly-trained graduates and very few research contributions toward solving urgent agricultural problems in the NWFP and in the Nation.

In this section, current agricultural research in the NWFP-AU is briefly described followed by an outline of a "new thrust" which is necessary to make research a vital part of the Agricultural University and the development of agriculture in the NWFP and Pakistan. The non-University provincial research is then generally described. A rationale for unification of the crops, livestock, food and agriculturally-related research is presented with a recommendation for a unified research system. A supplementary study team is suggested as a means of moving toward a unified system.

A. The Current NWFP-AU Research Program

1. Research Activities

Only a few staff members are engaged in research in any substantive way. Not more than 20 percent of staff time is devoted to research. The Agricultural Chemistry Department is doing some good research in human nutrition. The Institute of Development Studies (IDS) has established a record for securing research funding from outside agencies and for publishing reports from its projects. However, much of the research utilizes secondary data and consists of aggregate level analysis. Only about a

third of their research is directly related to the agricultural sector of the NWFP. As is usually the case with contract research units, the IDS projects reflect the needs of the funding agency rather than Agricultural University programs. Research in the Soil Science Department is focused on four projects in soil chemistry and fertility. Two of these projects are cooperative with the Pakistan Agricultural Research Council (PARC) and other organizations in Pakistan. Cooperation with PARC is commendable because it broadens the technical base of the work and generates additional financial support.

Very little research is being done by staff members in other departments of the Agricultural University where research is restricted primarily to student M.Sc. thesis work. This is fragmented and repetitive because thesis advisors in most departments do not have active research programs from which meaningful thesis problems can be identified for M.Sc. candidates to investigate.

The research is not oriented toward solving high priority problems. It rarely reflects a programmatic thrust to solving a specific aspect of a broader problem that exists on farms, in rural households, or in agri-business. There is a dearth of multidisciplinary research on problems which require such an approach to obtain meaningful solutions. Usually the research is not integrated with other related work, nor does it consider other factors which often affect the results obtained.

Research at the University is constrained by meager financial support, inadequate library and access to scientific literature, limited equipment, and lack of transport. Nevertheless, the

significant research being done in a few administrative units with aggressive leadership is indicative of prospects for a stronger general research program if these constraints are alleviated.

2. Staff

There are 94 academic and administrative faculty members in the Agricultural University (see Chapter 1, Table 1.2). The staff is more provincial than is desirable because most of them have been trained locally and much of their professional experience is limited to the NWFP. One-third of the staff have earned their highest academic degree outside of Pakistan. Of these, only 14 staff members (15%) have Ph.D. degrees. The quality of research and training for M.Sc. candidates is hampered by the inadequacy of advanced training and research experience of the staff.

3. Facilities

The library, equipment, and transport are inadequate to support a vigorous research program. Similarly the research laboratory facilities are inadequate and the experimental farm is undeveloped. Plans for correcting these deficiencies are described elsewhere in this report. The Design Team has worked in close association with staff members to prepare plans to develop the experimental farm and associated service center. Current research facilities have been inventoried and future functional requirements have been identified in collaboration with the architectural and engineering group.

B. The New Thrust for NWFP-AU Agricultural Research

1. The Need

A strong research component in the Agricultural University is essential in order to properly educate young professionals, especially at the M.Sc. level. Research and Extension in the Department of Agriculture can be no better than the graduates who are trained at the University. The Agricultural University should move into the research leadership position in the NWFP, rather than serving in a secondary role as is currently the case. In this section, essential changes are outlined that are needed to achieve a new thrust in research and thereby make the NWFP-AU effective in the development of agriculture in the NWFP.

The new thrust in research at the NWFP Agricultural University will be characterized by the following:

(1) Orientation to solving problems of farmers, rural households and the agri-business interests of the Province and Nation.

(2) Directed to increasing production and productivity of resources in the agricultural sector of the NWFP and increasing incomes and living levels of those in rural areas, particularly families on small farms.

(3) Constructive leadership and cooperative participation with other research organizations in the Province, the Nation, and internationally.

(4) A programmatic approach to problem solving with implementation of carefully designed programs.

(5) Multidisciplinary approach to problem solving in recognition of the complexities of the problems of those the NWFP-AU is to serve.

(6) Coordinated planning, implementation, and evaluation of research.

(7) The reseach and instruction functions of the NWFP-AU are to be complementary; student research is to be an integral part of the research program and the teaching-learning process.

(8) The research and outreach functions of the NWFP-AU are to be mutually supportive; research results are to be disseminated through outreach and extension; outreach provides close communication with the problems of those to be served.

a. Improved Organizational Structure

An improved organizational structure is needed to focus on the critical importance of research and to help administrative units and staff members do more and better research[3-1]. The new position of Director of Research will give strong leadership to research. The person in this position should be a recognized scientist and administrator who has actively participated in problem-oriented, multidisciplinary research.

There should be much more interaction and cooperation among research workers. Interaction stimulates thought and broadens perspectives; good ideas and insights come from many sources. The levels of interaction and cooperation which should be encouraged include the following:

(1) Among the NWFP-AU faculties and departments. Lack of cooperation within the Agricultural University has been one of the greatest deterrents to accomplishing meaningful research. Leadership by the Director of Research, Faculty Deans and Department Heads will be required to initiate and implement a program of problem-oriented, multidisciplinary research on high priority problems.

(2) Among Provincial and National Organizations. The following are included among the NWFP organizational units with which

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[3-1]See Chapter 10 for a more complete presentation of the organizational structure.

collaboration is important: the Agricultural and Animal Husbandry Research Institutes, stations, and sub-stations and farms; the Tobacco Research Station; the Veterinary Research Institute, the Fruit and Vegetable Development Board, the Nuclear Research Institute for Food and Agriculture (Tarnab), other NWFP universities and scientific organizations, the Extension Department, provincial governmental agencies concerned with agricultural development, and other public- and private-sector groups.

Collaboration with National and other provincial organizations will include the following: the Pakistan Agricultural Research Council (PARC) and its National Agricultural Research Centre (NARC); the Arid Zone Research Institute (Quetta); the Cereal Diseases Research Institute; the Pakistan Forest Institute (Peshawar); Agricultural Universities and research institutes in other provinces; and others.

(3) International Collaboration. The NWFP-AU needs to seek every opportunity for collaboration with agricultural research and education organizations in other countries such as universities and research institutes. Enduring linkages should be established with the International Agricultural Research Centers oriented toward the agro-ecological zones or commodities commonly grown or with potential in the NWFP. Examples are the International Rice Research Institute (IRRI); the International Center for Research in the Semi-Arid Tropics (ICRISAT); the International Potato Center (CIP); the International Center for Maize and Wheat Improvement (CIMMYT); the International Soybean Program (INTSOY); the Asian Vegetable Research and Development Center (AVRDC); the

International Center for Agricultural Research in Dry Areas (ICARDA); and the International Fertilizer Development Center (IFDC).

2. Two-Dimensional Administration of Research

The NWFP-AU research program will be administered using a "two-dimensional" type of administration by (1) faculties and departments; and (2) working groups.

a. Faculties and Departments. Faculties represent broad areas of common research and education interests; departments are made up of more specific applied agricultural disciplines and sub-disciplines. Faculty members with common scientific and applied professional interests are assigned to a faculty and department corresponding to those interests. The faculty and department are responsible for personnel management, including guidance and evaluation and budget allocation. Faculty deans and department heads are to give leadership and coordinate the research of their units, not serve as the principal investigator and director of all programs and projects. Their goals must be to support the ideas and abilities and maximize the productivity of faculty members, individually and collectively.

b. Research Task Groups. A Research Task Group will be formed for each priority research problem area. It will be a multidisciplinary working group which will be formed to cooperate on problem-solving research. Such groups are formed and disbanded as cooperative work is initiated and completed. It may include personnel from the NWFP-AU and cooperating organizations as identified in the research project outline.

This two-dimensional system of research administration combines the advantages of faculties and departments as a base for scientists with common disciplinary interests and the strengths of multidisciplinary groups to solve the complex developmental problems faced by farmers, rural households, and agribusiness.

3. Faculty Reorientation to Research

In the future, more faculty effort and other resources will be spent on research; most faculty will be actively involved. It is recommended that the overall faculty ratio should be about 45% teaching, 35% research, and 20% outreach. Such an arrangement will double the current effort on research and, with the new thrust, increase research output manyfold. Some ways to achieve this reorientation toward more research are:

a. Use time savings through improved teaching-learning methods and better telecommunications to conduct research and other University functions.

b. Conduct research throughout the year including the summer months. There should be more year-round employment and dedication to research with pay adjusted in accordance with the time devoted and effectiveness of each faculty member.

c. The time distribution of each faculty member in the teaching, research, and outreach functions will be agreed upon and regularized on an annual basis. Most staff members will have appointments on two functions. For example, a staff member might have a 2/3 time teaching and 1/3 time research appointment; an

Outreach Specialist might be 1/4 time research and 3/4 time outreach. Evaluation and compensation of each staff member will be on the basis of their accomplishments in their agreed-upon functions. The Deans of Faculties and Department Heads will have their time alloted to teaching, research, and outreach because they are responsible for the administration of all three functions.

d. In making promotions and in establishing salaries, more emphasis will be placed on individual staff productivity and less on seniority.

e. The constraints to reseearch must be alleviated as completely as feasible; therefore, more adequate financial support, a better library, more equipment and transport, and rewards and incentives for those who are productive researchers must be provided.

4. The Project Approach to Problem-Solving

Cooperative work on priority research problems will be broken into specific projects for implementation. The project provides a useful mechanism to marshall resources and to solve a specific problem. While planning for and solving the research problem, provisions will be made to plan for staff development, incorporate post-graduate training, plan for scientific publications, incorporate the results in teaching, and disseminate information to users through outreach.

The Director of Research will give overall leadership in program and project development and review, as well as in how the work will be evaluated and reported. The project outline for the

proposed research should be processed through appropriate channels (departments and faculties) to the Research Director. Individual faculty members should be encouraged to propose projects that have potential to contribute to the identified priority research thrusts of the University. A peer review process will be used for each proposed project in order to:

a. Evaluate the relevance of the proposed research to Provincial needs and University research priorities.

b. Evaluate the quality and scientific value of the proposed research.

c. Provide opportunity for faculty member(s) proposing the research to interact with reviewers and make adjustments as appropriate.

d. Consider opportunities for cooperation with other individuals or units.

An ad hoc committee will be selected to review each research project proposal. When the project is approved and resources are available, work will be started. The process outlined above is designed to facilitate the conduct of meaningful research, and it should be implemented in a manner that will achieve this objective. Care should be taken to insure that such procedures do not lead to delays that hinder research.

An outline for preparation of a research project proposal follows:

Project Number - To be assigned by the Research Director.

Title - A clear, concise statement of the subject of the research. The title should indicate the primary focus of the project.

Previous Work - A brief review of the current state of knowledge on the problem, and how it falls short of meeting current and future needs for knowledge. List literature citations at the end of the project outline.

Justification - A concise statement of the importance of the problem to the agriculture and rural life of the Province and Nation, reasons for doing the work at this location at this particular time, and potential benefits to agriculture and the public at large.

Objectives - A clear, complete, and logically arranged statement of the specific objectives of the project. This sections should be limited to the objectives and not include a restatement of justification nor an explanation of procedure. Whenever any material change in the objectives of a project is advisable, a new or revised project outline should be prepared.

Procedure - A statement of essential working plans and methods to be used in attaining each of the stated objectives. The procedures should correspond to the objectives and follow the same order. Phases of the work should be designated. The location of the work and the facilities and equipment available and needed should be specified.

Duration - An estimate of the time required to complete the research planned and to publish the results.

Personnel - A list of the leader or leaders and other technical workers to be assigned. Specify how undergraduate and graduate students will contribute to the research.

University Units Involved - A list of each subject matter unit in the Agricultural University contributing essential services or facilities. The responsibilities of each should be indicated. Specify the members of working groups to be involved in this project.

Cooperation - A statement on planned cooperation with provincial and national research organizations. Indentify international research organizations that will collaborate.

Financial Support - An estimate of the annual allocations by funds to salaries, wages, equipment, supplies, travel, publication, and any other expenses.

Plans for Publication of Results - Statement of anticipated type(s) of publications, i.e. provincial and national journals, international journals, bulletins, circulars, etc.

Outreach - How anticipated results will be disseminated through NWFP-AU outreach, Extension Department, in-service training, etc.

C. Priority Research Problems

A research program should be focused on specific, urgent problems that are faced by farmers and other groups involved in

producing, processing, and marketing agricultural products. This usually requires cooperative, multidisciplinary work in order to solve problems step-wise and then transmit the results to people who can use them. Such an approach is especially necessary for the complex, multi-enterprise farming systems that prevail in the NWFP.

In discussion with faculty members at the NWFP Agricultural University and agricultural workers, farmers, and government officials in the NWFP, many problems have been identified. In this section of the report, a few high priority problems will be outlined with some suggestions for cooperative research. A more extensive list of researchable problems is also included.

1. Problems in Tree Fruit Production and Marketing

The NWFP acreage and production of tree fruits increased 28% and 26%, respectively from 1975 to 1980. The increases for both production and acreage are in the range of 50% from 1975 to 1983. Production will continue to grow rapidly, and discussions with farmers indicate that new plantings will continue.

The need for research to protect the farmers' investments is of paramount importance. This Province produces about half of the apples and over one-third of the pears, peaches, plums, persimmons, grapes, and pomegranates of Pakistan.

This proposed research would increase net farm income, improve human nutrition, and generate convertible currency through an expanded export market.

a. Production Research. Visits to orchards indicate the need for pruning and the use of better fertility practices. Urea is used as a source of nitrogen - ammonium nitrate probably would

be more effective. There is also a need to develop more effective spray schedules to control insects and diseases and improve fruit quality. Water management for optimum yields needs to be further explored: research is needed to reduce waterlogging of the soils and to control potential salinity problems.

b. Marketing and Processing. There is need to explore ways to expand both the fresh and processed market for fruits in both the domestic and export markets, especially to Middle East countries.

The types of problems to be studied include: transportation, packaging, grading and standardization, storage, post-harvest losses, methods of harvesting, pricing, margins of various market intermediaries, quality control, and market information on quantity, quality, and price at alternative markets. Financing of fruit production, both short-term and intermediate, needs to be analyzed. There is need to find additional uses for fruit products. There may be need for feasibility studies on the development of processing facilities.

c. Cooperation. This research would require a multi-disciplinary approach involving horticulure, plant protection, soils, agricultural mechanization, farm management, finance, marketing, microbiology, food processing, and animal husbandry (the use of processing by-products as animal feed). It should be closely coordinated with such agencies as the NWFP Fruit and Vegetable Development Board.

2. Obtaining Fertilizer Use Effectiveness on Individual Fields and Crops

a. Background

Quantitative correlations are urgently needed between phosphorus (P) and potassium (K) soil test values and yield response to added P and K (and nitrogen) for important crops under irrigated and rainfed conditions. Some crops, such as wheat, are very responsive to P and, therefore, require generous P fertilization for optimum yields. Other crops, such as maize, sugarcane, and forages, usually require high levels of K. Crop yield responses to fertilizers are different under irrigation than under rainfed conditions. Different soil series vary in their ability to release available P and K for plant use. Previous applications of manure and fertilizer also affect levels of available P and K. Therefore, carefully calibrated, periodic, site-specific soil tests are essential to guide proper fertilization on individual fields.

A review by Dr. Saleem Ahmed[3-2] in 1980 indicated that 64,000 soil fertility trials had been conducted in Pakistan, but that site-specific soil test response surfaces or curves for P and K had not been established for important crops under irrigated and rainfed conditions. This serious deficiency still exists in 1983. From 1961 to 1978, the offtake of fertilizers increased 20 times from 50 to 1,000 nutrient tons[3-2], and their use is now increasing even more rapidly. Therefore, the need for

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[3-2] Integrating soil fertility, soil testing, and soil classification research in Pakistan. Saleem Ahmed, Pakistan Agricultural Research Council, 1980.

properly calibrated, site-specific soil tests is becoming increasingly more acute.

b. Research

A cooperative, integrated program is proposed to quantitatively correlate soil test values for available P and K with yield responses to added P and K (and various levels of N fertilization) for important crops under irrigated and rainfed conditions. The important differences between former soil fertility trials and these proposed experiments are as follows:

(1) The overall program will be planned to include all of the variables which are considered to be important.

(2) P and K soil tests will be made on <u>all</u> experimental plots <u>before</u> low through high rates of P and K fertilizers are applied. Available N and minor elements should be maintained on all plots at levels high enough to insure their adequacy for good crop growth. Likewise, good management practices (tillage, seed, plant population, control of pests, etc.) should be maintained on all plots so that these are not limiting factors.

(3) The experimental design and analysis will be planned so that the results can be presented quantitatively (with measures of reliability) as response curves (or response surfaces) for the conditions studied.

A limited number of properly planned and conducted experiments of this kind can produce more reliable information and site-specific guidance than thousands of the type of soil fertility trials which have previously been conducted in Pakistan.

After P and K response curves have been determined for various crops and other conditions studied, suitable economic analysis can give further guidance on the most profitable levels of fertilization.

c. Cooperation

Close cooperation is needed in this program between soil scientists at the Agricultural University, in the Agricultural Research Stations in the NWFP, and PARC. Within the Agricultural University, there should also be cooperation among scientists in Soils, Agronomy, Horticulture, Statistics, Crop Protection, Plant Breeding, Agricultural Economics, and Outreach.

3. Research to Triple the Yields of Maize in the NWFP Within Five Years

The average yield of maize in the NWFP is very low - about 1,200 kg/ha. Experiments at Pirsabak and other locations regularly yield 3 to 6 times as much maize under good management. The purpose of this proposed program will be to develop packages of management practices which will help farmers markedly increase maize yields. Adaptive research and outreach will comprise the major thrust to solve production problems. Since maize is grown on rainfed areas with < 35" rainfall as well as on irrigated areas and those with > 35" rainfall, different management practices will be needed for the low- and adequate-moisture regimes. Efficient post-harvest handling of the increased maize production will require an intensive research program.

a. Production

Varieties - hybrids versus composites or synthetics. Introduce (from CIMMYT, etc.) and improve.

Cultural practices -

Optimum planting time

Plant population and planting pattern

Fertilization - N, P, K, etc.

Moisture requirements - Timing and optimum under irrigation; minimum rainfall during growing season for profitable production under rainfed conditions.

Pest control - Weeds, insects, and diseases.

Harvesting methods

Costs and returns

b. Post-Harvest handling:

Storage

Drying and cleaning to prevent deterioration

Merits of various kinds of grain storage structures

Protection of stored grain from insects and rodents

Costs of various practices

Marketing

Merits of different methods of handling (bag, bulk, etc.)

Transportation - relative costs by different methods

Pricing and competitive positions with other grains

c. Cooperation

Cooperators would include Agronomy, Agricultural Economics, Soils, Crop Protection, Agricultural Engineering, Agricultural Research Stations, Outreach, Extension, Seed Farms, Agricultural Development Authority, Cooperative Supply and Marketing Societies, and the governmental grain purchasing

organization. Outreach should be heavily involved from the beginning of the program.

4. Research to Increase Production and Use of Forage

a. Background

A major problem in the NWFP is the under-production and utilizaton of quality forage as feed for ruminant animals. Therefore, a major research emphasis should be placed on the production, harvesting, storage, and utilization of forages from fields and rangeland. With one major exception, berseem, few crops are grown entirely for forage purposes, although such crops as immature maize, sugar beet pulp, and wheat and barley straw are used for animal feed along with miscellaneous grasses, weeds, and browse.

b. Research and Cooperation

Such a priority forage program should include the following disciplines with suggested emphases:

Animal Husbandry: Livestock feeding, including different species and combinations such as pasture, green-harvested forage, hay and straw, and silage. Grain supplementation for milk, meat, and wool yields.

Plant Sciences: Include soil type, drainage, fertility, and erosion control; introduction of new species and varieties, breeding for improvement of yield and quality; production and harvesting practices, pest control, and possible irrigation.

Agricultural Engineering Applications and Microbiology: Proper inoculation of legumes; seeding and harvesting equipment, including introduction of legumes and improved grasses into

pastures and rangelend; and storage improvement, including hay and silage.

Agricultural Economics/Rural Sociology: Farming systems to adapt the new forage crops and practices; economic costs and returns from improved quality and quantities of forages.

Outreach: Formulating "use" packages and other outreach programs for both forage production and livestock utilization.

5. Breeding Systems for Ruminant Livestock

a. Problem. The low genetic capacity of ruminant animals to produce is a major constraint to efficient production in the NWFP. Attempts to improve production through breeding have been tried for many years. The most common practice has been to establish herds of high quality and disseminate males from these herds (for example, the Livestock Experiment Station at Jaba). The resulting crosses should have a greater productive potential if the introduced males are superior to the local stock. These attempts often fail because accurate production records are not kept on individual animals and substandard animals are not removed from the breeding herd. It appears that the current artificial insemination program may also fail because of lack of progeny testing.

b. Objective: Develop a progeny testing program for cattle and buffalo.

c. Research: Establish an identification program for progeny of bulls used in artificial insemination on cooperating farms and instruct the cooperators in record keeping practices to determine rate of growth and milk production of progeny. Based on the data collected, the sires used in artificial insemination

should be evaluated. Then, only superior sires should be used to produce semen for artificial insemination.

d. Cooperating Units: Close collaboration should be obtained between the animal breeding researchers and those responsible for the reproductive efficiency research. To undertake this project, full cooperation must be obtained from the Animal Husbandry Department, artificial insemination centers, and field assistants, as well as the farmers.

6. Improvement of the Nutritional Level of People in the NWFP

a. Background

One of the prime requisites of a nation's food supply is that it be nutritious. Adequate nutrition is necessary for a person's well-being as well as efficiency; a healthy society is essential for a productive nation. Malnutrition has been shown to be a serious problem in Pakistan. Half of the children under 5 years of age suffer from protein and/or calorie malnutrition. Forty percent of all the population, with 50% of the children and 92-98% of pregnant and lactating women, are anemic. Dr. Tajammal Hussain has initiated research in this area dealing especially with the development of weaning foods from locally-available ingredients.

b. Research and Cooperation

The following are highlights of a research program which is suggested to address these problems. It would be a multidisciplinary approach involving nutritionists, medical and paramedical workers, social workers, economists, and agriculturalists. Obviously, outreach is a key element in this program.

Eight specific research projects are currently planned:

(1) Nutritional survey of the rural and urban population of the NWFP.

(2) Preparation and evaluation of supplementary weaning foods from local staple ingredients for children of low income families.

(3) Diet and its impact in eradicating anemia in Pakistan.

(4) Effect of protein and energy-rich supplementary food on maternal health and birth weight of children.

(5) Nutrient losses in traditional cooking methods.

(6) Preparation of food composition tables of raw and cooked Pakistani food.

(7) Nitrogen balance studies on human subjects.

(8) The effect of good nutrition on agricultural productivity.

As data from these projects become available, solutions or directions of attack on the problem will be clarified.

7. Meeting the Oilseed Needs of the NWFP and Pakistan

There is a shortage of plant oils and protein for the many purposes of cooking, diet supplementation, and industrial uses in Pakistan. Crops such as groundnut, soybean, cottonseed, sunflower, and mustard provide valuable oils and in most cases are excellent sources of protein for human and animal nutrition. Present productivity, however, is well below national needs due to limited and low-yielding oil and protein crops.

Emphasis should be placed within Plant Sciences, Food Technology, Human Nutrition, Animal Husbandry, and Agricultural Mechanization to solve this problem. Also, the economic costs, returns, and advantages of certain crops and the way they fit into various farming systems should be researched by Agricultural Economists.

Selection and improvement of species and varieties that will fit the various climatic zones, seasons, and appropriate soils are needed, as well as the necessary cultural practices to maximize yields and quality. Harvesting and processing and final testing for human and animal consumption and industrial uses would involve a number of disciplines.

Previous work has shown that high soybean yields can be produced at Mingora. Special emphasis should be placed on exploiting this promising start to extend the production and processing of soybeans to other areas where they are adapted.

8. Adoption and Spread of Recommended Technologies

a. Background

The basic research questions are why some producers are "resistant" to use of new information and inputs, and what can be done to increase their adoption rates. Answers to these questions require a good knowledge of other types of questions:

(1) How is information, particularly that pertaining to agriculture, disseminated through the village/community? What links do farmers have with both internal and external sources of information?

(2) Who or what types of individuals serve as opinion leaders or models at the village level?

(3) How are farmers' decisions affected by: decisions of neighbors; household differences - in terms of needs and available resources; recently experienced events; perceived alternatives and constraints; various various simplifying procedures (routines, rules of thumb, rituals) which farmers employ?

(4) With what types of village/community organizations and groups are farmers linked?

b. Cooperation

This research would be conducted by persons in Rural Sociology and Outreach in cooperation with other departments such

as Extension Education and Communications, Agricultural Economics, Agronomy, Animal Husbandry, Horticulture, Crop Protection, Plant Breeding, Soils, and Agricultural Mechanization. The results would be especially helpful in planning and conducting effective outreach programs.

9. Controlling Leaf Blight of Gram (Chick-pea)

a. Background

Gram (chick-pea) is an important crop in low-rainfall areas of southern NWFP. However, crop yields are low, and during recent years leaf blight has devastated the crop in many areas. This aggravates an already difficult situation in rainfed areas where rainfall is low and unpredictable and crop alternatives are very limited.

b. Cooperation

A cooperative high priority research program is desperately needed among staff members in Plant Pathology, Plant Breeding, Agronomy, Agricultural (Crops) Research Stations, Nuclear Institute for Food and Agriculture, and international agricultural research institutes which work with this crop to quickly develop resistant varieties or other methods to control leaf blight in gram.

10. Other Problems

The problems outlined above illustrate the need for agricultural research and the importance of attacking such problems with a cooperative, multidisciplinary team of specialists in order to obtain meaningful answers to many problems that occur on farms, in rural households, and in agri-business.

The following are additional problems that should be considered as the NWFP-AU develops its overall research program. A more thorough analysis will identify additional problems. Careful consideration must be given to selecting the highest priority research problems in terms of potential for obtaining useful results within the time and other resource constraints.

(1) Development of improved cropping systems and management practices for barani areas which have 8 to 30 inches annual rainfall.

(2) Selection and evaluation of wheat varieties resistant to rust.

(3) Growing berseem for forage and as a green manure crop with sugar cane and other crops.

(4) Selection and breeding for drouth resistance in crops adapted to barani areas with 8 to 30 inches annual rainfall.

(5) Increased production and improved quality of vegetables with better varieties, cost-efficient use of fertilizers, and improved irrigation practices.

(6) Storage diseases in fruits and vegetables.

(7) Weed control in an integrated crop protection system.

(8) Biological and chemical weed control in multiple cropping systems.

(9) Control of root-knot nematode in vegetables and sugarbeet.

(10) Control of pests in stored grain and seeds.

(11) Managing bees for increased honey production.

(12) Test different methods of fertilizer application to minimize losses of N and reduce excessive fixation of P in soils.

(13) Reclamation of saline and alkali soils with water plus chemical, biological, and/or physical means.

(14) Evaluation of selected cropping sequences for optimum production and profit.

(15) Feeds and feeding practices for ruminant livestock.

(16) Improving cattle and water buffalo reproductive efficiency.

(17) Increasing milk production in cattle and water buffalo.

(18) Improving the quality and variety of dairy products.

(19) Post-harvest handling of fruits and vegetables to reduce deterioration and loss.

(20) Development of improved oilseed processing.

(21) Evaluation of alternative irrigation systems for various crops.

(22) Design, development, and introduction of animal-drawn and simple tractor-drawn seed and fertilizer drills.

(23) Improved handling, processing and storage of crops to maintain quality and reduce losses.

(24) Improve the materials and practices used in the construction of farm and village buildings.

(25) The labor and economic roles of women in livestock production.

(26) Farm practices that pay.

(27) Economic evaluation of selected farming systems.

(28) Availability and use of purchased items, including credit, on small farms.

(29) Improvement in marketing agricultural products.

(30) Factors related to the success of cooperatives.

D. The NWFP Agriculture and Livestock Research System

Design Team members conducted a general study of the NWFP agriculture and livestock research system to understand the system and the relationship of NWFP-AU teaching, research, and outreach programs to the research that is the responsibility of the Director General of Agricultural Research, the Director of Animal Husbandry, and the Director of the Veterinary Research Institute.[3-3] The major research institutes, stations, and sub-

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[3-3] These three units are under the Secretariat for Agriculture, Animal Husbandry, Forestry and Cooperatives.

stations of the NWFP were visited and discussions were held with administrative and scientific staff.

1. Agricultural (Crops) Research

Adaptive research predominates in the work done at the 10 crops research institutes and sub-stations of the Department of Agriculture. It includes several islands of good work, such as that at the Sugar Crops Research Institute near Mardan. Expanded programs are being developed in some locations, such as at Mingora. No economic investigations are conducted by this group, even though such factors markedly affect the adoption of new practices by farmers. Currently, this organization does much more crops research than is done at the Agricultural University.

Significant improvements are needed in the crops research program. A better-trained staff would be one of the best ways to improve the quality of research. A greater problem-solving orientation and more interdisciplinary work would improve the applicability of research results to urgent farm problems. Economic research should be incorporated into the program of this group so that their results would apply more directly to actual farm problems. A higher ratio of operating funds versus staff salaries is essential to increased research productivity.

a. Staff

The Agricultural (Crops) Research staff includes 222 professional persons located in various institutes, stations, and sub-stations throughout the NWFP (Table 3.1 and Figure 3.1). Only two staff members have Ph.D. degrees and one is deputed to PARC. The M.Sc. is the highest degree held by 53% of the staff; therefore, the guidance and depth of research are limited by the

training of persons in leadership positions. Forty percent hold B.Sc. degrees and six percent do not hold a university degree. Nearly every staff member was trained in the NWFP, and only 13 percent of them earned their highest degree outside Pakistan. There is a high concentration of staff members (85%) in grade NPS 17, with little opportunity for advancement. Many who joined the staff in grade NPS 17 find themselves in the same grade 15 years later, irrespective of their productivity. This is a disincentive for superior work.

b. Facilities

Agricultural (Crops) Research is conducted at 5 institutes, 5 sub-stations and 1 summer nursery at the locations listed below. The staff, experimental land area and the main crops on which research are conducted are also shown. These research facilities are well distributed in the different agro-ecological regions of the NWFP (Figure 3.2), except for the replication of similar soil and climatic conditions at Tarnab and nearby Nowshera.

Research on tobacco is conducted near Mardan and Mansehra by about 40 professional staff members at the Tobacco Research Station under the Pakistan Tobacco Board.

2. Animal Husbandry Research

a. Program and Facilities

Work under the Director of Animal Husbandry is engaged primarily in extension and service work; however, they have two livestock research units.

Table 3.1. Current Agricultural (Crops) Research staff numbers by rank, training, and location in NWFP, Pakistan

Location	Degree source*	NPS 19 Ph. D.	NPS 19 M. Sc.	NPS 18 Ph. D.	NPS 18 M. Sc.	NPS 18 B. Sc.	NPS 17 Ph. D.	NPS 17 M. Sc.	NPS 17 B. Sc.	NPS 17 No B.Sc.	NPS 16 M. Sc.	NPS 16 B. Sc.	NPS 16 No B.Sc.	Sub-total	Total
Tarnab	I				1	1		26	18	1	3	1	4	55	
	O		1		3			3						7	62
Pirsabak	I							16	13	1			3	33	
	O						1	4						5	38
Mardan	I				1			6	7				2	16	
	O		1					2						3	19
Mingora	I				1			8	11				1	21	
	O		1		3			2						6	27
Mansehra	I							4	3					7	
	O				1									1	8
D. I. Khan	I							12	19				1	32	32
Agr. University	I				1									1	
	O				1			1						2	3
PARC	I							1	1					2	
	O	1			1			2						4	6
Abbottabad	I							1	2					3	
	O				1									1	4
Batakundi	I								1					1	1
Kohat	I							3	7					10	10
Karak	I							2						2	2
Serai Naurang	I							5	5					10	10
Subtotal	I				4	1		84	87	2	3	1	11	193	
	O	1	3		10		1	14						29	
Total	All	4			15			188			15				222
Percent	I													86.9	
	O													13.1	
	All	1.8			6.8			84.7			6.7				100.0

* Source of highest degree: I = Inside Pakistan, mostly NWFP; O = Outside Pakistan, mostly from American University, Beirut.

Figure 3.1
POLITICAL DIVISIONS IN THE NORTH-WEST FRONTIER
PROVINCE OF PAKISTAN

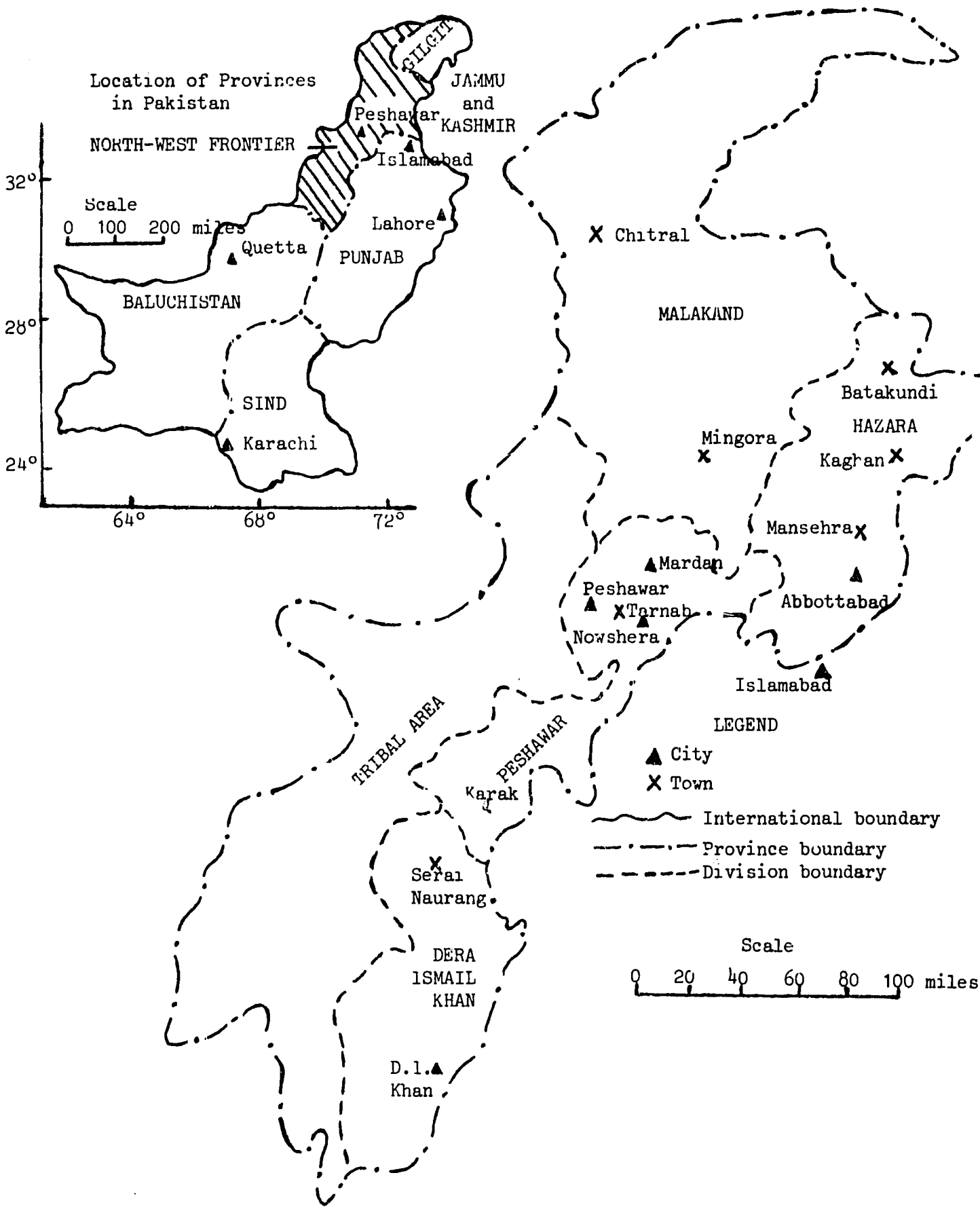
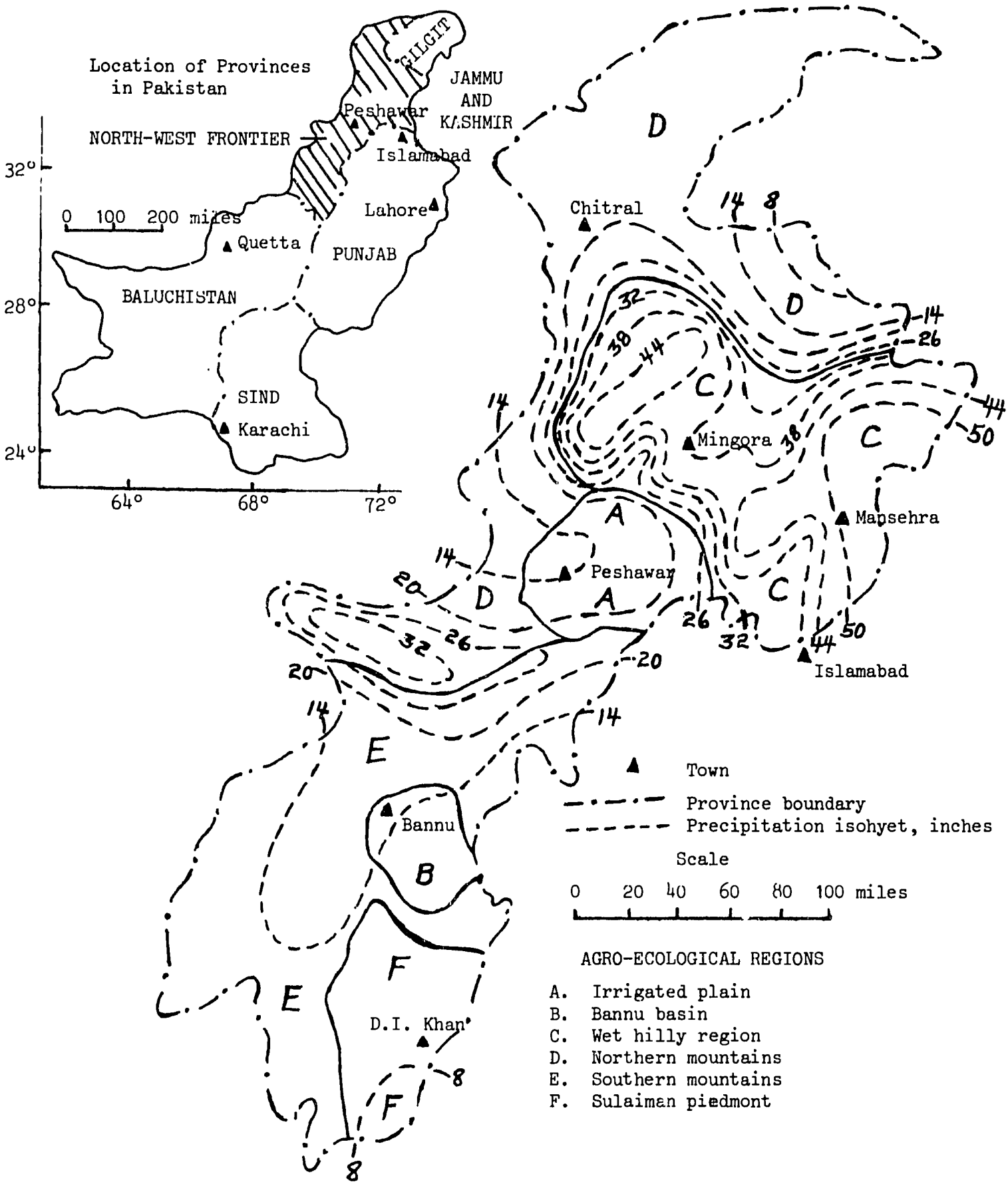


Figure 3.2
AVERAGE ANNUAL PRECIPITATION (Inches) IN
THE NORTH-WEST FRONTIER PROVINCE OF PAKISTAN



	Location	Staff	Acres	Main Crops
Agricultural Research Institute*	Tarnab	62	200	mixed
Cereal Crops Research Institute	Pirsabak (Nowshera)	38	437	wheat, maize, others
Sugar Crops Research Institute	Mardan	19	96	sugarcane sugarbeet
Agricultural Research Institute (North)	Mingora	27	25	rice, potato, oilseeds, fruits, vegetables
Agricultural Research Substation	Mansehra	8	25	oilseeds, maize
Agricultural Research Sub-station	Abbottabad	4	68	potato
Potato Substation	Batakundi	1	50	potato
Wheat Summer Nursery	Kaghan	--	46	wheat
Agricultural Research Institute (South)	D.I. Khan	32	1,025	mixed
Agricultural Research Sub-station	Serai Naurang	10	25	mixed, including sugar
Gram Research Sub-station	Karak	2	29	gram

*Headquarters of the Director General of Agricultural Research, NWFP

The Livestock Experiment Station at Jaba, near Mansehra, is primarily involved in supplying rams to local sheep herders. Rambouillet sheep were imported from the U.S.A. The flock has been maintained, but the level of production as measured by growth and wool production has declined by one-half. The major weakness in this project is the failure to upgrade the flock through intensive culling.

The other research unit is a newly-established dairy farm at Harichand. Ninety Holstein-Friesian cattle were donated by The Netherlands. Newly-constructed barns are now in use. The present objective of this operation is to provide breeding stock to dairy farms in the NWFP.

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Land is available for a dairy research farm facility adjacent to the Agricultural (Crops) Research Substation near Mansehra, but the livestock unit has not been developed.

Table 3.2. Current Animal Husbandry staff members by rank, training, and function in NWFP, Pakistan

Function	Degree source*	NPS 19 M. Sc.	NPS 19 B.V. Sc.	NPS 18 M. Phil.	NPS 18 B.V. Sc.	NPS 18 B.Sc. (AH)	NPS 17 M. Sc.	NPS 17 M. Phil.	NPS 17 D. V.M.	NPS 17 B.V. Sc.**	NPS 17 B.Sc. (AH)	Sub-total	Total
Director	I		1									1	
	0	1										1	2
Deputy Dir.	I				4	4						8	
	0			1								1	9
Asst. Dir.	I						10			6	17	33	
	0						1	1				2	35
Veterinary Officer	I	—	—	—	—	—	12	—	14	31	29	86	86
Subtotal	I		1		4	4	22		14	37	46	128	
	0	1		1			1	1				4	
Total	All	2		9			121						132
Percent	I											97.0	
	0											3.0	
	All	1.5		6.8			91.7						100.0

* Source of highest degree: I = Inside Pakistan, mostly NWFP; O = Outside Pakistan.

** Several of these staff members also have a B.Sc. (AH) degree.

b. Staff

There are 132 professional staff members in the Animal Husbandry Department (Table 3.2). Ninety-two percent of their staff is in the lowest professional grade (NPS 17), and 70% have only bachelor's degrees, which reflects their emphasis on extension and service rather than research. None of their staff has a Ph.D. degree, 11% hold the DVM degree, and only 3 percent of the staff have earned their highest degree outside Pakistan.

3. The Veterinary Research Institute

a. Program and Facilities

The major focus of the Veterinary Research Institute is to provide diagnostic services and produce vaccines at their headquarters in Peshawar. However, the Institute also includes a Division of Animal Production which has 8 research projects that emphasize animal husbandry rather than veterinary medicine.

The Veterinary Research Institute is in the process of establishing a 178-acre dairy farm for forage research at Surezai, which is located 25 miles from Peshawar. The barn and other farm buildings are under construction with financial assistance from The Netherlands. Holstein-Friesian and crosses with Sahiwal cattle, totalling about 200 animals, are to be used on the farm.

b. Staff

There are 32 professional staff members at the Veterinary Research Institute (Table 3.3). Almost all of the degree training of these staff persons has been in Pakistan, but most of the senior members have had additional, specialized post-graduate training outside Pakistan.

Table 3.3. Current Veterinary Research Institute staff numbers by rank, training, and function in NWFP, Pakistan

Function	NPS 19	NPS 18	NPS 17				Total
	G.B. V.C.	M. Sc.	M. Sc.	D. V.M.	B.V. Sc.*	B.Sc. (AH)	
Director**	1						1
Sr. Research Officer**		6					6
Research Officer**			3		3		6
Asst. Research Officer			4	1		1	6
Veterinary Officer			2	11			13
Total	1	6	9	12	3	1	32
Percent	3.1	18.8	78.1				100.0

* These staff members also have a B.Sc. (AH) degree.

** Almost all of the degree training has been in Pakistan. Most persons in this category (as well as a few persons in other categories) have had additional, specialized postgraduate training outside Pakistan.

E. Conclusion and Recommendation

An evaluation of the crop and livestock production research was beyond the terms of reference in the Design Team's mission. Nevertheless understanding of the magnitude and general quality of the research being conducted are relevant to the future of the Agricultural University and ultimately to the future of agricultural development in the NWFP.

The crop and livestock research in the NWFP is inadequate, fragmented, and not organized or coordinated in a programmatic way to solve urgent problems which are faced by farmers and agribusiness organizations. Most current work is on selected segments of farm problems with little or no consideration being given to other related aspects of problems, most of which require multidisciplinary research to obtain satisfactory solutions. In their work, researchers rarely consider the individual farm as an operating unit.

Research on crop production and livestock production are separated, even though such enterprises are intimately intertwined on almost every farm. No one works on how such enterprises and practices should be combined most advantageously on individual farms to economically produce abundant food and fiber. Almost no agricultural economic research is being done, even though such considerations are involved in almost every decision concerning farm production, storage, processing and marketing.

The staff of the research institutions and stations are not adequately trained to give leadership to research and to carry out and report on experimental work. This reflects the inadequacy of B.Sc. and M.Sc. levels of training at the NWFP-AU and

its predecessor institutions for those who are to pursue research careers. It presents a challenge for the immediate and continuing future to upgrade curricula and teaching-learning processes. Staff inadequacies are also an indication of the provincialism of NWFP higher education and the lack of opportunity for training at higher degree levels, particularly the Ph.D.

The NWFP research system also suffers from inadequate research support and a reward system that lacks incentive for staff to do excellent research.

1. The Need to Unify the NWFP Research System

It is imperative that the crop, livestock production, and other food and agriculturally-related research of the NWFP be both strengthened and coordinated. There are alternative ways of attaining varying degrees of coordination. The two obvious ones are:

Alternative A. Continue the current system of divided responsibilities between crops research and livestock production research, some in Animal Husbandry and some in Veterinary Research; provide for coordination through a coordinating board with a secretariat or a similiar mechanism.

Alternative B. Unify the crop, livestock production and related food and agriculturally-related research under the responsibility of one organization.

To fulfill the need for coordination of research in the NWFP, it is strongly recommended that the policy decision be taken to unify the agricultural and livestock production research of the

Province into a single research system. It is further recommended that the responsibility for the entire system be assigned to the NWFP Agricultural University together with concomitant resources to effectively meet this responsibility.

The NWFP Agricultural University will be further developed to have a strong research capability. It is planned that about 35% of the University's personnel resources be devoted to research. It will have an excellent library and access to national and international agricultural data bases.

The University provides nearly all the professionally educated manpower for the NWFP; therefore, plays the paramount role among agricultural institutions in spearheading higher production and productivity of the agricultural sector of the economy. Research, teaching, and outreach are mutually reinforcing, i.e. each is better because the others are present. The University must have a major role in research to perform its teaching and outreach functions; faculty members must do research if they are to educate future researchers for the Province and Nation. Technology flows from research results and those who are engaged in research can work with outreach specialists to prepare practice recommendations and packages of practices to support the work of the Extension Department.

Most of the current crop and livestock research of the NWFP is being conducted at provincial government research institutes and stations and the federally-related Tobacco Research Station (Pakistan Tobacco Board) and the Nuclear Institute for Food and Agriculture (Pakistan Atomic Energy Commission). In general, the provincially-supported research is neither programatically nor

problem-solving oriented. Crop and livestock research are fragmented and inadequately related to the realities of the farm and farming systems. Some livestock production research is being conducted by veterinary institutes. There is no economic research accompanying the technical research to make results applicable in economic terms as viewed by farm and agri-business decision makers. The staffs of provincial research oganizations are not adequately trained for current and future leadership in research and research program and project implementation. Staff are poorly supported except at the federally-related Tobacco Research Station and the Nuclear Institute for Food and Agriculture.

There is concern throughout Pakistan that the agricultural universities and the agricultural and livestock and veterinary institutes are not adequately linked together and coordinated.[3-4] The provincial governments have set up agricultural research coordination boards but, excepting Punjab Province, the boards have not functioned.[3-5] This has been confirmed to be the case in the NWFP. The Punjab Agricultural Research Coordination Board, established in 1979, has 69 members and a secretariat with objectives of "planning research, fixing priorities, assigning projects to research workers" and "approving methodologies, monitoring, inspecting, and evaluating research work."[3-6] While the need

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[3-4]Wahid, Abdul. "Review of Agricultural Research System of Pakistan," Pakistan Agricultural Research Council (PARC), December, 1982. p. 116.

[3-5]Ibid. p. 117.

[3-6]Punjab Agricultural Research Coordination Board (brief note), Tech. PARCB No. 3, University of Agriculture, Faisalabad. p. 2.

for coordination is apparent in the NWFP, it is not clear that the Punjab type of coordination board would be appropriate and cost effective in the NWFP. For the NWFP the functions stated as objectives might be better performed directly by the institutions responsible for conducting the research; the secretariat is likely to lead to diffusion of research responsibility in a Province where responsibility for research needs to be clearly identified.

The following benefits can be attained by unification of the crop, livestock production, and other food and agriculturally-related research of the NWFP, under the direction of the Agricultural University:

a. There will be a unified and coordinated research system with a developmental, problem-solving approach to meet the needs of farmers and the agro-industrial sector of the economy.

b. The University will provide the essential breadth to research involving not only crops and animal husbandry research but also the important areas of engineering applications, food technology, nutrition and the rural social sciences.

c. There will be more efficient use of the limited professional talent in the University and the agricultural and livestock production research institutes, stations, and sub-stations.

d. Graduate student research at the University will be fully planned and conducted to contribute to provincial research needs.

e. All researchers will be closely identified with the Agricultural University and its sources of research support: the

Library and data bases, the Learning Resources Center, the computer laboratory and data processing center, and modern research laboratories and equipment.

f. Duplication of expensive facilities and equipment will be minimized.

g. The costs of administering the provincial research will be reduced with only one administration for program planning, implementation, and evaluation.

h. It will be easier to retain researchers, all of whom are identified with an academic environment and a strong, unified, and productive system.

i. The unified research system will be more effective in support of the outreach function of the University and the Extension Department in preparation of practice recommendations and packages of practices for the diverse agro-climatic zones of the Province.

j. The research institutes, stations, and sub-stations will serve more effectively as technology transfer centers as well as research stations thereby strengthening the work of agricultural officers, agricultural field assistants. and livestock production assistants.

k. The University will have the primary responsibility for coordination with the provincially-located but federally-supported research organizations such as the Tobacco Research Station and the Nuclear Institute for Food and Agriculture.

1. The unified research system in the Province will provide a stronger mechanism for linking the research of the Province to that of other Provinces and the federal system, particularly the Pakistan Agricultural Research Council and the National Agricultural Research Centre.

2. Recommendation

As indicated earlier, it was beyond the terms of reference of the NWFP-AU Design Team to identify the needs for strengthening the non-University provincial agricultural and livestock production research system and consider the ramifications of unification of the entire system under the leadership and responsibility of the NWFP-AU. The primary focus was on NWFP-AU research, teaching, and outreach. However, major progress was made in identification of the problems of provincial agricultural research broadly defined.

In view of the importance of a strong, well-coordinated or unified research system to the success of the Agricultural University, the Design Team recommends that a small supplemental study team make an in-depth analysis of (1) the needs for strengthening the non-University NWFP agricultural research and (2) the questions related to coordination and/or unification of the provincial agricultural research system. This would be part of the design process for the NWFP-AU component and could be supported by USAID funding.

This supplemental study will require be made with the full support of GONWFP officials and should follow the policy decision to unify the provincial crop, livestock production and

agriculturally-related research system under the direction of the NWFP--AU.

3. Scope of Work

The following is an outline of the scope of work for the supplemental study team.

a. Review the locations of the provincial crop and livestock production research institutes, stations and sub-stations in terms of suitability to serve the agro-ecological zones of the Province; assess the effectiveness of the program of decentralization; recommend changes including expansion and/or consolidation.

b. Review the relationship between crops research and livestock production research and recommend means for closer coordination and/or integration.

c. Analyze the adequacy of professional staff in terms of numbers and quality; assess needs for upgrading and recommend training and other measures to correct deficiencies.

d. Review the administration of research sub-systems and recommend changes.

e. Analyze the procedures used in determining research priorities; analyze the relevance of research to the problems of farmers, rural households, and agro-business interests of the NWFP; recommend an improved research program.

f. Assess the adequacy of physical facilities, equipment and financial and other research support to carry out (1) the current

program of research; and (2) an improved program.

g. Assess the effectiveness of linkages to the federal agricultural research system and federally-supported institutes/stations located in the NWFP.

h. Identify the problems in creating a unified system under the responsibility of the NWFP-AU including transitional problems; problems of one-time versus phased change.

The relationship of NWFP-AU research to the other agricultural research of the NWFP is a priority issue bearing on the design and implementation of the integrated functions of teaching, research, and outreach at the Agricultural University. Therefore, the supplemental study should be completed as early as feasible. The period from September 1 to October 30, 1983 is suggested. The study could be completed by 3 or 4 persons with a total personnel requirement not to exceed 4-person months. In view of the information collected and insights gained during the design phase of the NWFP-AU project component, there would be economies and efficiencies in selecting persons for the supplemental study team who have served on the NWFP-AU Design Team.

CHAPTER 4

OUTREACH FROM THE NWFP AGRICULTURAL UNIVERSITY

The Outreach function of a major university is to disseminate knowledge, research results and recommendations beyond the classrooms. A well-trained faculty with a sound research base provides the depth of knowledge which gives credibility to the Outreach function.

The optimum structure for an efficient system designed to gain new knowledge for improved agricultural production and have this knowledge adopted by food producers is to have a combined research, instruction, and outreach structure under one central unit. Research provides the base of new knowledge and technology; instruction transfers this knowledge to campus-based students for their professional training; and Outreach interprets, packages and delivers this knowledge to producers, rural households, agribusiness and those other individuals who have influence upon producers.

An essential condition for maximum growth in food production is to have ample supplies of electricity, irrigation water, credit, and the basic inputs such as quality seed, fertilizer, feed supplements, pesticides, fuel, etc. These must be easily available in a timely manner. The final incentive is a market which responds to consumer and producer needs and rewards those in the agricultural sector when a function is well performed.

Current Situation: Currently no outreach function exists at the Agricultural University and very little in-service training is provided for professional agricultural workers such as research

scientists, agricultural officers or persons working in the agri-business sector such as credit, input suppliers, marketing, post-harvest storage or food preservation.

University Outreach (overview): An upgraded Agricultural University can have a major impact on agricultural development in the NWFP through an Outreach program, even though the Extension function is a responsibility of the Provincial government. Though it is beyond the purview of this project to assess the Extension Department in detail, there are several problems that are seriously constraining the present extension operations on which the University could make a considerable impact.

(1) The development of technology packages for major crops, animal husbandry practices, and the farming systems of the several agricultural zones. At present this aspect of the agricultural research is very poorly developed and the University could provide a coordinating and leadership role in developing multi-disciplinary packages for use by the Extension Department as well as in its outreach efforts.

(2) The in-service and refresher training of agricultural officers and subject matter specialists in the Provincial Extension Department. In cooperation with the field research stations, the outreach section can assist the Extension Department with the in-service training of field assistants.

(3) The University can also be effective as a supplemental source of information through mass media and programs for the more progressive farmers of all sizes. The Director of Extension sees this latter role as an important one for the University as

his personnel are best able to work on a personal contact basis with the more typical small farmers. Fulfillment of these major roles is badly needed and the general division of responsibility seems to be understood and supported by the Extension Department of the Province.

The Outreach function needs to be developed as the total University is upgraded even though the research base is presently not highly developed. The simultaneous development of the outreach function will help create a problem orientation and be mutually supportive to the teaching and research functions. Feedback regarding researchable problems can be important in guiding research and practical field experiences can enrich classroom activities.

Overall, it is proposed that the outreach function be set up as parallel as possible to the research and instruction structure. Whenever possible joint offices should be provided and where feasible, joint opportunities should be used to help insure integration of the functions. The closest kinds of linkages should be sought both with research and extension, regardless of where these functions exist.

The University Director of Outreach should concern himself in a leadership manner with the needs of the agricultural industry in general and with the needs of the Extension Department in particular. For example, he should be outspoken concerning the need to get technology packages to farmers, households, and agribusiness. This will result in improved production, marketing, income and general welfare. Through such activities he

should become a part of the leadership group in the agricultural arena. He should also be vocal concerning problems that are constraining the progress of farmers, such as farm policy, input supply, and marketing problems.

The linkage with the Extension Department is very important and will directly involve several members of the University Outreach staff. It would be highly desirable if the Provincial Extension Department could assign people to specific liaison with University outreach personnel.

Provincial Extension	University Staff
Extension Director	Director for Outreach
Training Officer	Dir. of the Cont. Ed. Center
Subject matter spec.	Subject matter spec.
Mass media personnel	Mass media personnel

It would also be highly desirable if the Director of the Extension Department and the Director of University Outreach could form several joint standing committees to recommend actions needed, prepare instructional materials, plan training and coordinate calendars. Personnel from field research stations should also be included on these committees. For example:

1. Training Committee (charged with determining training needs).

2. Commodity Teams (with representatives of research). This group would be charged with developing a set of technical packages for major crops and zones, and levels of inputs and updating it annually.

A sample of such a team for sugarcane technology would be as follows:

Chairperson - Program Leader in crops
Sugarcane Extension specialist
Sugarcane Research specialist
Agricultural Engineer
Agricultural Economist
Plant protection specialist

Such a document would be developed for both the Rabi and Kharif seasons as a basis for mass media information, as well as instruction throughout Extension and through University outreach.

A function of the above committee structure would also be to identify at least annually problems being encountered in the field that are transmitted to the research establishment. The specific product to be required of these groups is extremely important to their success as working groups.

An Agricultural Training Institute (ATI) Committee might also be formed so that the University and the Extension Department could work directly with the Principal of ATI in contributing to the training of Field Assistants. Regular short courses for the instructors could be a part of the Continuing Education Center's mission.

The training programs to be offered throughout Extension should be a decision of the Director with suggestions originating from any point. The Director for Outreach should be assigned the function of using the above committee structure to form an annual training plan and calendar. A special training committee could be formed to receive requests and recommend to the Director of Outreach those that appear important and feasible for implementation.

Consideration should be given to providing a University courtesy appointment to the Director of Extension and possibly

some of his key senior staff. This could be done to recognize that they would frequently be called upon to take part in University Outreach activities. This appointment would also serve as tangible evidence that the University and Extension Department are both a part of the knowledge transfer system of the Province; a part of a continuum with the University handling the subject matter related functions, with the Extension Department providing the field delivery function.

Assumptions: The following outline assumes that only on-campus research will be encompassed within the Agricultural University, with most research and extension functions being maintained within its current structure, outside the University.* Under this assumption University Outreach would function primarily through the new Continuing Education Center.

Objectives:

1. To develop an understanding and appreciation on the part of faculty for the role and impact that an outstanding Outreach educational program can have in improving agricultural productivity and rural living in the NWFP.

2. To stress that an aggressive and meaningful Outreach program can enhance the status of faculty and the Agricultural University in the eyes of key leaders and influential government officials.

3. To develop a well-integrated Outreach and Research program within departments for technology transfer to agricultural

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*See research organization alternative A on p. 69.

professionals and farmers with feedback to researchers of the major problems needing further study and refined research.

4. To involve the recipients of Outreach education in program planning committees to develop and evaluate educational activities that meet the needs of agriculture.

5. To serve as a center where experiment station researchers, extension subject-matter specialists, input suppliers, marketing people, lenders and farmers can jointly discuss recommended production, marketing and storage practices; and plan to have necessary inputs, credit and facilities available in a timely manner.

6. To develop an Outreach program for women including: agricultural production and storage, as well as, human nutrition, health and food processing.

Functions: The staff will develop informal linkages with appropriate scientists at research stations, extension subject matter specialists and agribusiness personnel. Their role will be to interpret research data and develop production recommendations. They will be responsible for developing information and technology packages, as well as teach in the Outreach function of the University.

Extension Agriculture Officers and subject-matter specialists will return for in-service training on latest recommendations to improve their knowledge and ability to effectively lead the field assistants assigned to them. Agribusiness staff and leaders will be taught the latest production recommendations and the importance of having the inputs they provide to farmers

available in the right quantity, quality and in a timely manner. Marketers and processors will be taught principles in maintaining the quality and minimizing waste upon receiving raw products.

In-service training of persons who serve in "contact positions" with women in rural areas will be included in Outreach programs. Training will include crop production, animal care, human nutrition, post-harvest storage and food preservation. These contact women include: Lady Health Vistors, lady teachers employed by the Pakistan Academy for Rural Development (PARD), and other agency personnel who are accepted in working with women in rural areas. Progressive farmers whose educational needs exceed the capabilities of most extension staff will be served from the outreach function.

The Continuing Education Center can serve as a location for getting responsible leaders together for the purpose of solving logistics problems which stifle the growing need for high quality food.

Specific activities to disseminate educational outreach programs will include the development of teaching packages, bulletins, fact sheets, as well as mass media materials such a news releases, radio and television tapes. Conferences, meetings and workshops will be conducted primarily at the Continuing Education Center although occasional off-campus conferences may best meet the clientele needs.

The Outreach faculty will use the staff at the Learning Resources Center to edit and produce outreach materials to use

in activities at the Center as well as for distribution to clientele and mass-communication networks.

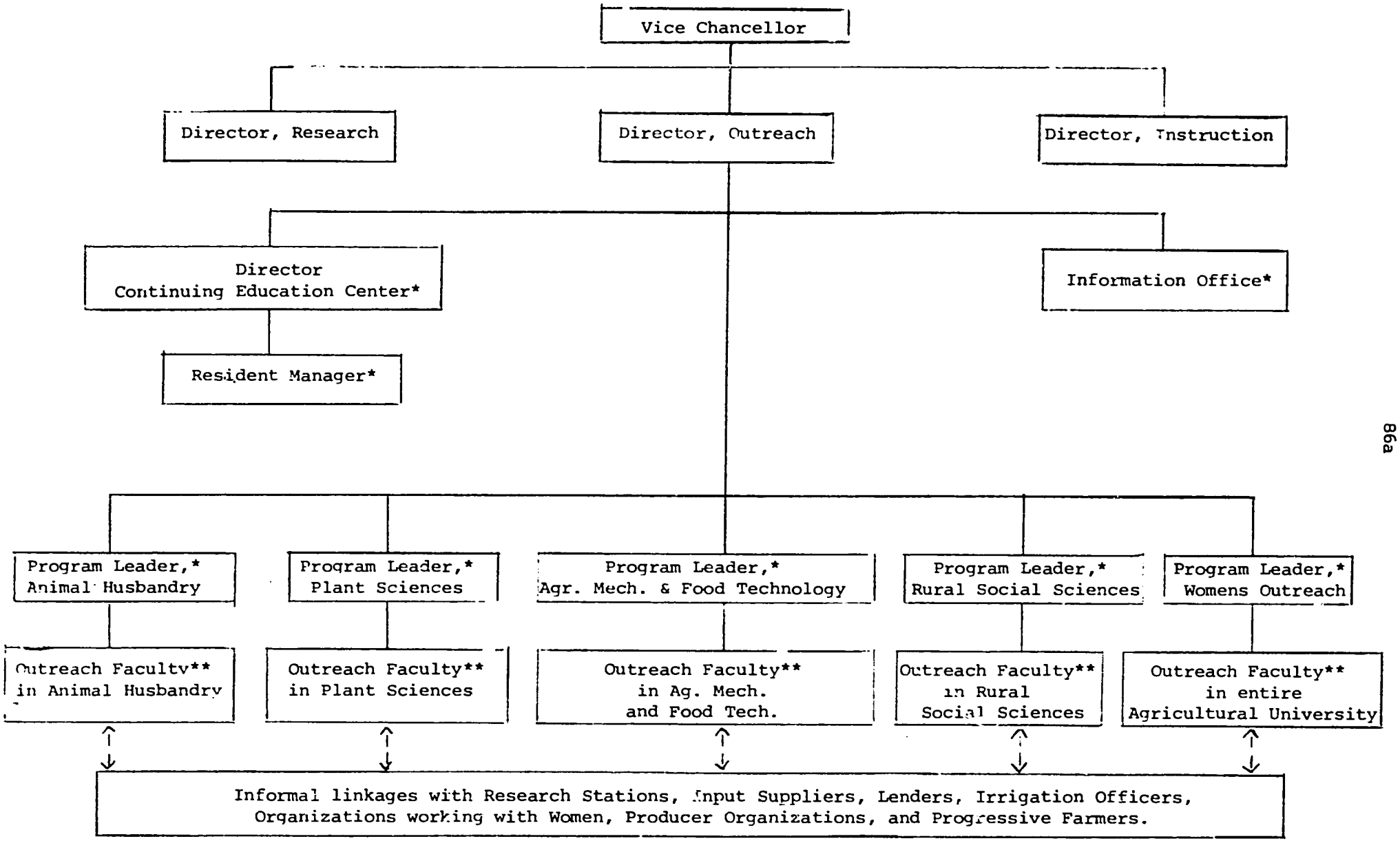
The ultimate goal is to establish the Agricultural University as a dynamic leading force not only in research and teaching but in getting educational programs to professionals and leaders in farming and agribusiness and in serving the educational needs of progressive farmers.

Structure: The Outreach function of the University will primarily take place on campus at the new Continuing Education Center. The center will house a few core staff with most Outreach staff integrated into faculties and departments with either full-time outreach assignments or joint research-outreach appointments.

Outreach Program Faculty and Staff: The Director of Outreach will work with the Vice Chancellor and the Directors of Instruction and Research on policy formulation and program and resource coordination. He will also work closely with the Deans of each Faculty and Department Heads to insure that the outreach function of the University is maintained as an integral part of the overall University mission. He should form linkages with Directors of research institutes and stations and Agricultural Extension for sharing research information and coordinating in-service training of all staff. The Director of Outreach will play an important role in establishing linkages with agencies and organizations who serve the agricultural and rural sectors to meet the overall needs of this common clientele.

The staff at the Continuing Education Center will consist of a Center Director, who will have overall administrative

Figure 4.2. Outreach Program Organization



* Directors for Outreach, Program Leaders and Center Staff will have offices in the Continuing Education Center.
** Faculty with Outreach appointments will be located in their respective departments.

responsibility for the Center, including scheduling of Center activities; a Resident Manager, who will oversee and manage the residential facility and food service; and an Information Officer, who will assist the Director of Outreach with campus visitors and a broad range of other public relations activities.

There will be a Program Leader for each Faculty who will coordinate and facilitate the outreach activities of their respective Faculties as well as coordinate and integrate the work among Faculties. They will work with research and outreach personnel on campus and scientists (through informal linkages) at research stations to formulate technical recommendations based on research findings. Outreach faculty will transfer these recommendations into appropriate extension media (bulletins, fact sheets, posters, radio, television, video tapes, newsletter, etc.) and then schedule in-service training workshops for clientele.

The Outreach Faculty will be housed in their respective departments and may be full-time outreach workers or carry joint research-outreach appointments. Approximately twenty (20) percent of faculty resources will be devoted to Outreach. Outreach faculty should develop linkages with on-campus and research station scientists to coordinate recommendations resulting from available knowledge and current research. Informal linkages with other agencies, agribusiness, producer associations and farmers should lead to more relevant and coordinated educational Outreach programs.

AN ALTERNATIVE APPROACH

Two alternative approaches to the organization of the outreach program are described in this paper. The first (described immediately above) is based on the promise that there will be no structural change in the organization of agricultural research, education and extension. The second approach, which follows, assumes that the Provincial research system will be unified and become the responsibility of the NWFP Agricultural University as recommended in Chapter 3.* Obviously these two approaches have major implications in regards to the type and magnitude of the AU's outreach program. In the former case, the University's role would be more modest and would largely function as a coordinating and facilitating mechanism. In the latter case, the University would become the lead agency in the Province for research, technology development and transfer (down to providing the technical messages and training for front-line extension personnel). This section has been written assuming that the recommendations of Chapter 3 will be adopted.

Assumptions: All agricultural research is merged into a unified system under the Agricultural University. The extension staff would remain under the Director of the Extension Department.

Objectives:

1. To develop a well-integrated system for technology development and transfer, including providing technical assistance, backstopping and training for field extension personnel and the feedback of problems to research.

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*See research organization alternative B on p. 70.

2. To develop a well-trained cadre of outreach personnel who would serve as the primary linkage between research and extension at each level in the system.

3. To conduct outreach activities including the joint formulation and verification of technical or agro-economic recommendations (package of practices) for each agro-ecological zone in the NWFP.

4. To enhance the Agricultural University's capacity and reputation as a problem-oriented institution, whose primary goal is to serve the needs of farmers, rural households and the agricultural sector of the NWFP.

Structure and Function

The University's outreach program must be fully integrated with research, both within on-campus departments, and with commodity and problem-oriented research programs on stations. Integration will be achieved largely through the use of joint appointments with most on-campus and many off-campus "research" personnel having some time allocated to outreach (e.g. a minimum of 15%). Generally most outreach personnel would have 75% of their appointment devoted to outreach activities.

Since it is assumed that the majority of the applied/adaptive research would be conducted at or from the University and its main research stations and sub-stations, outreach personnel will be responsible for implementing most of the on-farm adaptation and/or verification trials, and assisting extension with designing and implementing demonstration plots. These research and outreach activities will be planned jointly and carried out

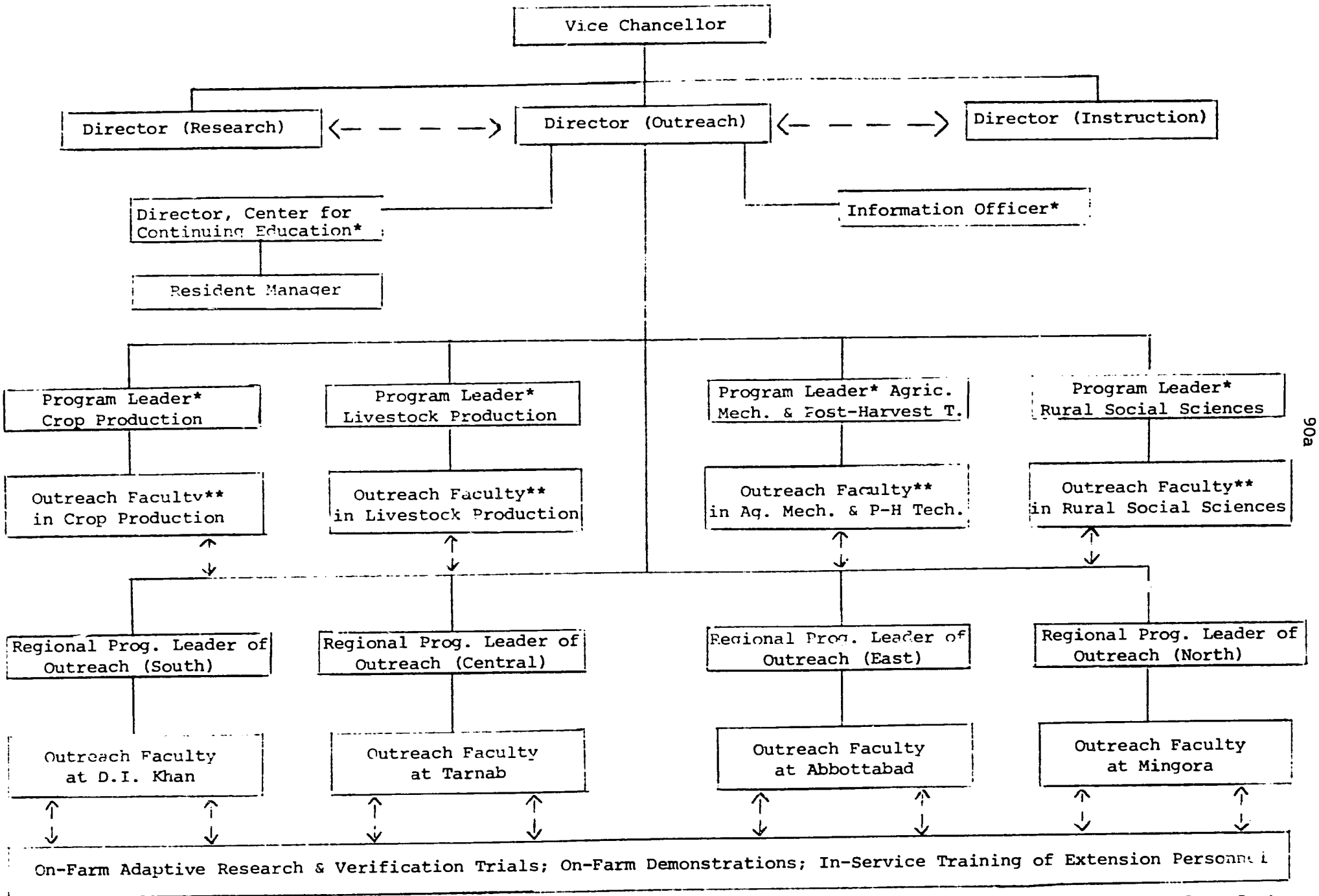
in close collaboration with their research colleagues. In addition to conducting on-farm trials and plots, outreach personnel (with assistance from their research counterparts) will provide technical assistance, backstopping and in-service training for field extension workers. In effect, this cadre of outreach personnel will function as subject matter specialists for extension, a category of personnel that currently exists in name only within Extension. Therefore, rather than Extension attempting to build this function into its system, it is recommended that the outreach program of the University serve as the primary linkage between research aimed at technology development and the dissemination of these technical recommendations through Extension's field personnel.

In addition to backstopping Extension, the outreach program will be expected to maintain a close working relationship with input suppliers and sources of credit (i.e the private sector, the Agricultural Development Authority and the Agricultural Development Bank). When technical packages (recommendations) are being formulated in advance of each growing season (based on latest research findings), input and credit suppliers must be involved in these decisions. Through their involvement they can better anticipate farmer demands, and/or warn outreach and extension personnel of possible input and/or credit constraints that would impact directly on the outreach program.

Organization of Outreach

On the University campus, the Director of Outreach and Program Leaders would operate out of the Center for Continuing

Figure 4.3. Outreach Program Organization With Unified Provincial Research System



Education, while outreach faculty would be assigned to their respective academic departments. Since campus research would tend to be more disciplinary oriented, outreach faculty in departments would be expected to backstop and provide in-service training to Extension that would deal with specific production and marketing problems that might occur throughout the province. The Director of Outreach and the Program Leaders for Outreach would provide overall direction and programatic coordination for the University's out each effort. Regional Program Leaders and their outreach faculty would further fine-tune and verify, and then transmit production recommendations to field extension workers, including both agricultural officers and field assistants. The following section briefly describes each of the major positions included under this expanded program.

Outreach Program Faculty and Staff

The Director of Outreach will work with the Vice Chancellor and the Directors of Instruction and Research on policy formulations, and program and resource coordination. He will also work closely with the Deans of each Faculty on campus and the Directors of research stations to insure that the outreach function of the University is maintained as an important and integral part of the overall University mission.

The Director of Outreach will give both programatic and administrative leadership to the outreach program. He will work to establish program objectives and priorities and then take the lead for implementing these priority programs. Because the off-campus outreach program would be larger in scope, this dimension

of the program would probably demand more attention, especially as he coordinates these off-campus activities with on-campus programs and resources.

The five on-campus Program Leaders will coordinate and facilitate the outreach activities of their respective Faculties as well as coordinate and integrate the work among Faculties. They will work with research-outreach personnel in their respective faculties to formulate technical recommendations (messages) based on research findings, to have outreach faculty transform these recommendations into appropriate media (bulletins, posters, slide sets, etc.) and then to schedule in-service training workshops - both on- and off-campus, as appropriate to the clientele to be served. They will also coordinate the technical backstopping of the off-campus program by the outreach and research faculty in departments.

The Regional Program Leaders will provide leadership for the overall outreach program in the three or four major agro-ecological zones in NWFP. Their programatic focus will be the major farming systems in their respective regions, as they seek to integrate research outcomes from each field of study into an overall outreach program that will meet the needs of farmers in their regions. They will direct and coordinate the off-station work of outreach faculty assigned to stations in their region. These outreach activities will include on-farm adaptive research and verification trials as well as demonstration plots. Although the primary clientele of the regional outreach faculty will be the Agricultural Officers and Field Assistants in extension, they will have some direct contact with farmers (through their on-farm

trials and demonstrations, which may include field days held jointly with extension). In addition, they will maintain regular contact with input and credit suppliers in their regions.

Because the off-campus outreach program is to be oriented directly to the major farming systems in the area, the regional outreach program will be organized more around commodity and farming system improvement programs, rather than around disciplinary departments (as would be the case on campus). At this point in the technology development and transfer process the focus must be integrative, as research and outreach attempt to provide useful solutions to farmers' problems. The most efficient and effective means of organizing research and outreach at this level is to focus on farmer problems that tend to be commodity specific and/or system related.

The Regional Program Leaders will be located on the main research stations but will report directly to the Director of Outreach. Since the off-campus outreach faculty would have at least partial research appointments, they will receive administrative support from the Research Station Director at their respective stations. However, they would report to the Regional Program Leader concerning the outreach portion of their assignments. It is expected that the Regional Program Leader would be on an equal status (NPS level) with the Research Station Director.

Resource Allocation to Outreach

If all agricultural research is brought under the direction of the Agricultural University as recommended, it is proposed

that about 30% of all University resources be devoted to the outreach activities described above. At the campus level, it is proposed that about 20% of total faculty resources be devoted to outreach, while on research stations and institutes, outreach should command about 35% of total professional staff time. This higher level of activity is proposed because outreach personnel will be primarily responsible for conducting on-farm verification and adaptive research trials, as well as the technical backstopping and training roles (with extension).

Therefore, given the current off-campus agricultural research staff of 225 officers, it is proposed that 50 be designated as outreach faculty (75% outreach, 25% research); 150 research officers have a 25% outreach appointment, with the other 25 officers being full time research (i.e. the research directors, etc.) or 15% outreach. By the end of Phase I of this project (in seven years) it is expected that the number of off-campus research-outreach personnel will have increased to about 325 (7% net growth/annum); therefore, the number of outreach personnel should rise to about 70 (75% outreach, 25% research) with 230 research faculty having 25% outreach appointments, with the remaining faculty having essentially full time research appointments.

In terms of on-campus faculty, it is expected that the Director of Outreach and the Program Leaders will devote 100% of their time to outreach. About ten full-time equivalent faculty will be allocated to the positions of Director of Outreach and Program Leaders and about 25-30 faculty in departments will hold 75% outreach and 25% research appointments.

CHAPTER 5

THE PROGRAM FOR WOMEN

Introduction: Taking the data from visits, interviews, selected literature and observations of conditions related to the involvement of women in the NWFP Agricultural University, the following program for women at the University is recommended. The presentation is divided into the following components:

I. The current state of affairs regarding women in rural areas and women in the AU

II. The desired state of affairs which includes specification of the desired outcomes by the year 1990.

III. A plan of action, a presentation of specific aspects of a plan for the program of education of women at the AU. Particular attention is paid to the teaching program and a unit for the "Study of Rural Households in Agriculture," a research unit which has a major focus on the roles, functions, and activities of rural women in agricultural activities.

I. CURRENT STATE OF AFFAIRS

A. Rural Women in Agriculture

Farming is a major occupation of those in households in the rural areas of Pakistan's NWFP. Within these households, women take on many of the farming responsibilities in addition to their household duties as wives and mothers. Eighty-two percent of the 280 rural women surveyed by the Pakistan Academy for Rural Development in the 5 districts of NWFP said they participate in agro-based activities.[5-1] These women spend up to 45% of their time in agro-based activities.[5-1] In terms of productivity, women's labor is responsible for 25% of the production of the major crops or

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[5-1] Studies on Rural Women in NWFP and Studies on Rural Women in Sind, 1980; Women's Division, Cabinet Secretariat, Government of Pakistan, Islamabad.

equivalent to Rs. 375 per acre.[5-1] Income rises as the amount of women's time spent in agro-labor rises.[5-1] However, because of religious and cultural traditions which are held as important aspects in their lives, Pakistan women in rural areas have had little access to the educational opportunities needed to strengthen their ability to improve the quality of life for all members of their households.[5-2] Currently, the literacy rate in Pakistan is 23% but only 13% for women; the literacy rate among rural women is only 5%.[5-3] However, it should be noted that in Pakistan's Sixth Five Year Plan period, the government is "truly committed to the cause of women's education."[5-4] On May 12, 1983, President Gen. Mohammed Zia-ul-Haq announced the formation of a National Coordinating Committee on education to address the issue of adult literacy. His opening address on female literacy included the following highlights:

"--Incentives to villages for 'undertaking the education of its inhabitants'

--Prizes for the increased performance in the fields

--Higher degrees should be given to candidates only when they had educated at least one person to read Yasr nal Quran

--Large volunteer forces of students and others should use summer vacations to work on literacy in rural areas"

[5-2]Households are described in this paper as any unit of individuals living together as a support group. Such units include both women and men.

[5-3]President Gen. Mohammed Zia-ul-haq; Khyber Mail, May 13, 1983.

[5-4]Ibid.

The President concluded his address by stating that "the education of women was the best way to educate the whole family which formed the basic unit of education."[5-5]

Educators of adults are well aware of the fact that an appropriate method of increasing the literacy rate among rural people, especially women, is to begin with methods that relate to the everyday tasks of these individuals. Therefore, educating rural women in improved methods of agriculture could increase their ability to transfer knowledge to other areas affecting the household.

Rural women are responsible for agricultural tasks related to animal husbandry, food storage and processing, seed selection, crop production and many other activities. For economic reasons, many of the cultural or religious constraints are reduced to allow for an increase in productivity of women in rural households. However, few methods have been found to reach large numbers of these households with appropriate technology to effect change in their current situation. In addition, some religious and cultural practices have been interpreted as barriers to the involvement of women in higher education programs. Educated women could generate and extend agricultural knowledge and practices to their households in rural communities. Many of these problems are recognized by the Government of Pakistan, and first steps are being taken to address them. Dr. Mahbubul Haq, Federal Minister for Planning and Development specified some of the targets for the development of programs for women in the Sixth 5-

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[5-5]President Gen. Mohammed Zia-ul-haq; Pakistan Times, May 13, 1983; Khyber Mail, May 13, 1983.

Year Development Plan. These include the enhancement of female literacy from 13% to 33%, reservation of 33% seats for female students in medical colleges, target of 15% female workers in offices and higher quota in civil services, and extensive job opportunities for women in agro-based industries.[5-6]

B. Women and the NWFP Agricultural University

The NWFP Agricultural University has a major mission to effect change in the productivity and agricultural practices of rural people, including women, in Pakistan's NWFP. In view of the importance of women in farm production processes, the Agricultural University cannot be fully effective unless the productivity of women, as well as men, is increased. Therefore an increased effort to extend higher education opportunities to women in agriculture subject matter is a major priority of the current leaders at the Agricultural University. For a variety of reasons bounded by cultural traditions, few women have earned the B.Sc. or M.Sc. degree at the AU. In the 1960's some 6 to 8 girls were enrolled in a combined program at the (then) College of Agriculture but this effort was dropped. However, the girls did earn their degrees and they are employed in professional level positions. No girl students are currently enrolled in any of the B.Sc. or M.Sc. programs at the University. Currently, two ladies, one in Soil Science along with a female clerical staff person, and another in the Institute of Development Studies, hold faculty positions at the University. Both ladies earned their M.Sc. degrees in the University of Peshawar. One lady who is

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[5-6]Dr. Mabubul Haq; Pakistan Times, May 15, 1983.

married with two children under 2 years of age comes from an urban area, the other lady who is single and has been accepted in a Ph.D. program at the University of Peshawar lives in a Peshawar women's hostel and returns to her home village in a rural area on weekends.

The University has no facilities to accommodate the needs of lady faculty members or girl students. There is some resistance to the involvement of women and girls but no formal university policies prohibit the involvement of women and girls in the agriculture programs at the University. The involvement of women and girls in combined education programs is not an unusual practice, it exists in other universities in the NWFP. Such programs are a source of students for the Agricultural University. Another source of students is the College of Home Economics of the University of Peshawar which awards the B.Sc. to some 100 girls each year. These and other issues including cultural factors reflect the problems of identifying, selecting and recruiting lady faculty and girl students for the AU program. From conversations with both men and women, news articles and observations, it appears that the system of segregating girls and women in an academic program is diminishing. Such action should make it possible for the education of girls at the B.Sc. and M.Sc. levels in all agriculture subject matter to be done in such a way as to take into account the Islamic values and customs related to women's roles in agriculture. The same issues are factors in the employment of women in professional level jobs. Currently opportunities do exist for at least 100 to 200 women graduates to be

placed at grade 17 level positions or above within the next five years. A variety of community-based organizations and agencies exist which could act as linkages for the University in its effort to recruit, educate and place its women graduates. These include the Pakistan Academy for Rural Development in NWFP, which has one female economist on its staff and employs 11 lady supervisors for 55 teachers in women's industrial homes, plus local health advisors/midwives. The Agricultural Extension Department at the moment employs one lady in its Peshawar office, but Punjab Province currently employs at least 38 lady field assistants trained in both agriculture and livestock development. Sind Province has plans for poultry training courses for women. These are precedents which can be encouraged in the NWFP.[B-7] In addition, all of the local research institutes contacted either now employ or are willing to employ qualified women as research assistants in their laboratories. The Agricultural University itself can employ qualified women on its teaching, research and outreach staffs and in the future can employ some of its lady graduates.

In summary, women are an important human resource in any effort to increase the economic well-being of households in rural areas through agriculture, a mainstay in the Pakistan society. There is support at the Agricultural University for the education of girls at the B.Sc. and M.Sc. levels. Similarly, there is support for employment of women in research, teaching and outreach work at the University on an equal basis with men.

[B-7] "Programmes and Projects for Women in Pakistan, June 1980 to June 1981", Women's Division, Cabinet Secretariat, Government of Pakistan, Islamabad.

Furthermore, job opportunities are expanding for women university graduates with scientific and/or scientifically-based practical backgrounds.

II. DESIRED STATE OF AFFAIRS

Given the goals of the NWFP-AU to provide quality education in the agricultural sciences to the people of NWFP to serve the rural society and agro-based industries of the Province and Nation, two broad-based policy statements are in order.

1. To provide quality education in the agricultural sciences to the people of the NWFP, the academic programs at the NWFP-AU shall be open to students of both sexes. There shall be equal opportunities and equal requirements for students of both sexes. There shall be segregation of sexes only in such areas as housing, eating and recreation facilities, toilet and sanitary facilities, or other physical arrangements as required by religion or society. Both sexes shall be represented on the faculty and all disciplines, or as many as there are qualified faculty available. The administrative faculty of the Agricultural University shall include a Dean of Women with responsibility for carrying out this policy.

2. To serve the rural population in the agricultural fields of NWFP, the Agricultural University shall provide outreach and in-service training in all such disciplines as it is qualified to do. This training for the women shall be given to groups of women working with rural women and the training and support materials shall be adapted to the educational and literacy levels of the intended audience. A Program Leader for Women's Outreach

with responsibility for implementation of this policy shall be on the staff of the Center for Continuing Education.

Given some of the factors that favor the active participation of women and girls in the agricultural work which impacts farm production and households, every effort should be made to increase the number of women enrolled in the B.Sc. and M.Sc. levels of study at the NWFP Agricultural University in all subject matter taught at the AU. More specially, by 1990, it would be desirable to have the following conditions existing regarding the participation of women and girls in the Agricultural University.

--The Instruction Program: The girl student population should be no less than the percent of girls represented in the total population of girls completing the certificate (interscience or interarts) for the B.Sc. entry or the B.Sc. completion at the M.Sc. entry level based on the average of the last 3 years, i.e. if 25% of the total population of diploma graduates representing the average of 3 years is girls, then 25% of the AU student population should be girls. The proportion of girls was 16% of the total interscience students passing examinations in 1972-74.[5-6] However, in light of the Government of Pakistan's Sixth Five Year Development Plan, and its target of 33% girl students in the medical colleges[5-6], it may be advisable for the Agricultural University to align its quota of reserved seats with the governmental target.

[5-6]Dr. Mabubul Haq: Pakistan Times, May 15, 1983.

--In the first five years, a percent of classroom seats should be reserved for girls with the number increasing each year until the percent of girls is equal to the number listed earlier. After that the numbers of reserved seats for girls should be reduced, correspondingly. This allows eventually for all students to compete for seats on an equal basis and it helps to maintain an appropriate balance between the number of boys and girls. The reserved seat system may be introduced again when the number of girls falls below the stated percentages.

--Curriculum: All courses should be opened to any girl student interested in and academically qualified to study the subject matter.

--Girls and boys should be combined in all academic classes and laboratories - at the B.Sc. and M.Sc. levels. This includes field trips and tours with special arrangements made to accommodate local customs.

--All courses should be taught giving equal presentation of men's and women's activities in the particular discipline without regard for the sex of the person who traditionally performs that duty. In addition, need for all agricultural activities should be presented equally with the female's perception of that subject or activity.

--Girls should be integrated into the same examination and grading system as that of the boys.

--Internship programs with academic credit towards the degree should be required of girls as well as boys. Suitable

experience for girls may be under the direction of a woman or a man.

--Girls should be part of any subject matter related student/faculty organization. However, selected honoraries, societies and associations governed by established codes/bylaws may exist on a male/female basis on approval by the University's administrative system.

--Girls should compete for prizes, scholarships, fellowship stipends and other sources of recognition on the same basis and in competition with boys. Initially, special competition may be established to attract selected girls. All girls should perform the same academic tasks within the agricultural subject area as that of their boy counterparts.

--Curriculum committees established by the University should include at least one woman. However, all members should be oriented to pay attention to sex equity issues in all curricula matters.

--A support unit to address the specific counselling needs of girl students should be established under the responsibility of the Director of Instruction with the Dean of Women. Such a unit would include the staff responsible for servicing the housing needs of women faculty and girl students.

--Permanent housing facilities should be built to accommodate girl students in such a manner that local customr and religious values may be upheld. Initiation of the teaching program for women should not await construction of new housing with appropriate housing to be located, on an interim basis, at other nearby colleges or universities.

--The Research Program: Each faculty and department is to recognize in its research program the role that women play in farm production and in the agro-based industries of the Province and Nation.

--A Division (not physical structure) for the Study of Rural Households should be established in the Faculty of Social Sciences for the purpose of focusing attention on the research and practices relevant to the needs of women engaged in agriculture work in rural areas.

--The Outreach Program: Due to prevailing lack of B.Sc. and M.Sc. women employed on outreach-type positions, continuing education courses may need to be designed for certain groups of women who only have Certificates or Matriculation Diplomas. This will enable the University to extend the scope of its education facilities more immediately through the services of Lady Health Visitors, primary school teachers, supervisors and teachers of the women's industrial homes and other agencies who already have established contacts with rural women.

--Campus-based continuing education opportunities should be opened to combined groups of men and women. Initially special recruitment efforts should be designed to attract women to these opportunities. Off-campus continuing education opportunities should be designed to take into account local customs and laws.

--In areas where combined men/women learning is not feasible, the use of distant learning methodology should be introduced

(i.e. interactive tv, teleconferences-lectures, audiotapes, computer assisted learning).

--As much as possible, staff working with local people should be trained in or near the work sites.

--Outreach materials generated by the Agricultural University should be written and illustrated to reflect sex equity in all subject matter areas; including materials for radio, tv, slides, and tapes. This suggests that girls will be utilized in the creation, production and distribution of such materials.

--There should be one woman on the Outreach staff specifically responsible for organizing short courses, soliciting proper assistance from the academic departments and preparing outreach materials directed to women and women's activities and adjusted to the level of literacy of the intended audiences.

--Faculty: Of the total faculty, women should hold faculty positions at a percent no less than the percent that are represented in the total population of M.Sc. level graduates in the Nation and particularly that of the Province, i.e. if women represent 25% of all M.Sc. level graduates in the Province, then at least 25% of the AU faculty should be women.

--Each Department should have at least one lady faculty member preferably with an earned doctorate and at least one lady should have an administrative position within the University.

--Each lady faculty member should have office space and access to laboratory facilities and library resources as well as support staff equal to that of her male counterparts, adjusted to conform to local customs and laws.

--University policy should be established to strengthen and maintain equal status of lady faculty and staff with that of men faculty and staff including opportunities for academic and health leaves. Sex equity should be maintained in the matter of visiting and adjunct faculty.

--Appropriately designed housing facilities for single lady faculty should be made available on or near the campus with adequate support services within the complex to accommodate needs which adhere to local customs and religious values, i.e. dining, laundries, meditation/lounge, personal hygiene and physical fitness areas.

III. PLAN OF ACTION

The plans in this section are descriptions of suggested action which could be initiated for the purpose of involving more women as faculty members and girls as students at the B.Sc. and M.Sc. levels in the NWFP Agricultural University. These plans are presented within the framework of the University's three functions of research, teaching, and outreach with the ultimate outcome being a method of impacting the lives of rural people engaged in agriculture and agriculture-related activities.

Plans for specific programs are described: (1) the academic program for girls leading to the B.Sc. and M.Sc. degrees in agriculture; (2) the NWFP-AU Advisory Committee on the Status of Women; (3) the research program: the Division for Study of Rural Households; (4) other matters related to support services for women and girls at the Agricultural University including the role of the Dean of Women; and (5) the Outreach program for women.

1. The Academic Program

The primary goal of the academic program for women and girls is the same as that of men and boys - to increase the knowledge of the faculty and students to the highest quality possible so that the people of the Province as well as national and international scholars may draw on the resources of the University for guidance in agriculture. Therefore, it is suggested that the subject matter curriculum for girls be the same as that for boys. This should be done in combined classes. When the local customs or traditions dictate special requirements, then the classroom should be designed to allow for the instructor to lecture to the group simultaneously. Where laboratory work is required, girl teaching assistants should be utilized. Interactive TV should be a major teaching tool in large classes of boys and girls whether combined or not.

Girls should be admitted to the University using the same admission policy guidelines as for boys. Initially, a critical mass should be established by reserving some 20 to 25 seats for girls in each of the first 2 years and increasing that number, proportionately, each year until the recommended percentage of girls is enrolled. Then the practice of reserving seats for girls should be diminished on a yearly basis.

The University administration (Vice Chancellor, Deputy Vice Chancellor, Directors, and Dean of Women) should encourage and support employment of lady faculty members in each academic unit in accordance with the teaching, research and outreach programs of these units. In many areas, an aggressive program of recruitment and faculty development will be required. Girls should be

encouraged to study in the disciplines of all academic units: however, initially, there may be special opportunities in such areas as food technology, extension education and communication, animal husbandry, biochemistry, and nutrition.

Girls should have required internship experiences to improve their understanding of rural households and the roles of family members in households and farm responsibilities and tasks, decision making, and rewards. The internship for girls should be equivalent to that of boys in terms of effort expended and credit received. It should be a summer experience at the end of the second or third year of the B.Sc.

It is suggested that the summer internship be titled: "Field Work in Rural Households." One or more faculty members would be responsible for organizing students' field experiences to contribute to data collection for a research project with the objective of understanding and describing the roles of family members in the household and the implications of the findings for increasing farm production and income and family levels of living.

The faculty members responsible for the girls' summer internship program would be responsible for training, site selection, placement of individual students and field supervisors. The Dean of Women would have overall administrative responsibility for the program.

Girls should also be advised to elect courses in the third and fourth year of the B.Sc. or at the M.Sc. level to get training in research methodology and additional practical experience

in rural households and farming communities. Such a course(s) might be offered by the Department of Agricultural Economics and Rural Sociology and field research might be supervised by the Institute of Development Studies/Rural Social Sciences.

2. The Advisory Committee on the Status of Women

There should be established an advisory committee to the Vice Chancellor created for the purpose of providing insights into the status of women at the AU and to help identify areas of concern related to rural households. The Vice Chancellor should act as chair and the Dean of Women should serve as the secretary to the group. The Head of the Division for Study of Rural Households and the Women's Outreach Program Leader should have ex officio roles.

The committee should be comprised of key leaders who can have an impact on the quality of programs for women through the AU. They would be most helpful in providing the Vice Chancellor with insights on the following topics:

1. Sources of women faculty and girl students relative to their recruitment.
2. Employment opportunities, current and projected
3. Conditions which need to exist for a satisfactory student life for girls on campus relative to customs and traditions.
4. Issues and concerns regarding women in rural households
5. Appropriate topics and appropriate methods and materials for outreach to rural women.
6. Developing and maintaining linkages with those agencies and organizations, governmental or otherwise, that have an established system of contacts with rural women.

The number of committee members should not exceed 12 and they should be persons who are interested in the well-being of women

in rural areas and a quality education, research and outreach program at the AU. The committee should include people such as the Head of the Women's Division at Islamabad, progressive women landowners and farmers in the NWFP, a representative from the College of Home Economics at the University of Peshawar, an officer in the Secretariat for Agriculture and the Extension Department as well as a major employer in science and industry. A faculty member from the agricultural sciences, and one from the social sciences should sit on this committee. Terms should be for three years and no individual should serve for more than two successive terms. Terms should be staggered to provide for continuity. They should meet no less than 3 times a year. The majority of the committee members should be women. It may be advisable to have sub-committees of the Advisory Committee responsible for different aspects of the Committee's work; one sub-committee, for example, might be appointed to pay special attention to Women's Outreach activities.

The initiation of this committee should begin immediately. However, a well defined written statement of purpose, goals, members' responsibilities and relationships should be prepared before individuals are identified to serve on the committee.

3. The Division for Study of Rural Households

This is a research division recommended to be placed in the Faculty of Rural Social Sciences. The purpose of this unit is to conduct research and disseminate research results regarding rural households with the major focus on women in agriculture at the

village or individual household level. The major objectives include, at least, the following:

--to generate data regarding the role of women in the home related to agriculture responsibilities

--to identify the impact of rural women on agricultural practices, specifically agricultural production

--to examine the concept of the family as the change agent for the purpose of improving the quality of life among rural people

A division head should be appointed who has competencies to manage a research unit, one who can work with faculty and the community on a cooperative basis, one who has skills in conducting social science research but has a great appreciation for agricultural sciences, extension and outreach. Preferences should be given to a woman. This person should hold an appointment in the Faculty of Rural Social Sciences and should be encouraged to teach the Social Science Methodology course at the B.Sc. level (as well as the summer internship on rural households at the B.Sc. level) and the M.Sc. level course. This person should have skills or be trained to utilize the computer for data collection and analysis. Adequate clerical staff and research scholars, as well as physical space and facilities should be provided to this Division Head.

The Division for Study of Rural Households should have major research responsibility for the:

1. Identification of research needs.

2. Solicitation of relevant research proposals from the academic departments.

3. Coordination of research design with the academic departments.

4. Adequate advance work in the study of villages to inform the villagers of the proposed project and obtain their consent and cooperation.

5. Adequate advance work in the study of villages to provide for acceptable food and lodging for all students during their stay in the village.

6. Analysis of relevant sociological data or transfer of technical data to the proper department for analysis.

7. Dissemination of research results regarding household activities to academic departments, Outreach Division and the Learning Resources Center.

8. Encouraging of departments and divisions to include these findings in their academic courses and to gear future research projects on the basis of the increasing understanding of household activities.

The general thrust of research sponsored or organized by this division will be the identification of the labor and economic roles played by all members of rural households, with a special interest in identifying the women's roles, what are year-round roles, what are seasonal roles and under what conditions these roles operate, and how are roles curtailed by cultural, social, economic, technological or other conditions.

This division will coordinate continuously with the Institute of Development Studies/Rural Social Sciences. It will also cooperate with and seek the advice and assistance of any other agency or organization with experience or interest in such research. The Department of Economics of Peshawar University, and in particular the Center for Applied Science and Technology in Rural Areas (CASTRA), should be consulted for its experience in such activities. Other possible collaborators are the Pakistan Agency for Rural Development and the Public Health School for Lady Health Visitors.

4. Support Services for Women

a. The Dean of Women

The Dean of Women is an administrative position responsible to the Vice Chancellor through the Director of Instruction. She will be an ex officio member of the Advisory Committee on the Status of Women. This lady should have a Ph.D. in a social science or agricultural science, as well as administrative skills. She must be of a calibre to ensure the respectability and security of the girl students to their parents or guardians.

Her responsibilities will include:

1. Coordinate recruitment of girl students.
2. Build and maintain contact with employers to develop placement opportunities for girl graduates.
3. Assist in the maintenance of a quality education program for girl students.
4. Build and maintain an atmosphere of non-discrimination.
5. Assist faculty with summer internship program.

b. Continuing Education

Continuing education for B.Sc. and M.Sc. women in positions in agricultural fields will be part of the regular program. It is not anticipated that any special arrangements will need to be made for these professional women, but they will participate fully in all such programs arranged for their male counterparts and co-workers.

These women, whether NWFP-AU graduates or not, can be encouraged to participate or assist also in research projects of the Division for Study of Rural Households, since they will have access to the women's domain of village life.

5. Women's Outreach

Given the present state of affairs of women and absence of women in the Extension Department of the Agriculture Secretariat, special arrangements will need to be made in order to fulfill the University's commitment to serve the poorest of society, the rural women.

Although the precedent for lady field assistants has been established in other provinces,[5-7] there are none presently serving in NWFP. The AU has neither the mandate nor the capability to establish such a service, however much the need is felt, or however well it would fulfill its overall mission. Therefore, that mission to serve the rural woman in her agricultural activities must be met through the mediation of other agencies and organizations. These are the agencies already specially designated to serve rural women, with the governmental mandate and social and cultural acceptance. These are agencies that use women to contact women in their homes in the villages. These women so employed already can be trained by the staff of the AU in those agricultural practices normally done by women. However, the same programs and techniques will not be feasible for these women as for the B.Sc. and M.Sc. women at the University.

The majority of women in these "contact positions" are at least matriculates. Some have certificates from the various governmental polytechnic institutes, some (Lady Health Visitors) have 2 years of training at the Public Health School (equivalent to F.Sc. in time, but not considered academically equivalent),

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[5-7] "Programmes and Projects for Women in Pakistan, June 1980 to June 1981", Women's Division, Cabinet Secretariat, Government of Pakistan, Islamabad.

and a very few are B.Sc., M.Sc., and M.D.'s. Because of this level of education, the level of training and support materials will have to be adjusted below that of the usual B.Sc./M.Sc.-continuing education courses.

a. Program Leader for Women's Outreach

1. As a result of suggestions from most of the people interviewed about this topic of outreach to rural women, the position of Program Leader for Women's Outreach is proposed, in addition to whatever lady faculty members should be part of the regular Outreach Division staff.

2. Qualifications: This person should be an academically qualified woman, with degrees in agricultural sciences, or degrees in social science with strong familiarity with the agricultural sciences. She should also have a deep interest in serving rural women and be skilled in coordination and administration. She will be a member of the academic faculty.

3. Responsibilities: This woman will be responsible for:

--establishing and maintaining contacts with those agencies that serve rural women

--coordinating short courses, in-service training and other programs with these agencies for training their women working in the villages

--soliciting the training needs of these agencies which the AU can feasibly serve

--soliciting proposals from the academic disciplines for training program topics which the academic departments feel would be of service to rural women and which they are equipped to provide

--working closely with the Learning Resources Center to assure that the materials used in these training programs are appropriate for the educational and literacy level of the women trainees, and that support

materials provided to them as packets of teaching information are appropriate for the literacy level of the rural women. This will require that someone on the communications staff have skills in readability scales and adult education instructional techniques

--assuring that all materials presented are socially and culturally acceptable for women

4. Advisory Committee: Because of the range of duties for this woman, it will be advisable to have either a separate Advisory Committee on the Status of Women, or a subcommittee of the Advisory Committee on the Status of Women specially charged to assist in project identification, implementation, and in screening materials for literacy level and cultural acceptability. This group should include representatives of some of those agencies whose women are, have been, or will be trained by the AU Outreach Division.

b. Coordination

1. Within the AU, the academic departments with which the Women's Outreach would be expected to intitially coordinate most closely, would be Agricultural Chemistry and Human Nutrition, Food Technology, Rural Sociology, and Animal Husbandry. Information collected by the Division for Study of Rural Households would be very influential in determining proper topics for training programs, although several have been repeatedly suggested by interviewees. These include all aspects of:

--foods and nutrition, specially infant, child and maternal nutrition foods

--animal husbandry and livestock production, including feeding, breeding and animal health

--food technology - grain storage, food preparation, preservation and sanitation

--hygiene and sanitation, including water use, personal and domestic hygiene

--horticulture, particularly vegetable production and use

2. Outside the AU, several agencies have been identified which should be closely involved in the activities of Women's Outreach.

a. The Pakistan Academy for Rural Development

This agency employs 11 lady supervisors and 55 lady teachers in their industrialization homes. Through these 55 homes they reach rural girls, on the average 30-40 girls per home although some have as many as 100 girls enrolled, and other girls attended sporadically.

The supervisors are matriculates, and the teachers have certificates from polytechnics. Both supervisors and teachers would be permitted and encouraged by PARD to attend training classes given by the AU. For those women in and around Peshawar no housing or transportation difficulties are expected.

At present most of the training given at these homes is in handicrafts, although most teachers seem to be giving literacy training as well. All those who were visited expressed interest in additional training in agricultural activities, both for themselves and for their fellow teachers.

The optimal training program as expressed by one project manager would be a one-month program on motivation and introduction to agricultural practices, followed by week-long courses at spaced intervals on specific topics such as those already enumerated.

b. Lady Health Visitors Trained by Public Health School

This school trains girls for employment by the Public Health Office as Lady Health Visitors. Once passed and employed they are posted to villages where they live and work. Along with the traditional midwives, they are among the highly respected members of the community.

Girl matriculates are given two years training in infant, child and maternal nutrition, supplemental and weaning foods, midwifery, sanitation and hygiene, immunization, and educational methods. Although this training does not result in an F.Sc., some girls go on to the F.Sc. and/or Nursing School.

Classes are in groups of 60 girls, for 2 years, followed by another group of 60. At present there are between 150-200 Lady Health Visitors working in the NWFP. Girls live at the hostel in the school and would need transportation to the AU.

Once a girl is employed and posted as a Lady Health Visitor, there is no regular schedule of in-service training, either for motivational or educational purposes. Sporadic sessions are given by various agencies, mostly PVD's or NGD's, as demanded by immediate agencies.

The Principal of the School would willingly accept any proffered assistance in training students, and would help organize any in-service training the AU would be willing to offer.

The Principal is trained in obstetrics and pediatrics. She and her 2 instructors are the only regular teaching staff of the school, although there are kitchen and cooking instructors, and occasional instructors from outside agencies.

She expressed immediate interest and desire for more training for her staff as well, from qualified AU staff or any U.S. technical assistance specialists who are at the University.

c. Other Possible Agencies

Other possible coordinating groups that were not interviewed include primary school teachers, lady councellors, and lady landlords. The possibility that the Extension Department will employ Lady Field Assistants remains in the future.

d. Media and Methods

All the usual media and methodology of Outreach should be employed, at the appropriate literacy level. As much as possible, practical, hands-on experience should be used because of the literacy problem. Printed materials from other countries designed for practical adult literacy education can be used wherever the women shown are culturally acceptable. Radio, audio cassettes, filmstrips, video cassettes and TV should be used in lieu of or along with printed material.

Short courses, seminars and in-service training have all been identified by nationals as acceptable, either at the AU or in outlying villages as appropriate or feasible.

As much as possible for cultural acceptability, programs should be labeled or identified as women's work, i.e. "Food and Grain Storage, Nutrition and Sanitation."

CHAPTER 6

STAFF DEVELOPMENT TO SUPPORT THE PROGRAM

The teaching, research, and outreach programs described above are dependent upon the realization of a common assumption that adequate numbers of staff with appropriate training are committed to the program. Over the life of this project, it is anticipated that the total size of the academic staff will increase from its current size of just over 90 to about 220, an increase of just over 135%. Most of the staff to be hired, as well as a significant number of current staff, must be given the opportunity to upgrade their skills through education and training programs.

The NWFP-AU is prepared to make a substantial commitment and investment to the development of its human capital in the early years of the project. The development of human capital is essential to the growth of overall productivity and efficient use of other resources. It is, afterall, people who shape and energize a nation's development. Where this fact has not been understood, or ignored, the most ambitious economic development efforts have been frustrated by inefficient public and private administration, low utilization of physical productive capacities, high rates of population growth, internal and external migration, and other social and economic problems. The development of human capital is a long-term process and is integral to the successful development of the NWFP-AU.

Planned Staff Development

The Design Team made a careful inventory of staff needs through 1990. From that inventory, and close consultation with all levels of Agricultural University faculty, training requirements were outlined. We currently project the need for training of 49 persons to Ph.D. degree, and 50 persons to the M.S. level. We project non-degree training for 31 staff members. This training will take many forms. Some have been suggested for 12-month post-doctorals, others for shorter periods of training, in the range of 3 to 4 months, in specially-constructed "hands-on" types of experiences.

Most of the degree students would be sent during the first three years of the project, while new classrooms, laboratories, learning centers, and other facilities are being constructed under the first phase of the master plan for campus development. The planned outflow of participants in the first year of operations, for example, is set at 42. This reflects the institution's determination to hire new staff for immediate participant training so that, as new physical facilities and equipment come on-stream, staff will be retruning who are able to make use of it. It may be more realistic to assume that the 15 current staff members identified will most certainly be deputed, while the remaining 27 persons yet to be hired will be sent over a two- or three-year period. For planning and budgeting reasons, and to provide the Vice Chancellor with the incentive of overseas training to offer promising candidates, we have conformed to the numbers and scheduling identified by the Design Team members and all faculty. Years 3, 4, and 5 will feature the completion of

such degree work and the return of the staff to the institution to move into and take good advantage of the new facilities and supporting equipments. Table 6.1 gives a summary of training requirements by faculty.

In-Country Thesis Research

The plan to have faculty members from the Northwest Frontier Province Agricultural University (NWFP-AU) complete their graduate course work in U.S. universitites and then conduct their thesis/dissertation research in Pakistan is viewed as an important mechanism to prepare participants for re-entry into the

Table 6.1. Summary of Training Requirements by Faculty*

	Degree				Non-Degree	
Faculty or Unit	No. Ph.D.	Mos.	No. M.S.	Mos.	No.	Mos.
1. General Administration	2	72	1	24	3	9
2. Plant Sciences	26	936	12	288	15	120
3. Engineering Applications and Food Technology	3	108	6	144	1	12
4. Animal Husbandry	5	180	7	168	4	27
5. Rural Social Sciences	6	216	12	288	2	6
6. Learning Resources Center	1	36	9	216	6	18
7. Continuing Education Center	6	216	3	72	--	--
	49	1,764	50	1,200	31	192

*Arts and Sciences Trainees are included in Faculties within which Departments or Divisions are administered.

Pakistan research and education system. Not only does this approach improve relevance of the overall graduate program, it

also substantially increases the quantity and quality of agricultural research underway in Pakistan. In-country thesis research often evolves into a long-term research program and thus provides the recently-returned faculty member an easy transition from graduate student to university researcher. Yet, as pointed out by the design team for the Management and Structure Components Project Paper[6-1], there are certain factors necessary to successfully utilize this approach. These include:

1. The resource base necessary for thesis/dissertation research must be adequate to meet U.S. university standards. This means that the small items which make research possible, such as pH meters, microscopes, fertilizers, basic chemicals/pesticides, etc., as well as facilities such as research plots, timely irrigation water, farm power and labor, etc., must be available. Control over these facilities must be such that proper research procedures can be carried out without interruption or disturbance.

2. A second major factor is the role of the local advisor. This is especially important for Ph.D. students, particularly those that are working in a field that is new to Pakistan agricultural research. The advisor must be available throughout the term of the student's research and has to be willing to play a surrogate role similar to that of the advisor in the U.S. university.

3. A third major issue is the other duties expected of the student while in "thesis status." It is critical that the

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[6-1] Agricultural Education, Research and Extension (Project No. 391-0447). Management and Structure Components Project Paper (final draft).

student be free to work full time on his/her thesis, yet there is going to be significant pressure placed on the individual to carry out other activities assigned by the immediate supervisor, Dean of the Faculty or even the Vice Chancellor.

An educational approach that requires in-country thesis research is compatible with the philosophy of the Design Team and this mechanism will be used in placing faculty sent for higher training. However, in certain areas, primarily the support disciplines such as mathematics, statistics, computer science and English, it can be argued that these programs do not lend themselves to in-country dissertation research. In the field of computer science, for example, a program individually tailored for the student at a U.S. university or at one of the International Agricutural Research Centers (IARCs) such as IRRI or ICRISAT, that makes extensive use of small computers, may offer a better research location than in Pakistan with its shortage of computing facilities. Even in some of the applied disciplines, food technology for example, there are certain research topics that can be carried out more quickly, more efficiently and with greater precision in a U.S. laboratory or at a third-world site rather than within Pakistan.

In-country thesis research tends to add 6-12 months, with accompanying costs, to a degree program and can in some cases lead to great frustration and disappointment. Experience has proven that in-country programs are more successful when they can be fit into an ongoing research project that has both adequate resources and competent, committed staff. In the case of the NWFP-AU, research facilities presently available do not meet the

former criterion nor, unfortunately, do most of the staff meet the latter. In many disciplines thesis research will have to be carried out at other research/academic institutions in Pakistan or even, in certain cases, at one of the IARCs. Thus, a degree of flexibility in training programs is necessary if the participants are to complete their degree programs.

In-country thesis research planning must start at the time of selection of the student and the U.S. academic institution that he/she will attend, not when the student has completed all course work. For a student to gain the maximum amount from his course work he must first have the necessary language skills to comprehend and complete course assignments. According to the training officer at PARC, this is a particularly significant problem with students from the Frontier and from Baluchistan. It is necessary to maintain high selection criteria, including TOEFL scores, and to ensure that students receive intensive English language training in Pakistan prior to departure. PARC's experience, with 18 of 23 participants sent to the U.S. under USAID's Research Strengthening Program requiring 6-9 months studying English in Washington, D.C. in order to raise their TOEFL scores to minimum entrance requirement levels, is too expensive and inefficient to repeat with this project.

The second part of the planning process is to make certain that students are placed with professors (advisors) in U.S. academic institutions who are receptive to the concept of in-country thesis research. Advisors should be selected who are familiar with Pakistan conditions and are supportive of in-

country research. To this extent, they should be willing to travel to Pakistan to help students organize research properly and to interact with local advisors.

Assuming participants have gone to the U.S. with sufficient English language skills, have been assigned to compatible academic institutions and advisors that are supportive of the concept of in-country thesis research, and who are working in an area that can be researched in Pakistan, the following procedures are suggested for organizing and coordinating in-country thesis research:

1. Even though students are, and will be, receiving their university salary while they are abroad and in-country for thesis research, it is important that they be provided a modest stipend (at least 1/4 of their U.S. maintenance allowance). This money is required for maintenance during field research and also will serve as an incentive to encourage students to return to Pakistan for thesis research. Without this stipend it is usually impossible for participants to support themselves during the field research phase of in-country research.

2. Every participant that returns to Pakistan for research should be assigned to a member of the technical assistance team. This individual does not have to be in the same discipline as the participant nor is the member of the technical assistance team expected to serve as a surrogate advisor for the participant. The role of this assignment is to make certain that there is at all times a point of contact both for the participant's U.S. and local advisors and for the participant if any problems arise. In

many cases the member of the technical assistance team will serve more the role of a "host family" than an administrator but it is clearly the responsibility of the expatriate expert to know at all times where the participant is working and what is the status of his/her progress.

3. As soon as possible after the participant returns to Pakistan, his/her advisor should join him/her for a short time, say 3-4 weeks to ensure the research plan and technology to be used are feasible under the resource constraints found in Pakistan. This step is critical if the participant is to complete his/her research in a manner that satisfies the requirements of the U.S. academic institution.

4. At least for the first five years, given the staff and resource weaknesses of the NWFP-UA and the heavy teaching/advising/administrative load on the limited number of staff, it is not recommended that the participant return to the NWFP-AU to carry out in-country research. Where capable staff and resources are available in the Frontier, such as at Tarnab and the Veterinary Research Institute, it is possible for the participant to work out of that institute, but it is unlikely that a participant can have the freedom required for thesis research during the initial phase of development at NWFP-AU. This is not to say that the participant is to be excluded from the NWFP-AU while in "thesis status" nor that, given the situation where a competent advisor is available from the staff or from the technical assistance team, it is forbidden to carry out thesis research at the

University; only that in most instances it is more likely for the participants to successfully complete their research if they are not directly involved in the day-to-day activities of the University.

5. Depending upon their field of specialization it is expected that participants will carry out their research at one of the research institutes or agricultural universities in Pakistan.

a. The National Agricultural Research Centre in Islamabad is rapidly expanding, both in terms of staff and facilities, and soon will be the premier agricultural research facility in the country. With a number of experienced expatriate advisors and, through PARC, with representatives from IRRI and CIMMYT, this is the obvious location for certain types of research. The Director of NARC has expressed willingness to assist participants with their thesis research, particularly in the case where their research interests mesh with ongoing NARC agricultural research thrusts. NARC has an intrinsic appeal as it is less than three hours from Peshawar, has strong technical staff in some areas, can grow many of the same crops as the NWFP and is rapidly developing impressive modern research facilities. The only reservation is a fear that NARC, or PARC, will try to attract the participant away from the NWFP-AU by offering them higher federal salaries and benefits.

b. The Arid Zone Research Institute (AZRI) in Quetta, with technical assistance from ICARDA, offers another possible research location. Here, participants can grow many of the horticultural and dryland crops found in the NWFP, and with assistance

from AZRI and technical assistance staff can carry out research under high altitude dry land conditions. As the final project paper for AZRI is yet to be completed, it is premature to determine exactly what type participants could carry out their research at AZRI but clearly this offers another possible site for in-country thesis research.

c. In terms of social science research the Centre for Applied Economics Research at the Univerity of Karachi, the Punjab Economic Research Institute in Lahore, the Pakistan Institute for Development Economics in Islamabad, the Pakistan Academy for Rural Development in Peshawar and the Institute of Development Studies in Peshawar, as well as the Faculty of Agricultural Economics and Rural Sociology at the University of Agriculture - Faisalabad all offer opportunities for participants to complete their in-country thesis research. The choice of location is more a factor of subject matter area and staff interests and capabilities than of quality of one institute compared to the other. More quantitative participants may be encouraged to work out of the institutes at Islamabad and Karachi while more institutional-oriented research is perhaps better oriented toward the staff in Peshawar and Faisalabad. At all of these institutes the respective Deans and Directors have agreed to have participants working on their in-country research and to provide as much support as possible.

d. The University of Agriculture and the Punjab Agricultural Research Institute at Faisalabad are possible locations for thesis research. PARC currently has students completing their in-country research at Faisalabad so there is a precedent for this

type of program. There may be locations in other provinces. The main limitation is the quality of advisory staff in a particular research area. There is also the drawback that these sites have different agro-ecological conditions from those of the Frontier. However, this is only crucial for certain types of research. The design team has spoken with a number of the administrators at these sites and they are agreeable to participants carrying out research in conjunction with their institutions assuming, of course, that the participants have their own research funds.

From the above discussion is it apparent that in-country thesis research is, under certain conditions, feasible in Pakistan and is supported by the project Design Team. However, there is no standard model, and given the breadth of disciplines represented at the NWFP-AU, no one facility has the staff capability and research mandate to meet the needs of all participants. Each case must be carefully organized to best meet the requirements of the participant and to provide the highest quality supervision available within the country. This is a critical requirement. Therefore, as mentioned previously, flexibility in organizing thesis research programs is necessary. All parties, i.e. participants, technical assistance team members, academic advisors and local advisors will have to work to ensure that in-country thesis research is a positive part of the graduate training program.

Beyond 1990

If, as suggested early in this chapter, the development process is one essentially of people committed to working together

to solve the common problems of society, the staff development program suggested for the NWFP-AU will result in a product that will reflect the efficiency with which educational resources are used, quantitative and qualitative indicators of education and training investment, and the effectiveness of the education and training program and supporting economic and social development objectives.

The mix of training suggested, including long- and medium-term academic programs and intermediate non-degree programs coupled with the provision for in-country dissertation research, will make the best use of time and resources of the NWFP-AU participants, their advisors, and the institutions at which they will be trained.

Quantification of the outputs of the staff development program will be relatively straight-forward. Quantitative outputs will be apparent, and can be easily measured, in the increased output of research publications on agricultural policy and production, problems that constrain agricultural development in the Province.

Quantative change will be observed after a period of time. As new graduates of the institution, benefitting by an improved curriculum and better-trained teachers, take up employment in public and private sector jobs, the general level of capacity to analyze, plan and implement programs and projects leading to increased productivity, employment and the general welfare of the citizens of the NWFP, will be materially improved.

CHAPTER 7

THE LEARNING RESOURCES CENTER

In a curriculum and teaching system based on a year-long syllabus, students and teachers are generally denied the flexibility to investigate new and potentially useful areas of study or develop innovative and stimulating techniques to impart education. Both student and teacher are essentially tied to the lecture hall, which stifles the process of education through experience and interaction with others. The Learning Resources Center designed for the Agricultural University will contribute to a more flexible, dynamic curriculum that will allow students significant opportunity for program specialization and practical application, and also allow released time for faculty to enagage in research and outreach activities that will feedback into the education program.

The concept of a Learning Resources Center is not new. Many U.S. universities have incorporated similar organizations into their instructional programs. The concept of including a Library with its own identity as part of the Learning Resources Center as recommended in this proposal is different. Because adequate libraries have long been included in the basic structure of U.S. universities, they have not been formally designated as component divisions of Learning Resources Centers. Conversely, many universities have incorporated instructional media services as part of general library services, a notable example being the University of Arizona at Tucson. Most library and learning materials

centers in U.S. elementary and secondary schools, however, are designated as Learning Resources Centers.

An outstanding example of the integration of print, visual, and audio material in an international context is the Institut Pertanian Bogor, Indonesia. There, the University of Wisconsin and USAID are cooperating in the developmenet of incorporating a learning resources center with supporting production services into the library system.

The combination of the elements of media production and library is logical for the developmental program of the NWFP-AU. New physical facilities are needed. Talented personnel must be trained to support communications services, incorporate them into the Library and to develop specific media for efficient and effective instruction.

The Learning Resources Center (LRC) will serve the instruction, research, and outreach functions and have three divisions: (1) Library; (2) Communication Services; and (3) Computer Laboratory. The LRC will be headed by a senior staff member who will serve as a coordinating link between the Vice Chancellor and Deputy Vice Chancellor and faculty and staff of the University. The LRC director should also be able to handle fiscal and long-range personnel programs in addition to general management, with operational details left to divisional administrators. The Director should be provided with some non-degree training in the United States to familiarize and orient him to proposed programs and their management. The Library Division should be headed by a trained librarian and provision should be made for that person to enroll in a Master of Library Science program at the University

of Illinois. The Communication Services Division should be headed by a Director. This person should be given opportunity to enter a Ph.D. program at the University of Illinois. It is recommended that the director-designate enter a graduate program in Agricultural Extension Education for a Masters degree and, upon completion, move into the Vocational and Technical Education Doctoral program. The program will be designed to include agricultural extension, communications, instructional design, education, and testing courses to provide a wide background of experience on which he can draw in his responsibilities as Division Director.

The remaining division, the Computer Laboratory, should be headed by a Director. That person should have the opportunity for graduate training at the Masters level in Computer Science at the University of Illinois. It is recommended that he be enrolled in a professional degree program leading to a Master of Computer Science (MCS). This program is designed to meet the educational needs of persons who enter without an extensive computer science background but expect to be involved with computers in their professional careers. The purpose of the MCS program is to develop professionals who can apply fundamental concepts in methods of computer science to fields where computers are of importance.

I. FUNCTIONS OF THE CENTER

After extensive discussions with faculty and staff of the Agricultural University, interactions with personnel of the Pakistan Broadcasting Corporation, information personnel from the

Directorate of Agricultural Extension, and others, the functions of the Center and its Divisions could be described. The overall function of the Learning Resources Center is to serve all segments of the University in improving the instruction, research, and outreach mission of the institution. Course development activitites will be important with the institution of the expanded end modified curriculum. Media service assistance will be provided to faculty for a variety of instructional needs. It will serve as a source of ideas for improvement of course structure, curriculum organization, and other institutional modifications that will be required as the Agricultural University matures and develops.

The basic unit of the Learning Resources Center is the Library. The current Library of the Agricultural University is woefully inadequate for its task. Its primary function appears to be the repository for rental text books. It has no system of cataloging, no significant collections of journals, an inadequate collection of reference materials, and limited space in which to work. The hours of the Library are precisely those hours that the students are in class. With the close of the academic day comes the locking-up of the Library. Students who need to take materials out of the Library do so by a number of means, legal and clandestine.

The new Learning Resources Center in which the Library will be physically located is envisioned as the academic heart of the University. It is planned to be included in the first phase of the construction of the new campus in accordance with the master

plan being developed by the architectural and engineering group. The Library will provide the conventional services offered by most libraries. There will be reading rooms, a reference service, card catalog, open stacks, maps, periodicals, and study carrels. In addition, certain new features are planned. The first is a language laboratory to improve English language comprehension and reading for all students. Second, multimedia carrels that incorporate various combinations of audio tape players, slide viewing equipment, printed materials, and video-viewing equipment will be provided. An estimated 20 carrels have been projected for design purposes. These units will enhance instruction because students will be able to study at their own pace on an individual basis. Additional units may be necessary as the program and enrollment expands. Third, microform reading areas for approximately 15 microfiche/microfilm readers are planned. Utilization of this technology will allow for rapid acquisition of professional research journals, particularly back issues of journals. It will also facilitate the receipt of current journals by shipment through international airmail. Fourth, a typing room for use by students and staff is planned. Fifth, electronic terminal facilities supported by the proposed University telecommunications system for connection to national and international data banks are planned. Finally, in addition to conventional technical services such as binding and photocopying, photographic duplication using diazo techniques for microform production and reproduction is planned so that microform services can be eventually expanded to other portions of the campus.

The current system of handling textbook rental by the Library should be discontinued. The responsibility should be transferred to the Student Services Section. The Library should not be involved in textbook rentals in any way. It dilutes the staff time and defeats the purpose of the Library as a place to study, to do research, and to utilize other learning resources. It also tends to lower student opinions of the values of the Library.

The most important overall change in the Library function will be a change in the operating procedures. Resources will be found to allow the Library to open in the morning and stay open until late evening to allow students to study at their convenience. The Library will also be open on a limited basis on Fridays and during academic free-periods when students remain on campus. In time, with increased use and resources, the Library will become a major academic resource of the University and for use by other agricultural professionals in Pakistan.

The Communications Services Division will provide print, audio, and visual support services to the instruction, and outreach staff. In addition, they will be able to provide instructional design, testing design, and evaluation and communication teaching services for students, in-service, and outreach clientele. Specific services to be available when the facility is completed and staffed include: (1) production of printed materials by letter-press, offset and silk-screen technology; (2) graphic design services for publications, charts, posters, and slide copy; (3) editorial capability and help for writing and

publication; (4) instructional design and test design; (5) photographic services for publication and audio visual needs; (6) audio recording capability on cassettes or reel-to-reel for instruction and/or broadcast; (7) video recording capability using color video cassette technology primarily for instruction, but with potential for broadcast; (8) maintenance of electronic communications and instrumentation equipment; (9) environmentally controlled storage for master units of teaching materials, e.g. slide masters, video tapes, printing masters; and (10) a central distribution and maintenance system for audio visual equipment used in classrooms and laboratories.

The Computer Laboratory will house both teaching and research computers. The Design Team has recommended that microcomputers be utilized rather than a central main-frame computer. This recommendation was based on the growing capacity of personal computers, the availability of a wide selection of software programs, and the ease of maintenance that microcomputers afford. A breakdown of a single unit does not shut down the entire system.

Since teaching and research place differing demands on the computers, both in terms of type of use and scheduling, it will be necessary to physically separate teaching and research computers in the Center. Five research microcomputers will be set aside in carrels in a research room with access limited to University faculty and staff. Twenty-five microcomputers will be located in a large student laboratory. In both cases the machines will require temperature, humidity, voltage, and dust control. The recommended way of housing the microcomputers is to place them in partitioned cubicles or carrels with enough room for the machine,

i.e. the basic unit, keyboard and printer; space for two individuals to be seated side by side; and space for papers, books, and other materials. The computer lab, then, will be both a research and instructional resource where students and staff can develop proficiency in the application of computer science to learning and investigation. The staff of the laboratory will be available to assist in developing special programs for the research staff.

In summary, the Learning Resources Center is an innovative approach to the significant improvement of the instructional and research program of the Agricultural University. It has the potential to vault the Agricultural University to the forefront of higher education in Pakistan. Given personnel and dedicated leadership, the potential for the Center can be realized.

CHAPTER 8

PHYSICAL FACILITIES

I. CURRENT

At the time of its creation in February 1981, the NWFP Agricultural University was ceded the land and buildings of the former Faculty of Agriculture of the University of Peshawar. The land, in terms of its area, is adequate to support the academic mission of the University, to house its students and staff, and to accommodate the infrastructure which undergirds an essentially self-contained community.

The approximately 434 acres of land are divided into three distinct areas, the largest being the University farm, comprising 327 acres. A riverbed, comprising some 37 acres, separates the farm from a 70 acre tract on which the existing academic buildings stand. The riverbed is dry for most of the year, however periodic heavy rains and runoffs from the nearby hills isolate the two higher stretches of ground for limited periods during the wet season.

The physical location of the University land is also quite satisfactory. It sets well off the Khyber Road toward the north end of the University of Peshawar, adjacent to the Forest Research Institute. The Khyber Hills provide a pleasant vista on clear days. The outline of the famed Khyber Pass can be seen in the distance.

In contrast to the location and land area available to the Agricultural University, the academic structures are only marginally adequate. The principal academic building is constructed

as a set of wings interconnected by walkways. It includes an administrative wing, wings for classrooms, laboratories and departmental offices, and almost as an afterthought, a two-story "laboratory" building, which is of questionable structural soundness, the early razing of which should be a priority. There are numerous smaller outbuildings which house the Department of Food Technology, the Institute of Development Studies, and the Works Directorate. A new poultry complex has been completed and will go into operation in the fall of 1983. Construction of a new dairy complex has been started but is not complete due to, as we understand it, default on the part of the contractor. A new building for the Institute of Development Studies has begun, however the discovery of faulty workmanship and materials have caused construction to be halted.

Some academic units of the Agricultural University can not now be housed in the academic complex due to lack of facilities. These include the Agricultural Mechanization Department and the Dairy Farm, both of which retain facilities in the University of Peshawar.

The Agricultural University shares two student hostels with the University of Peshawar and its students live in the hostels under crowded conditions that are unsatisfactory for study.

There is no residential accommodation for the Agricultural University staff. Some 30 senior staff have temporarily retained faculty housing of the University of Peshawar. Most, however, must seek private housing in the metropolitan Peshawar area where, at the present time, housing opportunities are severely

limited and rents generally exceed housing allowances available to the staff.

The farm manager's complex, which is sited in the approximate center of the University farm, is in need of immediate upgrading. The mud wall surrounding the complex is in disrepair and gaping holes add to the difficulty of securing farm equipment and supplies. Such infrastructure needs as improved roads on the farm, a bridge/causeway/ford across the wadi to unite the farm and main campus in the wet season, an improved electrical grid, an improved drainage system, and other needs, must be met to facilitate the work of the faculty and staff of the University.

II. THE NEW FUNCTIONAL REQUIREMENTS

The prestigious firm of Skidmore, Owings and Merrill (SOM) has been contracted to provide overall architectural and engineering services for the planning, design and construction supervision of major additions to the existing campus of the NWFP Agricultural University. SOM staff worked closely with the UIUC/SIU-C Design Team in the development of an overall master plan for the development of the Agricultural University. The Design Team and SOM group interacted extensively as SOM gathered the data necessary for the development of its master plan. An inventory of the existing space of the Agricultural University was completed and given to the A & E team. Members of the Design Team identified additional space needs, some immediate and some future, and this information was freely shared. The SOM group are charged to organize their findings and recommendations in a

self-contained report which serves as an annex to the project paper.

A key element in the infrastructure of the expanded Agricultural University is a system of improved internal and external communications. A consultant from Professional Planning Associates, Fort Collins, Colorado, with extensive experience in the designing and implementing of state-of-the-art communications systems, spent approximately 3 weeks assisting the Agricultural University staff and the Design Team in conceptualizing communications requirements. We support the recommendations contained in the consultants report, which is reproduced as Appendix C to this Volume. Cost estimates for its improved communications system have been included in the overall financial plan for the development of the University.

The product of this extensive collaborative effort, involving faculty and staff of the Agricultural University, UIUC/SIU-C Design Team, the A & E team and the communications consultant, will be a master plan for the development of the premier agricultural education, research, and outreach institution in the Northwest Frontier Province. The master plan will feature a logical, efficient, and flexible sequence of expansion. It will respond effectively to the special cultural, social, and climatic environment of the Province. It will serve as a model for institutional development that can be adopted by other provinces of the Islamic Republic of Pakistan.

CHAPTER 9

EQUIPMENT

With an expanded mission and increased staff, the need for field equipment, laboratory apparatus, scientific supplies, and other commodity support needs become paramount. The Design Team carefully weighed the expressed needs of Deans, Department Heads, and individual staff members against budgetary and other constraints; e.g. capacity to operate sophisticated equipment, the availability of within-country servicing, or alternatively, the ease of importation of spare parts, and the phasing of construction of new facilities. Based on these considerations, a commodity procurement program at the level of $4,668,000 will be necessary to equip the institution to conduct its mission. Table 9.1 provides a summary of equipment needs.

TABLE 9.1. Summary of Equipment Required By Faculty

1.	Plant Sciences	$1,185,000
2.	Engineering Applications and Food Technology	850,000
3.	Animal Husbandry	300,000
4.	Rural Social Sciences	34,000
5.	Arts and Sciences	325,000
6.	Learning Resources Center	890,000
7.	Continuing Education Center	48,000
		$3,632,000

Other NWFP-AU Commodity Needs

1.	Tube wells for campus/farm/colony	$ 125,000
2.	Vehicles for farm/student/research/outreach	500,000
3.	Project vehicles (U.S. title)	193,000
4.	Telecommunications Phases II - VII	228,000
		$1,036,000

Experience has proven the futility of developing fixed lists of equipment in the planning stage that govern commodity expenditure over the life of an extended project such as this. Such a procedure inevitably leads to frustration, the placement of orders for inappropriate items, a crash approach to spend money identified for commodities even though the persons who would be responsible for the use and maintenance of the equipment may be away from the institution on study leave, and other equally undesirable effects.

The approach taken by the Design Team has been one of preparing indicative lists of field, laboratory and classroom materials to be purchased against block allocations to faculties and other administrative units. Decisions will be made, primarily, at the scientist and department level in full consultation with the appropriate Faculty Dean. Those items most needed, those of the highest priority, will be purchased early on, but the balance of the money for materials and commodities will be phased throughout the first five years of the project. Some funds will be retained for the later years to provide flexibility to order equipment which could not now be identified, or, conceivably, which may not now be available. A listing of aggregate amounts to be allocated among departments is included in Chapter 12, Financial Requirements and Analysis.

CHAPTER 10

ORGANIZATIONAL STRUCTURE AND LEADERSHIP

The internal structure of an organization is the way in which personnel, physical facilities, and other resources are organized into divisions of responsibility among the different units of the organization, formal and informal patterns of authority, channels of communication, and means of formulating consensus on priorities, policies, and procedures. The leadership in the several units of the organizational structure is responsible for formulating and implementing programs that respond to the mission of the institution.

The Current University Organization

The current administrative structure of the NWFP-AU reflects a transition from its status as a Faculty of Agriculture in Peshawar University to the autonomous NWFP Agricultural University. The February 4, 1981 Ordinance that established the NWFP-AU set forth that there would be a Chancellor (the NWFP Governor) and that the administrative officers would be the Vice Chancellor, the Registrar, and Chairman or Heads of Departments. The amendment to the Ordinance dated November 18, 1981 provided for the establishing of faculties within the University with a Dean as the administrative officer of each Faculty. The Ordinance amendment provided for three faculties: Agriculture, Animal Husbandry and Veterinary Science, and Agricultural Economics, Rural Sociology and Development Studies. Senior department heads have been designated as Deans; however, incumbents refer to themselves as "paper deans" whose duties and responsibilities

vis-a-vis department heads and the Vice Chancellor are somewhat unclear. The Deans also serve as Department Heads. There are large numbers of departments for a University with a professional faculty of less than 100 persons. The largest Department has 13 faculty members, several have less than 5, and the average is about 7. Department Heads and the Director of the Institute of Development Studies report directly to the Vice Chancellor as do such administrative officers as the Registrar, Deputy Director for Finance, and the Director of Works. The evolving structure is adequate for the current mission and size of the University and with the dynamic leadership of the Vice Chancellor. However, there are too many individuals reporting directly to the Vice Chancellor and major changes in the administrative structure are required with the expanded missions of the University and the increase in size and quality of its programs.

The New Administrative Structure

The following needs were recognized in designing the recommended organizational structure for the new Agricultural University:

1. To permit the time and energies of the Vice Chancellor to be devoted to policy and program leadership and to management of linkages with government officials and agencies and with other groups.

2. To provide for coordinated program development and implementation to pursue the three complementary missions of the University: instruction, research and outreach.

3. To have a multidisciplinary approach to the instruction, research, and outreach functions within faculties and departments.

4. To have facuty members with closely related disciplinary and professional interests within administrative units.

5. To ensure strong basic sciences and arts units to meet the general educational needs of the University and to fully contribute to the research and outreach functions.

6. To provide for a coordinated and efficient administrative structure.

The new organizational structure of the NWFP-AU is outlined in Figure 10-1.

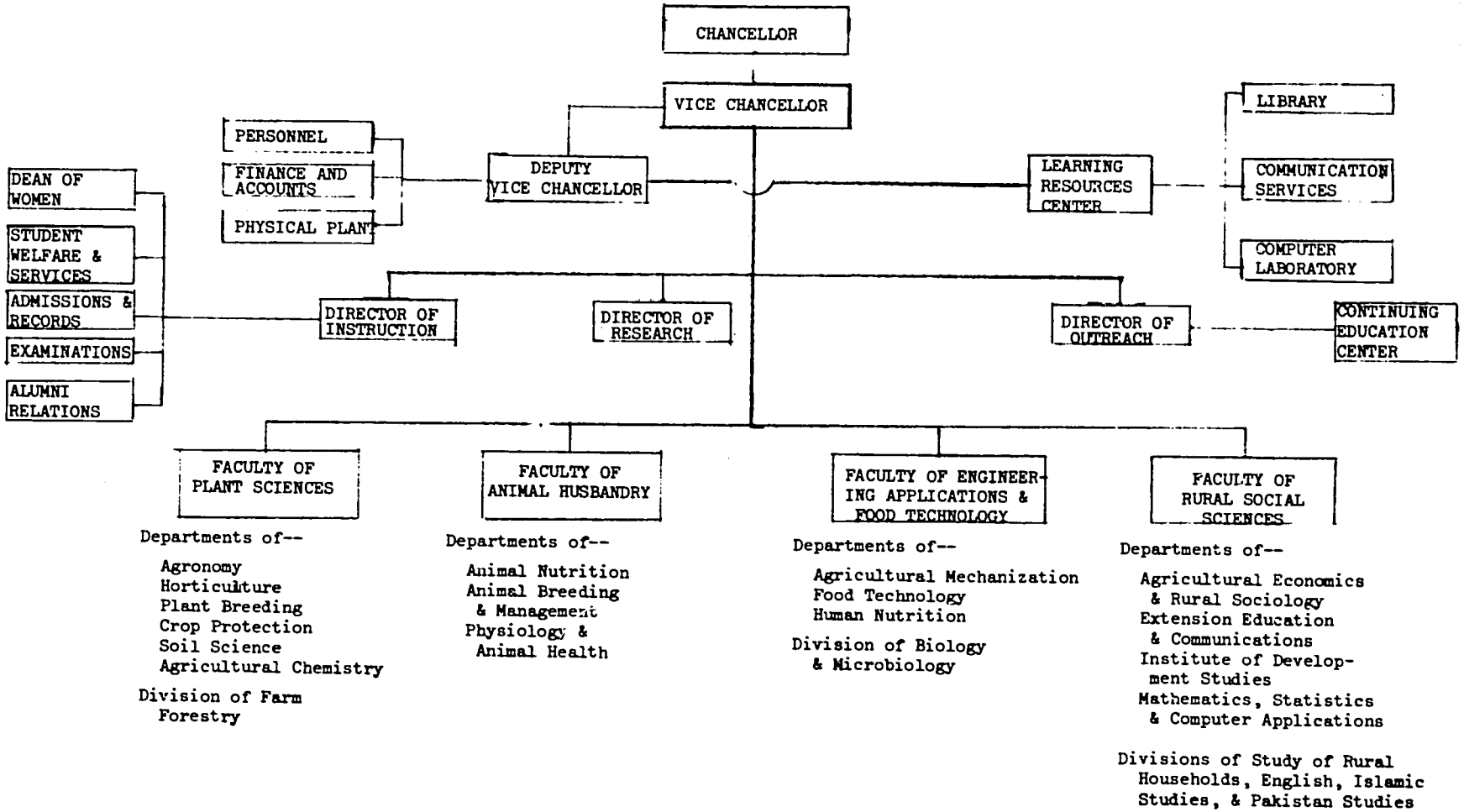
The Vice Chancellor. The Vice Chancellor is the chief administrative officer with responisbility for the total University program as provided by the Ordinance.

The Deputy Vice Chancellor. The position of Deputy Vice Chancellor is a new one. It can be briefly described as "Deputy Vice Chancellor for Administration." This position has the responsibility for support services such as personnel, finance and accounts, and the physical plant (or Directorate of Works). The person in this position will also be responsible for administration of the Learning Resources Center that includes the Library, Communications Services, and the Computer Laboratory, which serve the three major functional missions of the University. The position of Registrar will be eliminated inasmuch as the combination of duties of this position in the teaching-oriented

Figure 10.1

THE NWFP AGRICULTURAL UNIVERSITY

ORGANIZATION CHART



149-19

traditional university can be carried out more appropriately and efficiently by the Deputy Vice Chancellor for Administration and the Director of Instruction. In the NWFP-AU the Deputy Vice Chancellor for Administration will be responsible for general administrative matters for instruction, research, and outreach. Those responsibilities of the Registrar in the traditional university relating to instruction and student administration will be under the Director of Instruction. Included are such matters as student admissions and records, examination administering and student services.

The Instruction, Research, and Outreach Directorates

The Directorates of Instruction, Research, and Outreach reflect the needs of the administrative structure to carry out the three major missions of the new University. The duties and responsibilitiies of these positions justify the same level as that for the Deputy Vice Chancellor. The Directors will be directly responsible to the Vice Chancellor for their programs and coordinate with the Deputy Vice Chancellor on administrative matters. Each will be responsible for general program planning, implementation and evaluation, and multidisciplinary orientation of the programs. The three Directors will work closely together to see that the three functions are complementary, one to the other. Each will work closely with the Vice Chancellor on both internal program development and implementation, resource acquisition, and linkage management.

The Director of Instruction will be responsible for the curricula and teaching-learning process as outlined in Chapter 2 and

Appendix A. In addition, the Directorate will be responsible for admissions and records, examinations, and all student services including student welfare. The Dean of Women will have special responsibilities for the educational and welfare needs of girls in the integrated educational program for women (see Chapter 5). The Director of Instruction will also be responsible for maintaining records of graduates and contacts with them and their organizations following completion of training at the NWFP-AU. He would be jointly responsible, with the Director of Research, for the M.Sc. educational program. The Director of Instruction will be primarily responsible for the M.Sc. course program, with the Director of Research having primary responsibility for the M.Sc. thesis research, its relevance to the total research program, and its standards and quality.

The Director of Research will be responsible for the research program as outlined in Chapter 3. His responsibilities will include not only overall direction of the University research program but also joint planning and coordination of research conducted in other research organizations in the Province. He will assist Faculties and Departments in maintaining close liaison and develop cooperative research efforts with the programs of the Pakistan Agricultural Research Council, the National Agricultural Research Centre, and research in other agricultural universities and research institutes in the Provinces.

The Director of Outreach will be responsible for the outreach program as outlined in Chapter 4. Program development and functioning of the new Center for Continuing Education would be

one of his major responsibilities. The Director will work closely with faculties and departments in developing outreach programs and activities to be carried out through a wide range of media. Program leaders in disciplinary areas will assist with the outreach program.

The Director of Outreach will have a special relationship to the Extension Department in view of the objective of supporting and strengthening of the Department program. The Director will have linkage management responsibilities to the many agencies of government and private sector organizations involved in agricultural development of the Province.

The Faculties and Departments

The new structure provides for four faculties: Plant Sciences, Animal Husbandry, Engineering Applications and Food Technology, and Rural Social Sciences. These replace the current Faculties of Agriculture, Animal Husbandry and Veterinary Science, and Agricultural Economics, Rural Sociology and Development Studies. Special provisions will be made for the Arts and Sciences (or Basic Studies) as outlined below.

The Faculty, not the Department, will be the basic unit for support personnel and services to provide efficiences in use of resources in a structure with small departments.

Faculty of Plant Sciences. This Faculty will include the current Departments of Agronomy, Plant Breeding and Genetics (changed to Plant Breeding), Entomology, Horticulture, and Soil Science. The Department of Entomology will be broadened to a new Department of Crop Protection that includes Entomology, Plant

Pathology, and Weed Science. A Division of Farm Forestry is proposed to be attached to the Department of Horticulture. The Department of Agricultural Chemistry will also be in this Faculty.

Faculty of Animal Husbandry. This Faculty will include three Departments: Animal Nutrition; Animal Breeding and Management; and Physiology and Animal Health. Design Team members and University faculty members considered the alternatives of having a combined Faculty of Animal Husbandry and Veterinary Science; separate Faculties of Animal Husbandry and Veterinary Science; or a Faculty of Animal Husbandry. The result of this consideration was the recommendation that a strong Faculty of Animal Husbandry be established focusing on the need for animal production instruction, research, and outreach. Included in the analysis were such considerations as the existing work in the Province and country on veterinary science education and research, animal production education and research, and the personnel and other costs associated with the development of a Faculty of Veterinary Science. The option of establishing work in Veterinary Science at NWFP-AU, either as a separate Faculty or combined with Animal Husbandry, was rejected as a viable option for the foreseeable future; however, work in veterinary medicine is left as an option for the long-range future, but one to be pursued after establishing a strong program in animal production.

Faculty of Engineering Applications and Food Technology. This Faculty is to include three Departments: Agricultural Mechanization, Food Technology, and Human Nutrition. The Departments of Agricultural Mechanization and Food Technology require major

strengthening. Most of the work in Human Nutrition is now being done in the Department of Agricultural Chemistry reflecting, in large measure, the research interests of the leadership of that Department. The responsibility for Human Nutrition instruction, research, and outreach will be centered in this faculty to combine it with the closely-related work in food. There are disciplines in addition to chemistry concerned with improved food processing, distribution, and use that result in enhanced human nutrition. Centering foods and nutrition in this faculty does not preclude those in other Faculties and Departments from contributing to the research, instruction, and outreach work in the broad area of human nutrition; the foundation of human nutrition work in Agricultural Chemistry should be built upon and broadened by this Faculty. The Divisions of Biology and Microbiology will be in this Faculty.

Faculty of Rural Social Sciences. The new Faculty of Rural Social Sciences will include a Department of Agricultural Economics and Rural Sociology, the Institute of Development Studies, and the new Department of Extension Education and Communication. It is also to include a Division for Study of Rural Households to be closely allied with the Institute and the two Departments.

The Department of Extension Education and Communications is a new academic unit with instruction, research, and outreach functions. It is the purpose of the Department to provide a sound educational program for B.Sc. and M.Sc. students who will eventually hold positions in the Extension Department or other agricultural organizations. It is not the purpose of the

Department to do extension itself. There will be a close relationship to the Learning Resources Center as a place for student practicals and to learn the many skills necessary in extension education and communications.

The current Institute of Development Studies (IDS) is the sole source of research at NWFP-AU in the rural social science area. It is a research unit; however, there are plans to offer an M.S. degree. Much of the research utilizes secondary data and consists of aggregate level analysis. It is usually initiated by requests from external agencies and much of the research is not directly related to the agricultural sector of the NWFP. As is often the case with contract research units, the projects reflect the needs of the funding agency rather than the priorities of the Agricultural University.

The IDS is one of the few strong research units at the University. The work of the Institute will be more compatible with the missions of the Agricultural University with more of its research oriented toward farm level problems using primary data sources. With redirection of its work, requiring advanced training for some of the faculty, the IDS can become an increasingly important unit in the Faculty of Rural Social Sciences. Inasmuch as IDS is established as an Institute, administrative care will be required to make the Institute an integral part of the Faculty. The IDS has demonstrated that with strong leadership, selective staff recruitment, and availability of funding, it is possible to conduct effective social science research. With the paucity of social science research in the NWFP oriented toward agriculture the experiences of IDS are valuable as the entire

faculty moves to a stronger program of instruction, research, and outreach.

Division for Study of Rural Households. The purpose of this unit is to conduct research and disseminate research results regarding rural households with the major focus on women in agriculture at the village or household level (see Chapter 5). The major objectives include the following: to generate data regarding the role of women in the home related to agricultural responsibilities; to identify the impact of rural women on agricultural practices, specifically agricultural production; and to examine the concept of the family as the change agent for the purpose of improving the quality of life among rural people. This unit should have divisional status, not be a Department, and be closely integrated with the work of the Departments and Institute of Development Studies.

To be included in the Faculty of Rural Social Sciences are the Departments of Mathematics, Statistics, and Computer Applications and the Divisions of English, Islamic Studies, and Pakistan Studies.

The Arts and Sciences. The Arts and Sciences have a fundamental role to play in autonomous agricultural universities. The arts, broadly defined, provide broad socio-cultural content to the instructional program, a special need in universities with students (and faculty) with provincial backgrounds. The curricula of an agricultural university require strong bases in the biological and physical sciences.

There are alternative internal structures for the Arts and Sciences in agricultural universities. One is to establish a Faculty of Arts and Sciences or Basic Studies. Experience in other agricultural universities in the region and internationally has shown that such faculties are regarded as service faculties by colleagues in the applied agricultural faculties; faculty members serve the instruction function but have restricted opportunity to engage in the research and outreach missions of the university. High-quality faculty members are difficult to attract and retain.

In the NWFP-AU the Arts and Sciences will be closely allied to and administered in the other Faculties recognizing that these fields are of fundamental importance to the education of all agricultural students but to provide opportunities for those in these fields to contribute fully to the research and outreach of the University. The various fields will be associated with Faculties as follows: The Department of Agricultural Chemistry with Plant Sciences; the Division of Biology and Microbiology with the Faculty of Engineering Applications and Food Technology (Food Technology and Human Nutrition); the Department of Mathematics, Statistics, and Computer Applications; and the Divisions of Islamic Studies, Pakistan Studies, and English, with the Faculty of Rural Social Sciences. These units have strong program relationships with each of the faculties and it is recognized that some of the units could be administratively allied to other faculties as well as those to which they have been assigned. This structure should be under continual review to ensure that

the important work in the Arts and Sciences is properly recognized within the total University program.

Efficiency in Administration

The organizational structure as outlined in Figure 10.1 will be developed as programs grow and as personnel are identified or upgraded to assume the leadership of the various positions. Current faculty members should not be elevated to posts on the basis of seniority alone. Care will be taken to maximize the time that faculty members spend on instruction, research, or outreach services; the administrative structure will not become larger and more complicated than the program and numbers of professional personnel require. Most, if not all, of the faculty and departmental administrators will be actively involved in teaching, research, and outreach and will not be full-time administrators.

Leadership of the University. The organizational structure and leadership of an institution are closely related. The senior officers of the administrative units are usually referred to as the "leaders." In the case of the NWFP-AU, these are the persons in positions of Vice Chancellor; Deputy Vice Chancellor; Directors of Instruction, Research, and Outreach; Deans of Faculties; Department Heads; and those in other key administrative units. Such persons have special leadership roles; however, in a multi-mission agricultural university, "leadership" must be a shared responsibility not only among formal administrative units, but also among faculty and students as well.

The Vice Chancellor plays a crucial role at the NWFP-AU. The current Vice Chancellor is committed to the accelerated development of the agriculture of the Province and Nation as well as the missions of the University in contributing to development. His credentials as a practicing scientist and administrator have been firmly established and he is respected by educational leaders. He understands the importance of decentralized administration and shared leadership within a university. He has a firm, yet friendly, style of administration that encourages participation of individuals and groups.

The Vice Chancellor is appointed by the Chancellor, the Governor of the Province, on a renewable term basis. He is committed to devoting his talents and virtually unlimited energies to putting the new Agricultural University on a solid institutional foundation; and is amused by those who question whether he has the youth and vigor to accomplish the task.

There are others at the NWFP-AU serving in various leadership roles: Department Heads and Faculty Deans, singly and combined; administrative support officers; members of Boards of Studies, the Academic Council, and the Syndicate; leaders of the Teachers Association; and those serving as formal and informal student counsellors and hostel wardens. For many, leadership responsibilities will increase and change dramatically as the University's mission is now broadened. Fortunately, many faculty members have 15 to 20 years of loyal service to the University; several of the senior faculty members have experience in the multi-missioned U.S. Land Grant University system. They welcome the changes to be made possible by the Agricultural Research,

Education, and Extension Project. There is the potential of the younger faculty members to get advanced training and experience to grow into a wide range of leadership positions; and no evidence of lack of support for the changes in mission, programs, and projected operational means of attaining long range goals and intermediate objectives.

The leadership shared among many individuals and groups will ensure that there is an uninterrupted pursuit of the University's missions. Attainment of long range institutional goals must override immediate objectives of individuals or small groups of faculty members or students. Included in the short-range objectives may be interests partly or wholly tangential to the University's missions.

There is a question of the leadership role of student groups in universities in Pakistan, as well as many other countries. The following statement on "The Agricultural University Student" prepared by Vice Chancellor G. M. Khattak, gives insights into the leadership roles to be shared by administrators, faculty members, and students at the NWFP Agricultural University.

THE AGRICULTURAL UNIVERSITY STUDENT[10-1]

"The great majority of our students belong to NWFP and hail from rural areas. The average freshman is rustic, generally

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[10-1]Shortly after the Design Team arrived in Peshawar, there were disturbances at the Khyber Medical and Islamia Colleges of the University of Peshawar resulting in the closing of al Universities in the area and a decision by the Governor of the NWFP to ban student unions. This statement was prepared by the Vice Chancellor of the NWFP-AU in response to questions raised by Design Team members regarding measures to be taken to minimize unrest at the Agricultural University.

respectful to elders, keen to learn, but woefully weak in comprehension and communication skills. Before the recent ban on student unions, the new students on arrival were welcomed by the student representatives of various political parties who guided them in filling forms, depositing dues and securing hostel admission. In this process a few newcomers either strengthened their political bonds or gained new affiliations. But except for a small minority who became active political workers, the great majority remained sympathizers of various hues. And during elections, votes were generally cast on the basis of kinship, geographical affinity, and the personal popularity of the candidate, his rabble-rousing ability, and the success with which he had interceded with the authorities to gain minor favors for the students.

"The greatest defect in this system of student leadership was the sense of dependence created in the general body of students. The average student lacked the confidence of placing a simple request before the University authorities and invariably brought a student leader to be his advocate. In consequence, the great majority of students lost their initiative and failed to develop qualities of leadership during their stay at the University. With a ban on student unions, we have a welcome opportunity for playing a more active role in developing the personality of the student.

"We are still plagued, however, with a very poor system of education, mainly comprising poor quality lectures, which are generally ill-prepared and ill-delivered. The product of such education is a graduate who cannot compete with graduates of

other Universities for jobs where such competition is required. Our graduates therefore, generally tend to drift into jobs which only require a paper degree and NWFP domicile. Because his seniors are also a product of the same system, the longer he serves, the more he forgets what he has learned at the University. Of course there are exceptions: Some get into the Army and the Forest Service, or a progressive industry, or go abroad for advanced education, and are able to make good. No professional leadership has emerged out of graduates who have spent their lives in the Province and did not study abroad.

"The recent ban on student involvement in politics offers a tremendous opportunity to University teachers and administrators to win back the confidence of the students. In my opinion, the student's need for student unions has arisen out of his total neglect by the average University employee. This is true with special force of the students of the Agricultural University who are totally ignorant of how to even formulate a simple request seeking redress in a legitimate cause.

"The student of this University typically comes from a poor family and his most important concern is to obtain his degree and secure a job where he can earn his living and help his family. A vigorous effort should therefore be made by us to welcome all students on September 1, seek to understand their problems, and help them to secure quality education which is eagerly sought by the various employers. An efficient system of student counselling, student placement, and part-time jobs for the students would greatly help in maintaining student discipline.

"While dealing with student discipline, three questions arise:

> How was student discipline maintained in the University in the anarchic days when student unions ruled supreme?
>
> What is likely to be the situation when the University reopens on September 1, and how will it be handled?
>
> What will be the reaction of the students to the changes we are proposing to introduce?

"How was student discipline maintained in the past?

"The key to maintaining student discipline in this University is the teacher. In spite of the tremendous erosion of old-time values, the students of the Frontier, and especially those of Agriculture, have a great regard for their teachers and are generally guided by them. Since the great majority of our teachers want this University to develop, we had comparatively few discipline problems during the two years of our existence. Except for a voluntary closure for a week to avoid an anticipated student clash, we have had no major student problem. Even in this case we were considered to have overreacted to a situation which was normal for other universities. But for us it was abnormal. And we did not want to create a precedent of student violence which has never occurred on this campus before.

"Among our teachers, there is a special voluntary group who make it their responsibility to diagnose discontent and act immediately to remove it. Some specialize in students, and some in teachers, and some in staff affairs. Immediately a discontent is diagnosed, a council of such teachers is called and a strategy mapped for defusing the situation, and then for remedying it. Often a meeting of all Chairmen, and some times of all faculty

members, is called to obtain views on what needs to be done. Since the University is small, such meetings can be called at short notice. One of our greatest assets is a large pool of willingness, resourcefulness and contacts with various sources among our faculty. All this comes in very handy when we are in trouble.

"The arrangements described above are informal. Though we have such part-time positions for our faculty as Provost, Proctors, and Hostel Wardens for primarily dealing with student affairs, we have to rely on general faculty consensus to create an atmosphere where a spark of discontent will be quickly smothered. Moreover we have to secure the assistance of different members to deal with different problems.

"An outstanding success of this approach has been reflecteed in the conduct of our examinations. At the start the faculty decided that we must have fair examinations, regardless of what it may cost. And we have all along maintained this stand and have succeeded with it, without the need for Police interference.

"What is likely to be the situation when the University reopens on September 1?

"In the absence of student unions, I anticipate a diffused leadership emerging, mainly on geographic grounds. In order to build up the confidence of the student, we should encourage each student to come to the concerned authority with his problems himself, instead of bringing an advocate. When students realize that their grievances are being attended to expeditiously, their

reliance on student leaders would decrease. For this to occur, an efficient system of student counselling must be created.

"Group student grievances mainly arise in the conduct of examinations, and in the management of hostels. Students are particularly sensitive to real or imagined partiality on the part of teachers or hostel staff. Concerted thought must therefore be given to improving the management of hostels and the conduct of examinations. In the latter, the greatest source of discontent is a "difficult paper" or a question "out of course." Both these are in part due to external examination systems as well as the current state of teaching. So, when after a full year the student is asked to attempt questions perhaps not couched in the form in which his teacher taught them, he is naturally upset. And this situation is quickly capitalized on by the student-leader-on-the-make, especially if the examination is controlled by an inexperienced or discontented teacher.

"Group grievances in hostels arise due to weak, tactless, or inefficient administation of hostels: filthy bathrooms, unreliable electricity, poor food, rude employees, discrimination in alloting rooms, and in awarding punishments - all these can accumulate to a point where a minor incident will cause a disturbance. A vigorous effort is needed to create a new environment in hostels so that the students can feel the radical improvement and react to it positively.

"Will our students get involved in mass student movements, launched in other-universities?

"Once our students learn of all that we intend doing for them, few would get involved in disturbances which sweep other

adjacent campuses. And even the involvement of the few who must show their external sympathy for various reasons, would be half hearted and superficial.

"What about precautionary closures ordered by Government?

"No student of our University was involved in the recent disturbances in the Medical and Islamia Colleges. Yet Government closed all Universitites adjacent to these establishements as a precautionary measure. Though we can ensure adequate discipline in our small professional University, no assurance can be given about other institutions around us. So we must plan to function outside the campus whenever such a closure is ordered. And the design of the project being prepared provides opportunities to work on field experiment stations and on the farmers' fields. Given a flexible schedule of teaching, some student accommodation at each research station, and transport and camp equipment, it should not be difficult to change the venue of instructions at short notice and thus stick to our academic calendar.

"How will students react to the massive changes we intend to make in the method of teaching?

"If we go about it the right way, the students should welcome the improvements we want to make in the way we teach them at present. A number of changes would be welcome right away, e.g. reduction in length of teaching term, greater emphasis on the ability to do things than to learn by rote what he does not understand, reduction in time spent sitting in the classroom, use of audio-visual aids in teaching, possibilities of part-time

employment, better living accommodations, cleaner food, pleasantly landscaped campus, and a better road to the experimental farm.

"Difficulties may arise with the acceptance of internal evaluation, and the rigorous regimen of studying under the new system. Efforts must be started to explain the benefits of the new system to the class to which it will be applied. In this task teachers will play a crucial role. We must therefore ensure that we do not have even a single disgruntled teacher among us who will present the proposed changes in an adverse light. Effort must also be started to motivate our teachers to use absolute impartiality in dealing with students, especially while grading. A mechanism will also be evolved for dealing fairly with student appeals challenging teacher impartiality, in a manner which will be acceptable to the teacher and student alike.

"What about the existing students who will continue to study under the existing system

We must anticipate a demand from a considerable body of the students studying under the old system, for a number of changes which we are planning for students who enroll after project implementation starts. If the demand is universal, we will have to consider how to make improvements even in their schemes of studies."

CHAPTER 11

UNIVERSITY LINKAGES TO OTHER ORGANIZATIONS

The institution-building model or framework that has been used to design the new NWFP Agricultural University provides two groups of variables, the "institution variables," which are concerned with the internal programs, organization and operation of the University, and the "linkage variables," which are concerned with external relationships of the University with other organizations and the political, economic and social evironment. To date, the NWFP-AU has been primarily concerned with the internal institution variable with a primary focus toward the instruction function. The new NWPF-AU, with its broader mission and commitment to being the apex institution in agricultural development of the NWFP, will give equally strong attention to the institution variables and the environmental linkages.

Experience in developing agricultural universitites has shown that it is common to give too little attention to the environmental linkages. Those concerned with agricultural development point out the importance of organizational linkages but usually take a simplistic view of the meaning of linkages failing to recoignize that there are differences among them that call for different approaches to "linkage management."

A brief description of types of linkages follows with examples of linkages that are important to the strengthening of the NWFP-AU. A complete plan of linkage management will be developed early in the implementation stage of the project.

There are four types of environmental linkages: enabling, functional, normative, and diffused. The development and management of linkages varies from one type to another. Enabling linkages are the linkages with organizations that control the allocation of authority on resources needed by the institution to function. Functional linkages provide the inputs that are needed and take the outputs of the institution. Normative linkages are relationships with other organizations which have overlapping interests in the objectives or methods of the institution. There are both functional and normative linkages to many organizations. Diffused linkages are relationships with individuals and groups who are not aggregated into formal organizations but influence the standing of the developing institution in its environment.

Enabling Linkages

The important enabling linkages of the NWFP-AU are with the provincial government and with the Federal Ministry of Education and its closely related subsidiary organization, the University Grants Commission (UGC). All universities in Pakistan are national organizations receiving their authority through the Ministry of Education and financial support through the UGC that receives budget requests from all of the universities in Pakistan, approves budgets as well as new university projects and programs, recommends funding to the Ministry of Finance and approves and funds research proposals, travel and study awards and academic personnel inter-university transfers. The Minister of Education, who also serves as the Presidential Advisor for Higher Education and Chairman of UGC, is thoroughly knowledgable

and supportive of the new NWFP-AU. To date, budget requests have been modest and primarily to support the teaching function of the NWFP-AU. There is a growing awareness of the need for universities to develop science-based research programs and outreach programs to make the results of research and technology development available to organizations and individuals in the economy and general society. Enabling linkages to the Federal Ministry of Agriculture are currently weak and attention is needed to strengthening this relationship.

The NWFP-AU receives its provincial authority as an autonomous organization created by provincial ordinance with broad powers "to provide for instruction and research in and advancement and dissemination of knowledge in agriculture" and allied subjects. The "authorities of the University" include, among others, the Syndicate and the Academic Council, both of which have members from outside the internal university structure, provide linkages to important organizations and prominent leaders. Inasmuch as the UGC is looked on as the primary source of financial support for Pakistan universities, the provincial enabling linkage is primarily a legal one that does not commit the provincial government to financial support for the NWFP-AU.

Except for the legal authority provided in the Ordinance, the provincial enabling linkages are not strong. Finance of the teaching function is viewed as a federal responsibility through UGC. Support for provincial research and extension flows from the provincial government to the Agriculture Department and its Directorates for Agricultural and Animal Husbandry Research and Extension. University B.Sc. and M.Sc. graduates who provide

virtually all of the professional staff for provincial agricultural units are not viewed as being highly effective. They are often described as "having book knowledge but not being able to do things," particularly things of a practical nature. University graduates are often criticized individually for inadequacies due, in part, to weaknesses in the higher education, research, and extension systems. Nevertheless, the outputs of the University are not highly prized within the organizations where they are employed. With its development thrust and higher quality graduates and research and outreach services, within a few years the NWFP-AU will have an impact on provincial agricultural production and services to society. This will generate increased incomes to individuals and revenues to the provincial and federal governments. At that time, the University will have a strong case for support from the provincial government as well as the federal government.

Functional Linkages

Functionally linked organizations provide the inputs and take the outputs of the Agricultural University. The organizations that influence the quality of incoming students are of special importance. Included are the high schools and secondary school bodies that administer the F.Sc. examinations and organizations that have influence on the numbers and quality of incoming students interested in service to agriculture and rural society. Currently, these linkages seem to be weak or "neutral," i.e. there is little attempt to influence organizations to assist in getting the desired students into the University. Those who

pass the F.Sc. (pre-medicine) examinations and cannot be admitted to study of pre-medicine choose agriculture as a second, or perhaps last, resort. With the University having a development orientation, it is important to get students who are oriented toward development of the agriculture of the Province and Nation. With the program for education of women at the NWFP-AU, fully integrated into the academic program of faculties and departments, special efforts will be needed to work with organizations and leaders to attract young women with interests in careers of service to improved farm production, rural households, the agro-industries, and agricultural science and education.

On the output side, there will be functional linkages through the service of graduates, the research results, and the many-faceted outreach programs of the University. The University and its predecessor institutions have supplied a very high proportion of the professional level manpower for service to agriculture of the Province. These graduates have a loyalty to the University as shown by the pride expressed in being a University B.Sc. or M.Sc. graduate (or both) as they were visited by Design Team members and University faculty members. However, this loyalty has not been capitalized on by the University maintaining contacts with their graduates and soliciting their help in furthering the interests of the University as well as themselves. Thus, it is recommended that positive steps be taken to maintain such contacts through organizations such as alumni associations or "Old Boys Clubs," etc.

As the University establishes a strong research program, linkages with the provincial and federal research organizations will be of paramount importance. Currently, these links are weak inasmuch as the University is not perceived to be a strong contributor to the research findings needed for agricultural development. The primary link is through the employment of graduates, some of whom are not as well prepared to do research as the research system needs. As the quality of graduates improves, the stature of the University will be enhanced. The needs for coordination, or perhaps full unification, of the provincial research system were outlined in Chapter 3. The needs as outlined emphasize the importance of the functional linkages with research organizations.

The University will become more effective in supplying graduates to upgrade itself, but also for such institutions as the Faculty of Agriculture of Gomal University at D. I. Khan (see normative linkages below).

Graduates will be supplied to a large number of employing organizations such as the Agricultural Development Authority, Agricultural Development Bank, Cooperative Societies, and to the Extension Department. It is expected that the employment with private sector organizations will increase substantially as the agricultural development of the province proceeds at a greater pace.

The newly established outreach function of the University, coupled with the enhanced research capability, will provide many linkages. One of the strongest will be with and through the Extension Department. The Continuing Education Center will

provide a mechanism for improving relationships with many organizations and individuals by demonstrating the usefulness of the University as an organization to conduct short courses and in-service training for those from the Extension Department, research organizations, private sector groups, and leading farmers. Research results will contribute to the multi-media effort to distribute research results and other information to many audiences or clientele groups.

The University Library will serve the agricultural interests of the entire Province.

Normative Linkages

Relationships with organizations that have overlapping interests, or perceive that they have overlapping interests, with the Agricultural University are of special importance. These organizations are ones that also have functional relationships with the University, i.e. they are the receivers of some of the outputs and services such as graduates and benefits of research results and the outreach program. Because of the overlapping interests, there may be seeds of tension and competition, therefore, it is of special importance that there be understandings of the roles that can be played by the different institutions so the efforts are complementary, not competitive. Authority and responsibility need to be identified and understood and close working relationships established among the leadership of the several organizations with overlapping interests. Some examples of organizations with overlapping interests follow:

The Faculty of Agriculture, Gomal University. The Faculty of Agriculture of Gomal University at D. I. Khan started functioning in the 1980-81 academic year. Like the NWFP-AU, both B.Sc. (Honors) and M.Sc. (Honors) degrees are offered. B.Sc. specialization is limited to agronomy, agricultural chemistry, plant breeding and genetics, soil science, and food technology, entomology, horticulture, and animal sciences. The M.Sc. is offered in agronomy, agriculural chemistry, and food technology. During the 1982-83 year, there were 144 B.Sc. students and 9 M.Sc. students. There is a teaching staff of 30, of which 21 are assistant professors and 9 are lecturers. This Faculty of Agriculture is attempting to follow the curriculum and courses of the NWFP-AU, but with a more limited staff, all of whom hold one or more degrees from the NWFP-AU or its predecessor colleges or faculties. Only two faculty have Ph.D. degrees, one from a U. K. university and one from a university in Turkey.

With the upgrading of the NWFP-AU through a strengthened curricula and improved teaching-learning processes, and research and outreach programs, it will be difficult for the Faculty at Gomal University to emulate the NWFP-AU by offering degrees in more and more areas unless this Faculty is strengthened in many ways, all of which will require financial and personnel resources.

Thus, the overlapping interests of the NWFP-AU and the Faculty of Agriculture of Gomal Univeristy present a good example of institutions that have normative linkages. The existence of the two degree-granting agricultural institutions raises such questions as the following: Is there need for two such institutions in the NWFP? How can the costs of both be justified? Can

the Faculty of Agriculture (GU) maintain standards near those of the NWFP-AU as the latter is upgraded? How can the overlapping interests of the two institutions be worked out in a way to support most effectively the agricultural development of the NWFP?

The alternatives would seem to include the following (and perhaps others):

1. Phase out the Faculty of Agriculture, Gomal University, and consolidate all NWFP higher education in agriculture at NWFP-AU.

2. Make the Faculty of Agriculture, GU, a constituent College of the NWFP-AU.

3. Continue the current arragement.

Alternative 1 seems worthy of consideration in view of the personnel and financial costs of having two degree-granting agricultural institutions in a Province the size of NWFP.

Alternative 2 would have the advantage of close working relations between the College and the NWFP-AU, i.e. a mechanism for working out the overlapping relationships would be provided. The work of the constituent College would probably receive higher priority at the NWFP-AU than at Gomal University.

Alternative 3 is likely to lead to a widening gap between the quality of B.Sc. and M.Sc. holders at the two institutions, a result that would not be in the best interests of either institution.

The Design Team did not study this question in detail; however, it is of sufficient interest to the agricultural research, education, and extension of the NWFP-AU project that it is recommended that the issue be given thorough analysis and a

policy decision be made regarding the future of the higher education work in agriculture at Gomal University, D. I. Khan.

Other illustrations of normative linkages, i.e. overlapping, in the Province are those with the agricultural (crops), livestock production work in the Livestock Department and the Veterinary Department; the relationships between the outreach program of the NWFP-AU and the Extension Department; and relationships with the University of Peshawar in such areas as Home Economics and Agricultural Engineering. Special attention to research was given in Chapter 3 and to outreach in Chapter 4. The interests of the NWFP-AU and the research and extension systems of the Province are clearly overlapping and demand careful consideration by the leadership of the several organizations to see that the work of each is complementary and mutually supportive of the other. Once understanding has been reached regarding divisions of responsibilities, it may be desirable to have signed Memoranda of Understanding setting forth the understanding and the mechanisms to be used on a continuing basis to assure that the programs are non-duplicative and contribute to the agricultural development of the Province.

The future of work at the NWFP-AU, in some areas, is somewhat contingent upon developments at the University of Peshawar. Efficiencies of use of faculty is likely to demand interchange of personnel, particularly in the arts and sciences, support of the program for women, and in the agricultural mechanization/agricultural engineering area.

Relationships to the Pakistan Agricultural Research Council. PARC, at the federal level, is taking the leadership "--to undertake, aid, promote and coordinate agricultural research, arrange the expeditious utilization of research results, establish research institutions, arrange training of scientific manpower, maintain reference and research library and generate, acquire and disseminate information relating to agriculture."[11-1] Strong research systems are characterized by strong federal and provincial (or state) systems that are mutually supportive. Therefore, it is imperative that the NWPF-AU work out strong relationships with PARC and its National Agricultural Research Centre. There are many mutually advantageous opportunities in close cooperation with PARC and NARC. Among them are: faculty and staff exchange; complementary efforts in manpower development; participation in nationally coordinated research programs; NWFP-AU faculty and participant trainees conducting research at NARC; student internships at NARC; scientific literature exchange, etc.

The Management Program for Technology Development component of this project, coupled with the NWFP-AU component, is an excellent combination of mechanisms for smooth working relationships among federal and provincial research and education institutions. In view of the lag in developing either strong federal or provincial research systems in Pakistan, the realization of the need to "catch up" with other countries, and the shortage of trained manpower and other resources, there will be need for continuing

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[11-1]Amir Muhammed, Agricultural Research Systems of Pakistan, 1982, pp. 11-12.

attention to linkage management between provincial and federal leadership in the research system.

Diffused Linkages

The new NWPF-AU will have many important diffused linkages to individuals and informal groups. The University can be successful only if its outputs and services are recognized and appreciated by farmers and agribusiness men, the families of students and prospective students and graduates, and the teachers in primary and secondary schools. The informal relationships with political and government leaders at local, provincial, and federal levels are the sources of support throughout the political and social system. While these linkages are "diffused," they must be considered extremely important; indeed, the success of the new Agricultural University will depend, to a large degree, on these persons and groups recognizing that the outputs and services of the AU are contributing to their incomes and general welfare. If this is the case, they will, in turn, serve as sources of support for the University and have positive influences upon the leadership of other organizations in the political system.

CHAPTER 12

FINANCIAL REQUIREMENTS AND ANALYSIS

GENERAL

The development of the NWFP Agricultural University is a major undertaking in terms of scope of work to be completed, the anticipated length of the project comprising a series of phased activities, and the resources required to meet the overall objectives of the program.

Summaries of technical assistance and staff development requirements appeared earlier in this report. It is the judgement of the Design Team that this level of activity is necessary to bring the Agricultural University to the take off stage from which self-sustaining growth will result.

As shown in Table 12.1, the entire program over the next seven years is estimated at cost $51,525,000. Although some outside assistance was given to the antecedents of the Agricultural University, currently no other outside donor is engaged in developmental assistance to the institution. Therefore, the AID Project, which will provide 100% of the costs of the proposed activities, supports GOP efforts which to date have been unsupported by other donors.

Four summary tables are provided on the following pages. Table 12.1 summarizes project costs by fiscal year and source of funding; Table 12.2 describes project costs by expense category and source of funding; Table 12.3 provides a summary of project costs by project component; and Table 12.4 shows AID funding by foreign exchange and local costs. Supporting analyses sheets

TABLE 12.1

SUMMARY OF PROJECT COSTS
BY FISCAL YEAR AND SOURCE OF FUNDING
($ 000)

Source of Funding	FISCAL YEAR							
	FY 84	FY 85	FY 86	FY 87	FY 88	FY 89	FY 90	Total
1. A.I.D.								
a. Loan								
b. Grant	18,687	6,670	10,770	4,403	4,645	3,570	2,380	51,125
2. Mondale Rupees								
3. G.O.P.								
4. Other Donors								

TABLE 12.2

SUMMARY OF PROJECT COSTS[1/]

BY EXPENSE CATEGORY AND SOURCE OF FUNDING

($ 000)

Expense Category[2/]	Life of Project Funding					
	A.I.D. DOLLARS			Mondale Rupees	G.O.P.	Other Donors
	Loan	Grant	Total			
Technical Assistance						
a. Short-Term		5,098				
b. Long-Term		14,640				
Sub-Total		19,738				
Training						
a. U.S.						
i) Short-Term		679				
ii) Long-Term		3,322				
b. Third Country						
i) Short-Term						
ii) Long-Term						
c. In-Country (Res. Exp.)		2,000				
Sub-Total		6,001				
Commodities						
a. Vehicles		693				
b. Other		3,985				
Sub-Total		4,678				
Other Costs						
a. Construction[3/]		16,000				
b. Evaluation		60				
Sub-Total		16,060				
TOTAL		46,477				
Contingency (10 %)		4,648				
GRAND TOTAL		51,125				

oject costs defined as contingent obligations or as [illegible] of funding through
O's, contracts or purchase orders.
flation factor of 11% for FX and 11% for LC costs, [illegible] is included.
e also Volume II, Report of A&E firm.

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TABLE 12.3

SUMMARY OF PROJECT COSTS

BY PROJECT COMPONENT, EXPENSE CATEGORY, AND SOURCE OF FUNDING

($ 000)

Project Component	Life of Project Funding					
	A.I.D. Dollars			Mondale Rupees	G.O.P.	Other Donors
	Loan	Grant	Total			
1. Component A-Program Dev.						
a. Technical Assistance		19,738				
b. Training		6,001				
c. Commodities		4,678				
d. Other Costs		60				
Sub-Total		30,477				
2. Component B-Construction						
a. Technical Assistance		2,000				
b. -d. Construction		14,000				
Sub-Total		16,000				
3. Component C						
a. -d.						
Sub-Total						
4. Component D						
a. -d.						
Sub-Total						
TOTAL		46,477				
Contingency (10 %)		4,648				
GRAND TOTAL		51,125				

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TABLE 12.4

SUMMARY OF A.I.D. FUNDING
BY FOREIGN EXCHANGE (FX) AND LOCAL COSTS (LC), EXPENSE CATEGORY AND FISCAL YEAR
($ 000)

FISCAL YEAR	FY 84					FY 85					FY 86					FY 87					FY 88					FY 89					FY 90				
	A.I.D. Dollar					A.I.D. Dollar					A.I.D. Dollar					A.I.D. Dollar					A.I.D. Dollar					A.I.D. Dollar					A.I.D. Dollar				
	Loan		Grant			Loan		Grant			Loan		Grant			Loan		Grant			Loan		Grant			Loan		Grant			Loan		Grant		
	FX	LC	FX	LC	Rs	FX	LC	FX	LC	Rs	FX	LC	FX	LC	Rs	FX	LC	FX	LC	Rs	FX	LC	FX	LC	Rs	FX	LC	FX	LC	Rs	FX	LC	FX	LC	Rs
1. Technical Assistance																																			
a. Short-term			435	166				495	261				515	293				433	251				493	284				480	283				393	233	
b. Long-term			752	335				1583	1069				1465	1071				1309	1037				1445	1225				1099	983				670	567	
Sub-Total			1187	501				2068	1353				2080	1364				1742	1288				1938	1509				1579	1266				1063	800	
2. Training																																			
a. U.S.																																			
i) Short-term			136	23				193	25				224	30				11	3				41	3											
ii) Long-term			1591	108				760	50				298	45				351	23				88	8											
b. Third Country																																			
i) Short-term																																			
ii) Long-term																																			
c. In-Country (Res. Support)									300					300					300					400					400					300	
Sub-Total			1727	131				243	375				522	375				362	326				129	411					400					300	
3. Commodities																																			
a. Vehicles			193					300					200																						
b. Other			2000					1000					500					250					235												
Sub-Total			2193					1300					700					250					235												
4. Other Costs																																			
a. Construction[1/]			1250	10000									750	4000																					
b. Evaluation									25										35																
Sub-Total			1250	10000					25				750	4000					35																
TOTAL			6357	10634				4311	1753				4052	5739				2354	1649				2302	1920				1579	1666				1063	1100	
Contingency (10%)			636	1063				431	175				405	574				235	165				231	192				158	167				107	110	
GRAND TOTAL			6993	11697				4742	1928				4457	6313				2589	1814				2533	2112				1737	1833				1170	1210	

Rs = Mondale Rupees

1/ See also Volume II, report of the A&E firm.

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providing information on the development of estimates of various components shown in the tables, summaries of unit personnel requirements, technical assistance needs and staff development, and a summary of commodity allocations by department are shown as analyses sheets 12.1 through 12.11, respectively. More detailed commodity and equipment nneds are available but are not included in this report to reduce bulk.

Project costs are defined as anticipated sub-obligations or commitments of funding through PIO's, contracts, or purchase orders. Inflation was calculated on the basis of 10% for foreign exchange costs and 20% for local costs, all compounded annually. A contingency factor of 10% was applied to all costs. Local costs, where shown, are expressed as dollar equivalents at the exchange rate of US $1 = Rs. 12.91 as of 22 June 1982.

Cost estimates for the construction phase of the project are shown as aggregate amounts and must be considered preliminary. While the articulation between the Design Team and the A&E team has been as good as could be expected, the A&E Team did not include a cost estimator, preferring to devleop estimates at headquarters after the master planning concepts had been reviewed and approved by the Design Team, the NWFP-AU and USAID/ARD. The Design Team supports the conceptual framework developed by the A&E Team and reactions from the Agricultural University have been favorable. The final report of the A&E Team, which appears as Volume III, includes cost estimates based on locally or internationally accepted standards for construction estimates. Thus the figures included for construction in Tables 12.1-12.4 should be considered as indicative only with such adjustments as may be

ANALYSIS SHEET 12.1

WORKSHEET

FOR CALCULATING COSTS OF LONG-TERM TECHNICAL ASSISTANCE

	(1) FY 84		(2) FY 85		(3) FY 86		(4) FY 87		(5) FY 88		(6) FY 89		(7) FY 90	
	$	Rs.	$	Rs.	$	Rs.	$	Rs.	$	Rs.	$	Rs.	$	Rs.
I. DOLLAR COSTS[1]														
A. Annual Recurrent	11700		1[illegible]		[illegible]		150300		165300		181800		200000	
B. One-Time	41600		35800		53400		55500		61000		67100		738000	
II. RUPEE COSTS[5]														
A. Travel and Related Expenses														
1. Annual Recurrent		75000		90000		108000		129600		155500		186600		224000
2. One-Time														
a. Arrival Costs		173250		207900		249500		299400		359300		431100		517400
b. Departure Costs		297750		357300		408600		514500		617400		740900		889100
c. R&R Travel		162500		195000		234000		280800		337000		404400		485200
B. Housing Expenses														
1. Annual Recurrent		233000		279600		335500		402600		483100		579800		695700
2. One-Time		381000		457200		548640		658400		790000		948000		1137700
C. Office Expenses[3]														
1. Annual Recurrent														
2. One-Time														
III. Project Equipment[4] Supplies & Vehicles														
TOTAL	154500	94100	179000	1587000	197000	1904440	205800	2285300	273300	2742300	248900	3290800	273800	3949100
		(73000)[5]		(123000)		(147600)		(177200)		(212600)		(255100)		(306100)

1/ Inflation factor = 10% annually
2/ Inflation factor = 20% annually
3/ Included in Worksheet for Calculating Project Backstopping Costs.
4/ Project Equipment and Supplies included in Backstopping Cost estimates; vehicle in Commodities list.
5/ Expressed in Dollars using Rs. 12.9 = $1.00, rate current 22 June 1983.

ANALYSIS SHEET 12.2

ESTIMATES FOR LONG-TERM TA - 83 RATES

Line Item	$	Rs.
A. Annual Dollar Costs		
1. Salary ($\bar{x}$ 50 k/yr)	50,000	
2. Fringe (14.8%. incl. DBA insurance	7,400	
3. Allowances		
a. Post Differential (25%)	12,500	
b. Sunday Differential	2,500	
c. Education Allowance	15,000	
4. Other Direct Costs	1,000	
5. Indirect Costs (18% of 1-4)	15,500	
Total Annual Costs	$112,900	
B. One-Time Dollar Costs		
1. Int. per diem to post	1,000	
2. Int. per diem from post	1,000	
3. Shipment HHE to post	8,500	
4. Shipment POV to post	2,500	
5. Shipment UAB to post	2,000	
6. Int. per diem for Medical Travel	400	
7. Storage or HHE in U.S.	2,000	
8. Household Appliances & Equip.	17,500	
9. Indirect Cost (18% of 1-8)	6,700	
Total One-Time Costs	$41,600	
C. Annual Rupee Costs		
1. Travel		
a. air and per diem		75,000
2. Housing Expense (rent, utilities, etc.)		233,000
Total Annual Costs		Rs. 308,000
D. One-Time Rupee Costs		
1. Arrival Costs		
a. Travel to post		113.750
b. Medical travel/Emergency travel		44,500
c. Inland shipment of HHE and POV to Peshawar		15,000
2. Departure Costs		
a. Travel from post		113,750
b. Shipment HHE from post		110,500

c. Shipment POV from post			32,500
d. Shipment UAB from post			26,000
e. Inland shipment HHE and POV to Peshawar			15,000
3. R & R Travel			162,500
4. Housing Exp. (furniture, drapes, TLE, misc.)			381,000
Total One-Time Costs		Rs.	1,014,500
Total Cost for Long-Term TA	$152,000	Rs.	1,322,500 ($102,000)

ANALYSIS SHEET 12.3

WORKSHEET

FOR CALCULATING COSTS OF TECHNICAL ASSISTANCE PROJECT BACKSTOPPING

	(1) FY 84		(2) FY 85		(3) FY 86		(4) FY 87		(5) FY 88		(6) FY 89		(7) FY 90	
	$	Rs.	$	Rs.	$	Rs.	$	Rs.	$	Rs.	$	Rs.	$	Rs.
I. [illegible] 1/														
1. Annual Recurrent	85525		94100		103500		113800		125200		137800		157500	
2. One-Time	15000		NA		NA		NA		NA		NA		NA	
II. [illegible] 2/														
A. Travel and Related Expenses														
1. Annual Recurrent		169500		202200		242600		291200		349400		419300		503100
2. One-Time														
a. Arrival Costs														
b. Departure Costs		NA		NA		NA		NA		NA		NA		NA
c. R&R Travel														
B. Housing Expenses														
1. Annual Recurrent		NA		NA		NA		NA		NA		NA		NA
2. One-Time														
C. Office Expenses														
1. Annual Recurrent		298800		357600		429100		514900		617900		741500		889800
2. One-Time		82800		NA		NA		NA		NA		NA		NA
III. [illegible] Equipment/3/ Supplies & Vehicles														
TOTAL	100525	549300	94100	659800	103500	671700	113800	806100	125200	967300	137800	1160800	157500	1302900
		(42600)4/		(43400)		(52100)		(62500)		(75000)		(90000)		(198000)

1/ Inflation factor = 10% annually
2/ Inflation factor = 20% annually
3/ Vehicle included in Commodities list.
4/ Expressed in Dollars using Rs. 12.9 = $1.00, rate current 22 June 1983.

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ANALYSIS SHEET 12.4

ESTIMATE FOR PROJECT BACKSTOPPING

Line Item	$	Rs.
A. Annual Dollar Costs		
1. Salaries	35,000	
a. Campus Coordinator (.50fte @ 40 k/yr)	(20,000)	
b. Secretary (1.0 fte)	(15,000)	
2. Fringe 12.09	4,250	
3. Office Expense	24,000	
4. U.S. travel	2,500	
5. International per diem	600	
6. Indirect Costs 28.9% of 1-5	19,175	
	$85,525	
B. One Time Dollar Costs		
1. Field Office Equipment (WP, typewriter, telex, etc.)	15,000	
	$15,000	
C. Annual Rupee Costs		
1. Office Expense		298,000
a. Administrative Assistant		(60,000)
b. Secretary		(60,000)
c. Drivers (4@ 24 k/yr)		(98,000)
d. Telecommunications		(30,000)
e. Office Supplies		(50,000)
2. Travel for Campus Coord/Exec Visitor		168,500
a. Airfare (3 RT @ 44,500)		(133,500)
b. In-country per diem (6 weeks @ $62/day)		(35,000)
		466,500
D. One Time Rupee Costs		
1. Office Expenses		82,800
a. Furniture and furnishings		(37,800)
b. Office renovation		(20,000)
c. One-time office supplies		(5,000)
d. Vehicle rental		(20,000)
		82,800
TOTALS	$100,525	Rs. 549,300

ANALYSIS SHEET 12.5

WORKSHEET FOR ESTIMATIONS OF SHORT-TERM

TECHNICAL ASSISTANCE COSTS

		Dollar Costs	Rupee (Local) Costs
A.	Dollar Costs[1/]		
	Number of months x total monthly dollar costs	$ 3,139,220	
B.	Rupee Costs[2/]		
	Number of months x total monthly rupee costs		Rs. 15,470,000
C.	Trip Costs[3/]		
	Number of round trips from U.S. x:	$ 75,200	8,554,000
D.	Post Differential[4/]		
	Number of work days over 42 calendar days in-country x daily rate x 25%	$ 195,000	
E.	Sunday Differential	$ 26,320	
	Total Costs of Short-Term Technical Assistance	$ 3,503,740	Rs. 24,024,000[5/] $ 1,862,325

[1/] 476 mos. x $6595/mo.

[2/] 476 mos. x Rs. 32,500

[3/] 188 round trip x $400
188 round trip x Rs. 45,500

[4/] 3,900 work days x 200 x 25% (Peshawar PDA = 25%)

[5/] Expressed in Dollars using Rs. 12.9 = $1.00, rate current 22 June 1983

ANALYSIS SHEET 12.6

ESTIMATES FOR SHORT-TERM TA - MONTHLY COSTS, 83 RATES

Line Item	$	Rs.
1. Salary (x 50 k/yr)	4,200	
2. Fringe (14.8% incl. DBA insurance)	625	
3. Sunday Differential	140	
4. Other Direct Costs	600	
5. Indirect Costs (18% of 1-4; rounded)	1,000	
6. Travel		
a. in-country		5,000
b. Local per diem		27,500
c. International travel		45,500
d. International per diem	400	
Total Costs	$6,965	Rs. 78,000 ($6,000)
Rounded up to	$7,000	

ANALYSIS SHEET 12.7

ESTIMATES FOR TRAINING EXPENSE - 83 RATES

	Line Item	$	Ks.
1.	Recurrent Costs		
	a. Academic/Long-term	14,600/yr	
	b. Short Course/Study Tour	3,400/mo	
	c. Third Country	1,200/mo	
2.	One-Time Costs		
	a. International Air Fare		32,500

ANALYSIS SHEET 12.8

SUMMARY OF UNIT PERSONNEL REQUIREMENTS

(1) Unit (Area)	(2) Number Required 208	(3) Currently Available 88	(4) Deficit (2) - (3) 120	(5) Estimated Attrition 89	(6) Total New Personnel Required (4, + (5)= 159
1. General Administration	6	1	5	0	5
2. Plant Science	78	40	38	10	48
3. Engineering App. & Food Tech.	36	15	21	0	21
4. Animal Husbandry	17	7	10	4	14
5. Rural Social Science	36	23	13	1	14
6. Learning Resources Center	27	2	25	22	47
7. Continuing Education Center	8	0	8	2	10
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ANALYSIS SHEET 12.8 (continued)

SUMMARY OF UNIT PERSONNEL REQUIREMENTS

(1) Unit (Area)	(2) Number Required	(3) Currently Available	(4) Deficit (2) - (3)	(5) Estimated Attrition	(6) Total New Personnel Required (4) + (5)
GENERAL ADMINISTRATION	6	1	5	0	5
1. Vice Chancellor	1	1	0	0	0
2. Directors of Instruction/Research, Outreach	3	0	3	0	3
3. Deputy Vice Chancellor	1	0	1	0	1
4. Dean of Women	1	0	1	0	1
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ANALYSIS SHEET 12.8 (continued)

SUMMARY OF UNIT PERSONNEL REQUIREMENTS

(1) Unit (Area)	(2) Number Required	(3) Currently Available	(4) Deficit (2) - (3)	(5) Estimated Attrition	(6) Total New Personnel Required (4) + (5)
Plant Science	78	40	38	10	48
1. Horticulture	15	4	11	0	11
2. Crop Protection-Ent. Pl. Path, Weed Sci	27	11	16	1	17
3. Soil Science	12	8	4	5	9
4. Agronomy	9	6	3	1	4
5. Plant Breeding & Genetics	7	5	2	2	4
6. Instrumentation Lab	2	0	2	1	3
7. Ag Chemistry	6	6	0	0	0
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ANALYSIS SHEET 12.8 (continued)

SUMMARY OF UNIT PERSONNEL REQUIREMENTS

(1) Unit (Area)	(2) Number Required	(3) Currently Available	(4) Deficit (2) - (3)	(5) Estimated Attrition	(6) Total New Personnel Required (4) + (5)
Engineering Applications & Food Tech	36	15	21	0	21
1. Agricultural Mechanization	8	4	4	0	4
2. Food Technology	26	11	15	0	15
3. Biology and Microbiology	2	0	2	0	2
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ANALYSIS SHEET 12.8 (continued)

SUMMARY OF UNIT PERSONNEL REQUIREMENTS

(1) Unit (Area)	(2) Number Required	(3) Currently Available	(4) Deficit (2) - (3)	(5) Estimated Attrition	(6) Total New Personnel Required (4) + (5) = 14
ANIMAL HUSBANDRY	17	7	10	4	
1. Nutrition	4*	4*	0	1	1
2. Physiology & Animal Health	4	1	3	0	3
3. Animal Breeding & Mgt.	9	2	7	3	10
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* Mian is included in these figures.

ANALYSIS SHEET 12.8 (continued)

SUMMARY OF UNIT PERSONNEL REQUIREMENTS

(1) Unit (Area)	(2) Number Required	(3) Currently Available	(4) Deficit (2) - (3)	(5) Estimated Attrition	(6) Total New Personnel Required (4) + (5)
Rural Social Sciences	36	23	13	1	14
1. Extension Education & Communication	5	1	4	1	5
2. Div. Study of Rural Households	2	1	1	0	1
3. Ag. Economics & Rural Sociology	6	2	4	0	4
4. Inst. Developmental Studies	13	12	1	0	1
5. Islamic Studies	1	1	0	0	0
6. Pakistan Studies	1	0	1	0	1
7. English	4	4	0	0	0
8. Math-Statistics-Computer Applic.	4	2	2	0	2
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ANALYSIS SHEET 12.8 (continued)

SUMMARY OF UNIT PERSONNEL REQUIREMENTS

(1) Unit (Area)	(2) Number Required	(3) Currently Available	(4) Deficit (2) - (3)	(5) Estimated Attrition	(6) Total New Personnel Required (4) + (5) = 45
LEARNING RESOURCES CENTER	27	2	25	22	
1. Library	9	2	7	9	16
2. Communications Services	15	0	15	12	27
3. Computer Laboratory	3	0	3	1	4
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ANALYSIS SHEET 12.8 (continued)

SUMMARY OF UNIT PERSONNEL REQUIREMENTS

(1) Unit (Area)	(2) Number Required	(3) Currently Available	(4) Deficit (2) - (3)	(5) Estimated Attrition	(6) Total New Personnel Required (4) + (5)
CONTINUING EDUCATION CENTRE	8	0	8	2	10
1. Director CEC	1	0	1	0	1
2. Resident Mgr	1	0	1	0	1
3. Information Officer	1	0	1	0	1
4. Program Leaders	5	0	5	2	7
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ANALYSIS SHEET 12.9

U. S. TECHNICAL ASSISTANCE PERSONNEL NEEDS

Unit (Area) General Administration

Administrative unit, discipline, etc.	Months	1984	1985	1986	1987	1988	1989	1990	Remarks
1. Adviser to V.C. and Team Leader	60								
2. Adviser to Dy. V.C. for Teaching	58								
3. Adviser to Dy. V.C. for Research	60								
4. Adviser to Dy. V.C. [illegible] Outreach	52								
5. Unspecified Short Term TA	7								
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ANALYSIS SHEET 12.9 (continued)

U. S. TECHNICAL ASSISTANCE PERSONNEL NEEDS

Unit (Area) Plant Sciences

Administrative unit, discipline, etc.	Months	1984	1985	1986	1987	1988	1989	1990	Remarks
1. Irrigation and Water Mgt.	24	—	—	—					
2. Soils Science	6		—		—		—		
3. Entomologist--Research	6		—		—	—	—		
4. Plant Pathologist--Research	4		—		—		—	—	
5. Weed Scientist--Research	4			—		—	—		
6. Entomologist--Outreach	4	—		—				—	
7. Plant Pathologist--Outreach	3			—		—		—	
8. Weed Scientist--Outreach	3			—			—		
9. Horticultural Outreach--Fruits	12		—			—			
10. Horticulture Outreach--Vegetables	12		—			—			
11. Research Farm Mgt.--Horticulture	9	—	—						
12. Horticulture Research--Fruit	13			—		—	—	—	
13. Horticulture Research--Vegetables	13			—		—	—	—	
14. Agronomist--Seed Technology	5				—	—			
15. Agronomist--Biometrician	5			—	—				

ANALYSIS SHEET 12.9 (continued)

U. S. TECHNICAL ASSISTANCE PERSONNEL NEEDS

Unit (Area) Plant Sciences--Continued

Administrative unit, discipline, etc.	Months	1984	1985	1986	1987	1988	1989	1990	Remarks
1. Agronomist--Forage or Range Mgt.	6						—	—	
2. Plant Breeder--Wheat	3			—	—				
3. Plant Breeder--Maize	3			—	—				
4. Plant Breeder--Soybeans	5						—	—	
5. Plant Breeder--Oilseed Crops	5					—	—		
6. Unspecified Short Term TA	14	—	—	—	—	—	—	—	
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ANALYSIS SHEET 12.9 (continued)

U. S. TECHNICAL ASSISTANCE PERSONNEL NEEDS

Unit (Area) Engineering Applications & Food Technology

Administrative unit, discipline, etc.	Months	1984	1985	1986	1987	1988	1989	1990	Remarks
1. Adviser to Head, Ag. Mechanization	36	—	—	—	—				
2. Power and Machinery	2					—			
3. Irrigation and Drainage	2						—		
4. Food Microbiologist	12	—	—		—	—	—	—	
5. Food Processing Technologist	10			—	—	—		—	
6. Human Nutritionist	9		—	—		—			
7. Glassblower	6				—	—	—		
8. Equipment/Instrumentation	27	—	—	—	—	—	—	—	
9. Unspecified Short Term TA	14	—	—	—	—	—	—	—	
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ANALYSIS SHEET 12.9 (continued)

U. S. TECHNICAL ASSISTANCE PERSONNEL NEEDS

Unit (Area) Animal Husbandry

Administrative unit, discipline, etc.	Months	1984	1985	1986	1987	1988	1989	1990	Remarks
1. Dairy Production/Adv. to Dean	45	—	—	—	—	—	—	—	
2. Meat Animal Production/Adv. Dean	45	—	—	—	—	—	—	—	
3. Animal Breeder	15	—	—	—		—		—	
4. Poultry Nutrition	15	—	—		—	—		—	
5. Reproductive Physiology	15	—		—	—		—	—	
6. Veterinary Clinician	15	—		—	—		—	—	
7. Forage Utilization	12	—	—		—		—		
8. Meat Science	12	—	—		—		—		
9. Dairy Heard Management	6	—		—					
10. Sheep/Goat Herd Management	6	—		—					
11. Range Management	12	—	—	—	—		—		
12. Unspecified Short Term TA	7	—	—	—	—	—	—	—	
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ANALYSIS SHEET 12.9 (continued)

U. S. TECHNICAL ASSISTANCE PERSONNEL NEEDS

Unit (Area) Rural Social Sciences

Administrative unit, discipline, etc.	Months	1984	1985	1986	1987	1988	1989	1990	Remarks
1. Adviser to Dean, Rural Social Science	36	—	—	—	—				
2. Adviser to Women's Outreach	18		—	—		—	—		
3. Ag. Economics--Program Development	7	–	–	–	–	–	–	–	
4. Ag. Economics--Research	7		—	—	–				
5. Extension Education	10	—	—	–	–	–	–	–	
6. Math, Statistics, Computers	24	—	—	—	—	—	—	—	
7. Unspecified Short Term TA	14	—	—	—	—	—	—	—	
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ANALYSIS SHEET 12.9 (continued)

U. S. TECHNICAL ASSISTANCE PERSONNEL NEEDS

Unit (Area) Learning Resources Center

Administrative unit, discipline, etc.	Months	1984	1985	1986	1987	1988	1989	1990	Remarks
1. Adviser to Director, L.R.C.	36		—	—	—	—			
2. Library Adviser	11	—		—	—	—	—	—	
3. Communications Production	24				—	—	—		
4. Unspecified Short Term TA	7	—	—	—	—	—	—	—	
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ANALYSIS SHEET 12.10

PERSONNEL UPGRADING SCHEDULE

Unit (Area) General Administration

Sub-discipline or sub-area	1984	1985	1986	1987	1988	1989	1990	Remarks
1. Director of Instruction								36 Mos. PhD in Education Administration
2. Director of Research								3 Mos. Non-Degree
3. Director of Outreach								3 Mos. Non-Degree; 24 Mos. M.S. Ext. Ed.
4. Deputy Vice Chancellor								3 Mos. Non-Degree; 36 Mos. PhD Ed. Administration
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ANALYSIS SHEET 12.10 (continued)

PERSONNEL UPGRADING SCHEDULE

Unit (Area) Plant Sciences

Sub-discipline or sub-area	1984	1985	1986	1987	1988	1989	1990	Remarks
1. Horticulture--M. Ishtaq								36 Mos. PhD--Tropical Fruits
2. Horticulture--A.H. Shah								36 Mos. PhD Major area to be determined
3. Horticulture--A.F. Lodhi								4 Mos. Non-Degree--Administrative Tour
4. Horticulture--W. Mohammed								24 Mos. M.S. Vegetable Production/Outreach
5. Horticulture--S. Mohammed								24 Mos. M.S.--General Hort/Outreach
6. Crop Protection/Entomology--M. Shahid								12 Mos. Non-Degree, Post Doc. w/ Additional Management Component
7. CP/Entomology--Karimullah								12 Mos. Non-Degree, Post Doc.
8. CP/Entomology--M. Naeem								36 Mos. PhD--Integrated Pest Mgt (IPM)
9. CP/Entomology--S. Jan								36 Mos. PhD--Insect Pests Affecting Soybeans
10. CP/Entomology--S. Khan								12 Mos. Non-Degree, Post Doc., Insect Pathology
11. CP/Entomology--M.A. Shah								12 Mos. Non-Degree, Post. Doc., IPM/Stored Crops
12. CP/Entomology								36 Mos. PhD--Apiculture
13. CP/Entomology								36 Mos. PhD--Insect Taxonomy
14. CP/Entomology								24 Mos. M.S.--General Ent. w/Ext. Minor
15. CP/Entomology								3 Mos. Non-Degree, Field Trials

ANALYSIS SHEET 12.10 (continued)

PERSONNEL UPGRADING SCHEDULE

Unit (Area) Plant Sciences (Continued)

Sub-discipline or sub-area	1984	1985	1986	1987	1988	1989	1990	Remarks
1. CP/Plant Pathology--Amad Gul								12 Mos. Non-Degree, Post Doc., Nematology
2. CP/Plant Pathology--A. Rasi								36 Mos. PhD--Phytobacteriology
3. CP/Plant Pathology--M. Ahmed								24 Mos. M.S., General Crop Protection/Outreach
4. CP/Plant Pathology								36 Mos. PhD, Fungal Diseases
5. CP/Plant Pathology								36 Mos. PhD, Seed Pathology
6. CP/Plant Pathology--M. Khan								24 Mos. M.S., Fungal Diseases
7. CP/Weed Science--K.B. Manwot								36 Mos. PhD, Taxonomy/Systemics
8. CP/Weed Science--M. Jamal								36 Mos. PhD, Herbicide Physiology & Biochemistry
9. CP/Weed Science--M. Farid								36 Mos. PhD, Biotic Control of Weeds
10. CP/Weed Science, Q. Awaz								36 Mos. PhD, Chemical Control of Weeds
11. CP/Weed Science								36 Mos. PhD, Biochemistry of Herbicides/Soil Residues
12. CP/Weed Science								24 Mos. M.S., General Weed Control/Ext. Minor
13. CP/Weed Science								24 Mos. M.S., General Weed Control/Ext. Minor
14. Agronomy--M. Salim								3 Mos. Non-Degree, Study Tour of Dept. Organ.
15. Agronomy--M. I. Shah								4 Mos. Non-Degree--Research Farm Mgt. and Operations

ANALYSIS SHEET 12.10 (continued)

PERSONNEL UPGRADING SCHEDULE

Unit (Area) Plant Sciences (Continued)

Sub-discipline or sub-area	1984	1985	1986	1987	1988	1989	1990	Remarks
1. Agronomy--B. Ahmad								36 Mos. PhD, Seed Technology with Minor in Extension
2. Agronomy--P. Shah								36 Mos. PhD, Oilseed Crops/Biometrics
3. Agronomy								36 Mos. PhD, Forage Production/Range Mgt.
4. Agronomy--F.H. Taj								12 Mos. Non-Degree, Post Doc. Soybeans and Other Oilseed Crops
5. Plant Breeding and Genetics--Z. Ahmad								36 Mos. PhD, Wheat/Barley; Rust/Drough Resistance
6. P.B.G.--H. Rahman								36 Mos. PhD, Maize & Other Cross-Pollinated Crops
7. PBG--S. Hassan								12 Mos. Non-Degree, Post Doc. Protein Quality in Wheat
8. PBG--M. Ataullah Khan								3 Mos. Non-Degree, Departmental Administration
9. PBG--M. Ashraf								24 Mos. M.S., Breeding Oilseed Crops, e.g., Sunflower, pulses, chickpea
10. PBG--K. Ahmad								24 Mos. M.S., Soybean Breeding
11. PBG--A. Iftikhar								24 Mos. M.S., Evaluation/Tests & Measurement
12. Soil Science--J. K. Khattak								3 Mos. Non-Degree Soil Test Response/ Program Development
13. Soil Science--A. Bhatti								36 Mos. PhD, Soil Physics or Soil Microbiology
14. Soil Science--Miss S. Parveen								36 Mos. PhD, Soil Analysis
15. Soil Science								36 Mos. PhD, Soil Physics
16. Soil Science								36 Mos. PhD, Soil Genisis and Classification

ANALYSIS SHEET 12.10 (continued)

PERSONNEL UPGRADING SCHEDULE

Unit (Area) Plant Sciences (Continued)

Sub-discipline or sub-area	1984	1985	1986	1987	1988	1989	1990	Remarks
1. Soil Science								36 Mos. PhD., Soil Microbiology
2. Soil Science								24 Mos. M.S., General Soils w/Ext. Minor
3. Soil Science								24 Mos. M.S., General Soils w/Ext. Minor
4. Ag. Chemistry, P. Iqbal								36 Mos., Ph.D., Nutrition w/minor in Chem Anal
5. Ag. Chemistry, H. Shah								36 Mos., Ph.D., Analytic Chemistry
6. Ag. Chemistry, R. Bakshi								4 Mos. Develop Animal Colony
7. Ag. Chemistry, T. Hussain								12 Mos. Non-Degree, Post Doc., Human Nutrition
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ANALYSIS SHEET 12.10 (continued)

PERSONNEL UPGRADING SCHEDULE

Unit (Area) Engineering Applications and Food Technology

Sub-discipline or sub-area	1984	1985	1986	1987	1988	1989	1990	Remarks
1. Soil and Water Mgt., M. Arshad								24 Mos. M.S., Ag. Mech. & Extension Methods
2. Power and Machinery								36 Mos., Ph.D.
3. Workshop Skills								24 Mos. M.S., Vo Tech
4. Structures								24 Mos., M.S., Farm Structures
5. Ag. Processing, Electric--M. Tariq								12 Mos. Non-Degree, Ag. Mech. Program Develop
6. Ag. Processing, Electric								24 Mos., M.S.
7. Food Technology, Rafiullah								36 Mos., Ph.D., Food Engineering, Unit Operations
8. Food Technology, J. Mohammad								24 Mos., M.S., Food Processing
9. Food Technology, M. Shamsul								24 Mos., M.S. Food Processing
10. Biochemistry								36 Mos. Ph.D.
11.								
12.								
13.								

ANALYSIS SHEET 12.10 (continued)

PERSONNEL UPGRADING SCHEDULE

Unit (Area) Animal Husbandry

Sub-discipline or sub-area	1984	1985	1986	1987	1988	1989	1990	Remarks
1. Ruminant Nutrition, S. I. Shah								6 Mos. Non-Degree
2. Dairy Cattle Nutrition, M. Amjad								36 Mos. Ph.D., Large Ruminant Nutrition
3. Range Mgt., T. Mohammed								36 Mos., Ph.D., Sheep and Goats
4. Poultry Mgt., M. Ali								36 Mos., Ph.D., Poultry Disease
5. Dairy Farm Mgt., S. Ahmad								24 Mos. M.S.
6. Dairy Production, S. A. Shah								9 Mos. Non-Degree, Dairy Processing Tech/Dept. Administratin
7. Animal Breeding--Genetics								36 Mos. Ph.D., Dairy Cattle
8. Reproductive Physiology								36 Mos. Ph.D., Dairy Cattle
9. Animal Health								24 Mos., M.S. Clinical and Preventive Medicine
10. Meat Science								24 Mos., M.S., Beef/Mutton
11. Forage Utilization								24 Mos., M.S. Dairy Feeding
12. Research Farm Mgt. Sheep & Goat								6 Mos., Non-Degree, Supervised Experience
13. Research Farm Mgt., Poultry								6 Mos., Non-Degree, Supervised Experience
14. Cattle/Buffalo Mgt.								24 Mos. M.S. Reproduction w/work in Ext.
15. Sheep/Goat Mgt.								24 Mos. M.S., Range Mgt. w/work in Ext.
16. Poultry Mgt.								24 Mos. M.S., Nutrition w/work in Ext.

ANALYSIS SHEET 12.10 (continued)

PERSONNEL UPGRADING SCHEDULE

Unit (Area) Rural Social Science

Sub-discipline or sub-area	1984	1985	1986	1987	1988	1989	1990	Remarks
1. Agricultural Economics								24 Mos. M.S., Farm Mgt/Farming Systems
2. Ag. Economics, Ikramullah								36 Mos. Ph.D., Marketing and Prices
3. Ag. Economics								24 Mos. M.S., Marketing and Prices
4. Ag. Economics								24 Mos. M.S., Marketing and Prices
5. Ag. Economics								24 Mos. M.S., Farm Mgt.
6. Ag. Economics								24 Mos. M.S., Marketing and Prices
7. Ag. Economics, J. Siddili								3 Mos. Non-Degree, Dept. Administration
8. Rural Sociology, J. Khan								36 Mos. Ph.D., Soc. of Development
9. Rural Sociology, M. Akram								24 Mos. M.S., General Rural Soc.
10. Rural Sociology								36 Mos. Ph.D., Communications & Soc. Change
11. Social Science--Dean of Faculty								3 Mos., Non-Degree, Study Tour
12. Ext. Ed., Head of Dept.								36 Mos. Ph.D.
13. Ext. Ed., Asmatullah *								36 Mos., Ph.D. M.S. in Ext. Ed. then vs. Tech
14. Ext. Ed.								24 Mos. M.S., Adoption Process
15. Ext. Ed.								36 Mos. Ph.D.
16. Ext. Ed.								3 Mos. Non-Degree, Dept. Administra-

ANALYSIS SHEET 12.10 (continued)

PERSONNEL UPGRADING SCHEDULE

Unit (Area) Rural Social Science (Continued)

Sub-discipline or sub-area	1984	1985	1986	1987	1988	1989	1990	Remarks
1. English								24 Mos., M.A., English as Second Language
2. English								24 Mos., M.A., English as Second Language
3. Math, Stats, Computer								24 Mos., M.S., Statistical Methods
4. Math, Stats, Computer								24 Mos., M.S., Computer Science
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ANALYSIS SHEET 12.10 (continued)

PERSONNEL UPGRADING SCHEDULE

Unit (Area) Learning Resources Center

Sub-discipline or sub-area	1984	1985	1986	1987	1988	1989	1990	Remarks
1. Library Science								24 Mos., M.L.S.
2. Library Science								24 Mos., M.L.S.
3. Library Science								24 Mos. M.L.S.
4. Media-Carrel Operator								2 Mos. Non-Degree Study Tour
5. Language Lab Operator								2 Mos. Non-Degree Study Tour
6. Ag. Communications/Ext. Ed., Dir of Div.								36 Mos., Ph.D.
7. Radio Communication								24 Mos., M.S.
8. Video Communications								24 Mos., M.S.
9. Print Media								24 Mos., M.S.
10. Publications Editor								24 Mos., M.S.
11. Audio-Visual Specialist								24 Mos., M.S.
12. Graphics Design								3 Mos., Non-Degree Study Tour
13. Radio/Video Support								3 Mos., Non-Degree Study Tour
14. Maintenance Engineer								4 Mos., Non-Degree Tour Factories in US/Japan
15. Photographer								4 Mos., Non-Degree Study Tour
16. Computer Laboratory								24 Mos., M.S., Professional Program/Computer Sci

ANALYSIS SHEET 17.10 (continued)

PERSONNEL UPGRADING SCHEDULE

Unit (Area): Continuing Education Centre

Sub-discipline or sub-area	1984	1985	1986	1987	1988	1989	1990	Remarks
1. Extension Ed., Dir. of Outreach								36 Mos., PhD., in Ext. Ed/Vo Tech. Ed.
2. Hotel Management, Dir. CEC								24 Mos. M.S. Hotel Mgt. incl. Tour of CEC's in US
3. Hotel Management, Res. Mgr. CEC								24 Mos., M.S. Hotel Mgt., " " "
4. Extension Ed., Information Officer								24 Mos., M.S. in Ext. Ed.
5. Animal Science, Program Leader An								36 Mos., PhD., in An. Sci. w/Minor in Ext. Ed.
6. Plant Science, Program Leader PS								36 Mos., PhD., in Agron. or Hort w/" " "
7. Ag. Mech/Food Tech, Program Leader								36 Mos., PhD., in appropriate area w/ " "
8. Rural Social Science, Program Leader								36 Mos., PhD., in Ag Econ w/ Minor in Rural Soc.
9. Women's Outreach, Program Leader								36 Mos., PhD., in appropriate area w/ minor in Ext. Ed.
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ANALYSIS SHEET 12.11

COMMODITY ALLOCATIONS BY DEPARTMENT

Agronomy	$ 160,000
Horticulture	200,000
Soil Science	300,000
Plant Breeding	125,000
Plant Protection	400,000
Agricultural Mechanization	100,000
Food Technology	750,000
Animal Husbandry	300,000
Agricultural Chemistry	325,000
Extension Education and Communications	19,000
Communications Teaching	15,000
LRC - Library	470,000
LRC - Communications Services	300,000
LRC - Computer Laboratory	120,000
Continuing Education Center	48,000
Telecommunications System	228,000
Tube Wells	125,000
Vehicles for NWFP-AU	500,000
Project Vehicles	193,000
	$4,678,000

necessary to be reflected in the final Project Paper for the Agricultural Education, Research and Extension Project.

SUMMARY COST ESTIMATES AND FINANCIAL PLAN

The total cost of the project is $51,125,000, derived from grant funds. The proposed obligation schedule for the dollar grant is as follows (in $000): FY 1984 $18,687; FY 1985 $6,670; FY 1986 $10,770; FY 1987 $4,403; FY 1988 $4,645; FY 1989 $3,570; FY 1990 $3,380. A major proportion, 52.6%, of the AID dollar grant will be used to finance local costs under this project. Much of these costs will support the construction phase of the NWFP Agricultural University Master Campus Plan, but they also include the costs for local-hire project staff, vehicle maintenance and repair, in-country expenses, and the local costs associated with technical assistance. These funds will be dispersed in US dollars in order to maximize the balance of payments impact of this program in accordance with the overall objectives of the renewed US/GOP economic and development assistance program. A FAA Section 6.12 (B) certification has been signed by the USAID/Pakistan Mission Director and is made part of the project paper. The remaining 47.7% of the grant will be used for the foreign exchange costs associated with overseas training of Agricultural University staff, commodities procured off-shore, and technical assistance. AID will finance the international travel costs of all participants under this project. A participant training travel waiver which exempts the GOP from having to cover these costs has been signed by the USAID/Pakistan Mission Director and is included in the project paper. Of the total grant,

allocations by expense category are as follows: 12% for training; 9% for vehicles and commodities procured off-shore; 38% for technical assistance; 31% for construction and evaluation; and the remaining 10% for contingencies.

GOP Contribution. The GOP will make substantial contributions to this project through augmentation of UGC and other grants to the Agricultural University for increases in staff size and program responsibilities.

While much of this support will be derived from central government funds, it is anticipated that resources will be made available by the NWFP government for special projects associated with the development of the institution.

CHAPTER 13

TECHNICAL ASSISTANCE REQUIREMENTS

Long- and short-term TA needs were identified by Design Team members working in close collaboration with faculty and administrative staff of the Agricultural University. The project will finance a total of 458 work-months of long-term and 455 work-months of short-term expatriate technical assistance. A summary of the TA requirements by faculty is listed in Table 13.1. In addition, short-term TA to install communications equipment and train Agricultural University staff in its use will be provided under a sub-contract.

Table 13.1. Summary of TA Requirements by Faculty

Faculty or Unit	Long-term	Short-term
1. General Administration	230 months	7 months
2. Plant Sciences	24 months	135 months
3. Engineering Applications and Food Technology	36 months	82 months
4. Animal Husbandry	72 months	133 months
5. Rural Social Sciences	36 months	80 months
6. Learning Resources Center	60 months	18 months
	458 months	455 months

Long-term technical assistance is skewed toward policy-level positions at the senior administrative level, comprising approximately 50% of the long-term TA requirements. A significant amount of short-term involvement is foreseen to

support the in-country thesis research of Pakistani graduate students sent to the United States for course work.

Long-term expatriate TA will consist of a Team Leader and an advisor to the Vice Chancellor; advisors to the Directors of Instruction, Research, and Outreach; an irrigation or water management specialist; a dairy production specialist; a meat animal production specialist; the latter two serving consecutive terms and doubling as advisor to the Dean of Animal Husbandry; an advisor to the Director of the Learning Resources Center; a specialist in communications production; an advisor to the Dean of the Faculty of Rural Social Sciences; and an advisor to the Head of the Department of Agricultural Mechanization. Slightly less than 5.5 FTE per year will be required for long-term expatriate TA.

Four hundred fifty-five months of short-term TA are programmed over the life of the project in various academic disciplines. Included in this is up to 63 work-months of unspecified short-term TA to provide necessary flexibility for new program requirements throughout the life of the project. The short-term TA component may appear disproportionately large in relation to more traditional projects. The plan to maximize in-country thesis research for the NWFP-AU participants, as discussed in Chapter 6, Staff Development to Support the Program, requires on-site tours by academic advisors in order to properly supervise the research of the student and interact with Agricultural University faculty and the resident TA assigned to monitor the student's progress. But the Design Team expects more of a thesis advisor

than to work exclusively with the advisee. Thesis advisors will also be expected to contribute to overall departmental faculty programs through such means as reviewing and critiquing departmental research projects, counselling individual faculty on their current or planned research, offering seminars to specific and general audiences, and other services that support departmental research efforts. We anticipate that over the life of the project a number of thesis advisors will make multiple trips and thus promote enduring linkages between the NWFP-AU and several U.S. universities.

All TA will be provided by the University of Illinois at Urbana-Champaign, the contracting institution, its cooperating sister institution, Southern Illinois University at Carbondale, and other appropriate institutions. The TA for telecommunications procurement, installation, and training will be subcontracted from the private sector.

Funds will also be provided to hire local staff for the project administrative office in Peshawar. It is anticipated that an administrative assistant, a secretary, and at least four drivers will be employed. All local staff will be contracted on a one-year basis with option to renew based on satisfactory performance.

Detailed information on long- and short-term TA requirements and their scheduling are found in Chapter 12, Financial Requirements and Analysis.

APPENDIX A

THE NEW CURRICULA AND COURSES

Appendix A contains the details of the B.Sc. and M.Sc. level curricula and courses that were developed following evaluation of current curricula and courses and specification of guidelines to be used in building needed curricula.

The new curricula and courses were developed by Agricultural University faculty members and Design Team members in a truly collaborative manner. Virtually every faculty member was involved in discussion; disciplinary specialists on the design team permitted detailed interactions with faculty members in faculties and departments. The details will need review, and some modifications during implementation; however, the information on curricula and courses in Chapters 2 and this Appendix are the result of many hours of consensus development through group discussions, seminars, and general meetings of University faculty and Design Team members.

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A. THE B.SC. CURRICULUM

FIRST YEAR

1st Term		Credit
Orientation to Agricultural Professions		1
Introduction to Plant Sciences		3
Introduction Animal Husbandry		3
English writing		3
1 of 2 Mathematics I [F.Sc. (pre-med)]	3	
Biology I [F.Sc. (pre-eng)]	3	3
Introduction to Computers		2
		15

2nd Term	
Introductory Agricultural Economics	3
Chemistry I for Agriculture (including Organic and Biochemistry)	4
Engineering Applications to Agriculture	3
Animal and Plant Genetics	3
Pakistan Studies	2
	15

SECOND YEAR

1st Term	Credit	
Animal Nutrition		3
Soils		3
Microbiology		3
Agricultural Program Development and Implementation		2
1 of 2 Mathematics II	2	
Biology	2	2
Islamiyat		2
		15

2nd Term	
Animal Hygiene and Disease Prevention	3
Field Crop Production	3
Management of the Farming System	3
Introduction to Food Technology	3
Statistics	2
Seminar (Careers, Internships and Academic Advisement)	1
	15

Summer Internship	4
Women: (required household studies internship)	4

THIRD YEAR

1st Term	Credit
Soil Fertility and Water Management (Food T.: Raw Material Handling)	3
Introduction to Agricultural Communications	3
Introductory Crop Protection	4
Islamic Studies (or Ethical Behavior)	2
Elective	3
Agricultural Development Problems in Pakistan	
Chemistry II	
Crop Production elective	
1 of 2 Forage Production	
Horticulture	
Shop Practices	
Introductory Entomology	
Introduction to Breeding Methods in Crops	
	15

2nd Term	
Introduction to Rural Sociology	3
Farm Forestry Practices (Food T.: Food Safety & Env. San.)	3
Animal Production elective	3
Dairy Cattle and Water Buffalo Management	
1 of 3 Sheep and Goat Management	
Poultry Management	
Elective	3
Micro economics	
Animal Physiology	
Plant Physiology	
Soil Genesis and Classification	
Farm Power and Machinery	
Elective	3
Accounting	
Plant Pathology or Weed Science	
Animal Breeding	
Chemical Effects of Processing of Food	
Agricultural Communication Programs	
	15

Summer	
Required Internship (if not previously completed)	4

FOURTH YEAR

Complete the selected specialization as outlined below:

SPECIALIZATION
(Years III and IV)

SPECIALIZATION REQUIREMENTS

A. Year III (electives). If not taken in Year III, may be taken in Year IV, substituting the courses taken as alternates in Year III as Year IV electives.

B. Year IV: 12-24 credits

SPECIALIZATION ELECTIVES

--6-18 credits, total, of which 6 or more from faculties other than the specialization

--Chosen by student and advisor in light of:
  academic ability of student
  career choice of student
  plans for M.Sc., etc.

--Leading to two options

C	D
Career employment with B.Sc.	Advanced study or research

B. THE NWFP AGRICULTURAL UNIVERSITY

GENERAL UNIVERSITY COURSES

Orientation to Agricultural Professions, Year I

A multidisciplinary, global orientation, but with emphasis on NWFP, to: problems in food and fiber production, processing and distribution; the teaching, research and service activities of the UA-NWFP which are directed toward the resolution of these problems; and career and professional opportunities in agriculture.

A one-credit course coordinated by the Deputy Vice Chancellor for Teaching but with integrated segments presented by each of the faculties. Each faculty is to have one representative on the teaching team. One lecture and one small-group discussion period per week. Lecture sections limited to 150; discussion sections limited to 30.

Seminar, Year II

A required seminar, meeting one period per week during the 2nd term. The course will:

1. Present work force supply/demand data and trends.

2. Review the options for specialization which will begin in the third year.

3. Suggest some bases for selecting an option

   a. academic requirements
   b. interests, talents, abilities, limitations
   c. employment opportunities
   d. typical working/living environment
   e. typical pay scale and perquisites
   f. opportunities for advancement
   g. interviews/reports with recent graduates in typical careers representing all options

4. Provide orientation to the required internship.

5. Provide orientation to the academic advisement system for Years III and IV.

6. Explain the implications of selecting the elective for first term, Year III, and counsel students in making the selection.

C. COURSES AND M.SC. CURRICULA

1. THE ARTS AND SCIENCES

a. Curriculum and Courses in Mathematics, Statistics, and Computer Applications

INTRODUCTION TO COMPUTERS (required for all students)

Introduction to the basic microcomputer including: input devices, output devices, central processing unit, random access memory, and data storage devices. Understanding of programming with emphasis on the BASIC language, technique of flow charting a problem, and its application to simple agricultural problems, use of the packaged computer programs available for the microcomputers applied to the solution of agricultural problems.

MATHEMATICS I

An introductory course required for those students with pre-med training. Included in the course are: Algebra covering counting problems, permutations and combinations and their evaluation, permutations with repetition, the binomial theorem, and the binomial series; trigonometry encompassing common logarithms, logarithmic functions including trigonometric functions, logarithmic computation, solution of right triangles, and applications of trigonometry to problems of heights and distances; and mensuration or the calculation of areas, volumes, and surfaces of elementary shapes. Examples used in the course will be drawn from agriculture.

MATHEMATICS II (required for all students)

Introduction to matricies and calculus. The course includes: matricies, their determinants and manipulation; concept of continuous functions, limit of function, important limits, and functions that approach infinity; concept of derivative, the chain function, power formula, and derivatives of the more important functions; and integration, indefinite integrals, definite integrals, the geometric significance of definite integrals, the fundamental theorem of calculus, and some of the standard integrals.

STATISTICS I (required for all students)

A general introduction to statistics, using both continuous and discrete variables. Includes: collection of primary and secondary data and its geographical presentation; sampling; probability distributions; measurement of central tendencies - mean, median, mode, and quatriles; measures of dispersion, such as mean deviation, standard deviation, and coefficient of variations;

curve fitting using least squares and simple regression analyses; the concept of confidence intervals; and significance testing using the chi-square, F-test, and T-tests. Application of the above concepts will be made, using typical data concerning agricultural problems and statistical packages available on the computer.

STATISTICS II (4th year elective)

A statistics course for those students preparing to go on for the M.Sc. degree. A recommended course for those in the social sciences, plant sciences, and animal sciences. The concepts of probability distributions and sampling theory will be reviewed. The course will include: experimental design; one, two, three, and four way analysis of variance; analysis of covariance; simple and multiple linear regression; use of maximum likelihood estimators; and hypothesis testing. Emphasis will be placed on application of the above concepts to statistical analysis of agricultural research data using computer packages. For those students in the appropriate agricultural sciences, there will be a section of the course dealing with field plot techniques and their applications.

COMPUTER PROGRAMMING (elective)

Introduction to computer languages beyond BASIC and their application to programming in solving agricultural problems. The main emphasis will be on programming in Fortran but other languages such as Pascal will be taught. Students will be required to undertake several example programs. Students will also be introduced to data systems management, such as sorting, updating and retrieval of information from data files.

b. Agricultural Chemistry

CHEMISTRY I

CHEMICAL AND INSTRUMENTAL METHODS OF ANALYSIS

Credit hours - 4

(Lecture topics covered)

1. ACIDS AND BASES
   Modern concept of acids and bases, dissociation of weak and strong electrolytes, buffer solution, definition of pH, working of pH meter, glass and calomel electrode, measurement of pH of a solution

2. COLORIMETRY
   Basic principles of colorimeter spectrophotometry

3. FLAME PHOTOMETRY
   Methods and application

4. POLARIMETRY
   Principle and working of a polarimeter. Measurement of optical rotation, application and uses

5. SAMPLING AND SEPARATION
   Importance of representative sample; adapting methods to complex systems; importance of mixture separations

6. CHROMATOGRAPHIC TECHNIQUE
   Principles, classification and application of chromatography

7. PROXIMATE ANALYSIS
   Determination of moisture, ash, fat, fibre, and protein in food and feed

8. CARBOHYDRATE
   Definition of carbohydrate. Determination of glucose, fructose, sucrose, starch and cellulose in food and/or plant and animal systems as appropriate (e.g., blood glucose)

9. FAT AND OILS
   Chemical nature of fat and oil. Physical constants, i.e., melting point, refractive index, specific gravity. Chemical constants, i.e., iodine value, saponification value, acid value, R.M. value of fat and oil

10. PROTEIN
    Definition, qualitative tests for protein. Quantitative determination of protein

11. VITAMINS

Estimation of vitamins A, C, thiamine and niacin in various commodities

12. MINERALS

Principles of determination of sodium, calcium, potassium, phosphorous, iron and iodine by chemical and instrumental methods

(Practicals)

1. Determination of pH of a solution by pH meter

2. Determination of moisture, ash, fat, fibre, and starch in food and feed

3. Determination of protein in cereals and legumes

4. Determination of vitamin C by Dye method and vitamin A by Carr Price method

5. Determination of nitrogen and phosphorous fertility

6. Determination of chloride, sulphate, etc., in irrigation water

7.* Chromatographic separation of plant pigments or sugars in a mixture

CHEMISTRY II.

BIOCHEMISTRY

Credit hours - 4

(Lecture topics covered)

1. CARBOHYDRATES

Classification into mono-, di, and trisaccharides, chemistry and properties of glucose, fructose, sucrose, and starch. Manufacture of sucrose from cane sugar. Interconversion of monosaccharides, tests for carbohydrates

2. LIPIDS

Classification of lipids, phospholipids, waxes and sterols. Properties of oil and fats. Hydrogenation of oil, hydrolysis of fats and oils. Classification of fatty acids, rancidity and its causes

*This experiment will be added when equipment and supplies are in place.

3. PROTEIN AND AMINO ACIDS

Classification of protein, simple protein, conjugated proteins, derived proteins. Introduction to the structure of protein molecules. Amino acid classification, formulas and properties or amino acids

4. VITAMINS

Introduction, physiological action, deficiency symptoms and sources of vitamins A, D, E, K, and vitamin B complex, ascorbic acid

5. ENZYMES

Nature of enzymes, classification, specificity of enzymes, factors affecting enzyme action

6. CHEMISTRY OF DIGESTION

7. METABOLISM OF CARBOHYDRATES

Introduction to intermediary metabolism, Kreb's cycle. Glycolysis, glycogenesis, glycogenolysis, role of hormones in metabolic regulation

8. METABOLISM OF PROTEINS

Digestion, end product of protein metabolism, pathways of protein utilization, urea formation, etc. Deamination, transamination, decarboxylation

9. METABOLISM OF LIPIDS

Biochemical oxidation of lipids, different theories of fatty acid oxidation

10. BIOLOGICAL OXIDATION AND ENERGY METABOLISM

11. MINERALS

Sources, physiological action, deficiency symptoms of the following minerals: calcium, iron, iodine, phosphorus

(Practicals)

1. Preparation of exact N/10 NaOH solution
2. Preparation of exact N/10 HCl from normal solution
3. Determination of reducing sugar in a gur sample
4. Determination of non-reducing sugar in a gur sample
5. Determination of acid value of an oil
6. Determination of saponification value of an oil
7. Determination of iodine value
8. Determination of casein in milk

9. Experiment on enzyme purification (added when equipment available) or assay of enzyme activity

Text Books

1. Text Book of Biochemistry by West and Todd

2. Physiological Chemistry by Harper

3. Essentials of Medical Biochemistry, Vols. I & II, by Dr. Mushtaq Ahmad

4. Biochemistry by Dr. M. Rafique

5. Biochemistry by Leninger

Reference Books

1. Biochemistry for Medical Student by Thorpe

2. Dynamic Aspect of Biochemistry by E. Baldwin, 4th Edition

3. Biochemistry by Kleiner

c. Biology and Microbiology

INTRODUCTION TO MICROBIOLOGY

Credit hours - 3

(Lecture topics covered)

Historical introduction - overview of microbiology and its effect on man and society

Taxonomy - morphology of major groups of bacteria, yeast, molds, protozoa and algae

Discussion of microbial action within the three following concepts, using specific examples:

1. Disease-producing microbes
2. Microbes responsible for destruction or spoilage of various commodities
3. Microbes can produce products useful to man

Methods used to isolate and identify major groups of microbes - principle of selective enrichment - methods of pure culture technique - aseptic transfer and culture maintenance

Methods used to control microbes - temperature, filtration, chemicals, radiation, antibiotics

Role of bacterial viruses for the good and detriment of man

Role of microbes in maintaining balance in nature and their potential for agents of change in Pakistan

(Lab practicals)

1. Culture handling - aseptic technique - inoculation, transfer and maintenance of a culture

2. Isolation and sampling from the environment techniques, e.g. Staphylococcus aureus from the skin

3. Enumeration techniques for microbes - sample dilution and standard plate counts

4. Determination of coliforms in a sample by use of a selective medium

5. Principle of selective enrichment - boil sample for ten minutes - isolate sporeformer from boiled sample

6. Preparation of simple stains and Gram stain of representative bacteria - introduction to use of microscope - use of image projection for group viewing

7. Effect of salt, pH and heat on microbial growth

8. Follow growth of microbe by measuring a by-product produced during growth (e.g., determine titratable acidity with time)

d. Specialization in Agriculture, Sub-Specialization in Agricultural Chemistry

FOURTH YEAR B.SC.

For this specialization each student must complete, in addition to the courses required of all students by the University, the following courses which are required by the Specializtion:

A. Courses listed as electives in Year III, but required for the Specialization (taken in Year IV, if not previously):

1. Chemistry II

B. Other required courses for Year IV (either career employment or advanced study and research option)

		Credit
1.	Organic Chemistry	4
2.	Physical Chemistry	4
3.	Industrial Chemistry	4
4.	Advanced Biochemistry	4
5.	Human Nutrition	4

PLUS THE FOLLOWING FOR THE RESPECTIVE OPTION:

C. Career employment option

Electives, unless the courses listed in A above were not taken in Year III, in which case they must be taken in Year IV and the electives taken in Year III can count in this place (no less than 6 credits) 10

D. Advanced study or research option

Electives (same as statement C) no less than 6 10

--

MINIMUM TOTAL CREDITS FOR FOURTH YEAR 30

e. Specialization in Agriculture, Sub-Specialization in Biochemistry and Human Nutrition

M.SC. CURRICULUM

The following proposed curriculum is based on the assumption that the student has a B.Sc. (Hons) in the respective specialization, and that the student is admissible for graduate study.

FIRST YEAR

Required Courses	Credit
1. Advanced Nutrition	4
2. Enzyme Chemistry	4
3. Advanced Analytical Chemistry	4
4. Advanced Statistics	2-3
Elective Courses	
Free electives	10

SECOND YEAR

Research and thesis (6-8 credits suggested)	6
MINIMUM TOTAL GRADUATE LEVEL CREDITS	30

2. FACULTY OF PLANT SCIENCES

a. Plant Science - Brief Course Descriptions

(1) Agronomy Sub-Discipline

First Year, 1st term (required for all students)

Introduction to Plant Science - 3 (with practical)
Introduction to Agronomy and Horticulture. classification, distribution and adaptation of crops grown in Pakistan; land use, crop rotation and factors affecting yield and quality of crop plants. (Team-taught by Agronomy and Horticulture)

Second Year, 2nd term (required for all students)

Field Crop Production and Improvement - 3 (with practical)
Discussion of seeds and their germination; tillage, sowing, irrigation, fertilizer usage, harvesting and utilization of cereals, pulses, oilseed, sugar and forage crops.
Improvement of crops through breeding; mode of reproduction; crops classified as to self- and cross-pollinated; brief description of breeding methods--introduction, selection, hybridization, seed certification. (Team-taught by Agronomy and Plant Breeding)

Third and Fourth Year Electives and M.Sc.

Forage Crops - 3 (with practical)
Forage crop characteristics and their production, harvesting and utilization; forage and rangeland as related to animal production, soil conservation, crop rotation and land use.

Plant Physiology - 3 (with practical)
Introduction to plant physiology. Study of physiological processes affecting growth and development of crop plants, including water relations, mineral nutrition, metabolsim and reproduction.

Cereal Crops - 3 (with practical)
Detailed study of wheat, maize, rice and sorghum with reference to economic importance, special cultural practices, improved varieties and utilization. Brief study of other cereal crops.

Industrial and Special Crops - 3 (with practical)
Economic importance of sugarcane, sugarbeet, tobacco and cotton, their regional adaptability, morphological characteristics, cultural requirements, improved varieties, harvesting and utilization.

Oilseed Crops - 2 (with practical)
Economic importance of groundnut, sunflower, soybean, sarsoon and mustards, their regional adaptation, morphological

characteristics, improved varieties, cultural requirements, harvesting and utilization.

Pulse Crops - 2 (with practical)
Detailed study of gram, mung, mash, lentils, and pigeonpea with special reference to economic importance, adaptation, cultural practices, improved varieties, harvesting and utilization.

Seed Production and Technology - 2 (with practical)
Seed production practices, multiplication, certification, testing seed quality; proper cleaning, storage and distribution of improved seeds.

(2) Horticulture Sub-Discipline

Third Year Elective

Introduction to Horticulture - 3 (with practical)
Basic principles of plant growth and development as they apply to the production of fruits and vegetables in Pakistan.

Fourth Year and M.Sc.

Fruit Production I - 3 (with practical)
Survey of fruits grown in Pakistan, area of adaptation and climatic relations; choice of soils and sites for fruit trees; major cultivars of Pakistan temperate fruits; general principles of fertilizer use and irrigation; planting, training and pruning.

Fruit Production II - (with practical)
Growth and development of perennial temperate tree fruits; dormancy and chilling; flower bed formation; fruiting habits; pollination and fruit set; fruit development; maturity and ripening; exogenous chemical regulation.

Vegetable Production I - 3 (with practical)
Principles and practices in production of cool-weather vegetables.

Vegetable Production II - 3 (with practical)
Principles and practices of production of warm-weather vegetables.

Tropical and Sub-tropical Fruit Production - 3 (with practical)
Major differences between tropical and temperate fruits: principal cultivars; principles and practices in production of citrus, bananas, mango, guava and other tropical fruits.

Harvesting, Storage and Marketing of Horticultural Crops - 3 (with practical)
Maturity standards, harvesting methods; grading to meet market needs; packing and packaging; conditions and methods for storage and transport.

Potato and Seed Potato Production - 3 (with practical)
Warm and cool weather production practices; soils and fertilizer relatons; irrigation; planting methods; special techniques in production of seed potatoes.

Plant Propagation and Nursery Management - 3 (with practical)
Production of rootstocks and asexually propagated fruit trees and ornamentals; propagation methods; maintaining trueness to name; cultural methods for efficient and rapid production of saleable plants.

For Research - Advanced Study

Advanced Plant Physiology - 3 (cross-listed)
General consideration of photosynthesis, respiration, transpiration, translocation, metabolism and plant growth regulation by endogenous and exogenous substances.

Laboratory Research Methods - 2 (cross-listed with other Plant Sciences)
Common laboratory equipment, instruments, and their proper use; common laboratory methods; suitability of equipment and instruments in relation to experimental work.

Breeding of Horticultural Crops - 3
Techniques for sexually reproduced horticultural crops; sources of germplasm; selection and testing; development of true breeding lines and cultivars.

(3) Crop Protection Sub-Discipline

Third Year, 1st Term (required of all students)

Introduction to Plant Protection - 4
Lecture, laboratory and field practice to study the protection of plants from insects, plant pathogens and weeds with an introduction to the safe use of pesticides.

Third and Fourth Year (Electives)

Introduction to Plant Pathology - 3 (elective)
Lecture and laboratory to study the principles of plant pathology with respect to agricultural crops; emphasis on symptoms, causal agents and control.

Introduction to Weed Science - 3 (elective)
Lecture and laboratory to study the principles of weed science with respect to agricultural crops; emphasis on major weed species, their classification and control.

Introduction to Entomology - 3 (elective)
Lecture and laboratory to study the importance of insects in agriculture, including classification, epidemiology, and biology with emphasis on reproduction and control.

Applied Control Practices for Plant Protection - 3 (elective)
Lecture and laboratory on strategies of pest control using nonchemical and chemical methods with discussion of the effect of pesticides, their use and method of application.

(4) Plant Pathology

Fourth Year or M.Sc.

Principles of Plant Pathology - 3 (with practical)
Inoculum production, dispersion and survival; infection, incubation, establishment; symptom production; host-parasite relationships; epidemiology and disease prediction.

Diseases of Field Crops - 3 (with practical) (Service course)
In-depth study of the diseases of field crops in Pakistan, epidemiology, disease cycle, economic importance and approaches to control.

Diseases of Horticultural Crops - 3 (with practical) (Service course)
In-depth study of the diseases of horticultural crops in Pakistan, epidemiology, disease cycle, economic importance and approaches to control.

M.Sc.

Plant Nematology - 3 (with practical)
Diseases of plants caused by nematodes; identification, epidemiology, biology of nematodes; economic importance and approaches to control of diseases.

Plant Virology - 3 (with practical)
Viruses and virus diseases of plants and virus-like pathogens; identification, epidemiology, vector-pathogen relations of viruses; economic importance and approaches to control.

Phytobacteriology - 3 (with practical)
Plant diseases caused by bacteria and trycoplasma; identification, epidemiology, biology of phytobacteria; economic importance and approaches to control.

Diseases Caused by Fungi - 3 (with practical)
Symptomatic approach to fungal diseases and pathogens; epidemiology and biology of important pathogens of Pakistan; economic importance and approaches to control.

Research Methods in Plant Pathology - 3 (with practical)
Methods of laboratory, glasshouse, environmental chambers and field research: literature review, manuscript preparation, thesis writing. (Also suggested for Entomology, Weeds, Plant Breeding and Agronomy with title changes to Research Methods in the Plant Sciences.)

Control of Plant Diseases - 3 (with practical)
Nonchemical and chemical control of plant diseases: eradication, immunity, exclusion, protection, and integrated disease management.

Seminar - 1
Discussions of history of plant pathology, current trends, research, thesis reports, etc.

(5) Entomology

Fourth Year Courses and M.Sc.

Applied Entomology of Injurious Insects - 3 (Service course)
Lecture, laboratory and field practice in the recognition and management of important insect pests of agriculture; classification, structure, life histories and behavior involved with injury and methods of control.

Insect Pest Management - 3
Lectures, laboratory, and field practice to study the principles underlying the control of important insect pests of agriculture and human and animal health with emphasis on integrated pest management involving a systems approach which combines biological, cultural and chemical controls.

Agricultural and Other Useful Insects - 3
Lecture, laboratory and field practice to study the principles of beekeeping and honey production. Other useful insects and their importance in our environment will be studied.

Agricultural Zoology - 2
Lecture, laboratory and field practice to study agriculturally important zoological pests other than insects such as ticks, mites, and rodents.

Seminar - 1
Same as Plant Pathology and Weed Science.

(6) Weed Science

M.Sc.

Principles of Weed Science - 3 (with practical) (Service course)
Weeds in various cropping systems: their identification and economic importance with approaches to control.

Weed Ecology - 3 (with practical)
The distribution of weeds as influenced by geography, climate, and cropping systems; evolution of weed populations, survival of weeds and weed seeds.

Weed Biology - 3 (with practical)
Reproduction, seed dispersal, adaptation to environmental change; relation to soil, other weeds and other plants.

Weed Control - 3 (with practical)
Nonchemical and chemical weed control with discussion of control in an integrated plant pest control program.

Seminar - 1
Discussions of history and recent advances in weed science, post-graduate and faculty reports.
(Suggest one seminar in Crop Protection)

(7) Plant Breeding and Genetics Sub-Discipline

First Year, 2nd Term (required by all students)

Animal and Plant Genetics - 3 (with practical)
Principles of heredity and genetics applied to animal and plant improvement. Study of cell and cell division. Chromosomes, Mendelian and modified ratios, multiple allelism, linkage, mutations and extra-chromosomal inheritance as represented by selected plants, animals and human inheritance and variation.

Third Year, 1st Term

Introduction to Plant Breeding - 3 (with practical)
Plant breeding principles and practices. Methods in breeding of representative self-pollinated and cross-pollinated crop plants. Techniques in selfing, crossing, and maintenance of pure lines. Special emphasis on breeding for pest resistance, quality and yield.

Fourth Year and M.Sc.

Breeding Field Crops - 3 (with practical)
Genetic basis of breeding methods. Detailed methods in breeding of wheat and other major self-pollinated field crops; selection for rust resistance, lodging, drouth and protein quality; techniques in breeding of maize and other cross-pollinated field crops. Synthetic and composite varieties and three-way crosses and heterosis.

Cytogenetic Basis of Plant Breeding - 3 (with practical)
Genetic and cytogenetic basis for developing plant materials; protoplasm, chromosome complements and genomes, chromosome

mapping, structure of genetic material and gene action, mutations; cytoplasmic inheritance.

Breeding Pulses, Sugar and Oil Crops - 3 (with practical)
Genetic inheritance and evolution of the various pulses, sugar and oil crops; selfing and crossing techniques in selected pulses, and sugar and oil crops; world germplasm banks and international centers for sources for disease and insect resistance and quality and yield improvement.

Breeding Forage and Fiber Crops - 3 (with practical)
Study of improvement of various grasses and legumes for forage and fiber. Introduction of new species and varieties and selection criteria; breeding of selected forages will be covered.

Origin and Evolution of Crop Plants - 3 (with practical)
Origin, cytogenetics and evolution; classification morphology and anatomy of major crop plants; mechanisms of reproduction and inheritance of characters of economic importance; speciation and evolution of genetic systems and polyploids.

(8) Soil Science Sub-Discipline

First Term

Soils - 3 (required of all students) (with practical)
The nature of soils, soil profiles, and landscapes. Factors which cause soil differences. Soil classification. Physical, chemical, and biological properties of soils. Soil organic matter; its sources, nature, and influence in soils. Nitrogen, phosphorus, and potassium in soils and their use in fertilizers to grow plants. Moisture management (rainfall, irrigation, drainage, and runoff) in soils to grow plants efficiently, prevent salt acculumations, and control soil erosion.

Third Year, 1st Term

Soil Fertility and Water Management - 3 (required of all students) (with practical)
Physical, chemical, and biological properties of soils in relation to plant growth. The plant; essential elements (macro- and micro-nutrients) in soils and ways of assessing their needs precisely for different crops and management systems. Principles of applying fertilizer for optimum efficiency and profit on different crops.
Precipitation and temperature regions in Pakistan. Moisture requirements of different crops. Water conservation practices in moisture-deficient areas. Characteristics and management of saline and saline-alkali soils; relative tolerance of different crops to them. Determining when to irrigate and amounts for different crops and soils. Drainage to control salt accumulation. Principles and practices underlying the control of soil erosion.

Third or Fourth Year

Soil Genesis and Classification - 3 (elective) (with practical)
Emphasis on soils in Pakistan. Effects of parent material, climate, topography and drainage, organisms, and weathering upon soils. Soil-forming processes. Diagnostic horizons. FAO and USDA soils classification systems. Interpretation and utilization of soil survey information for land-use planning and other purposes.

Fourth Year Electives and M.Sc.

Saline and Alkali Soils - 3 (with practical)
Origin and classification of salt-affected soils. Osmotic, tonic, physical and nutritional effects on crops. Salt tolerance and crop choice for saline and alkali soils. Causes, effects, and control of salinity in agriculture. Quality of irrigation water.

Soil and Water Conservation - 3 (with practical)
Principles of soil conservation. Soil erosion: types, causes, and factors affecting rate of water and wind erosion. Erosion problems in Pakistan. Soil and water conservation practices. Hydrologic cycle. Use of structures, tillage practices, and vegetative cover to control soil erosion. Application of principles of soil management to the solution of land-use and conservation problems.

Soil Microbiology - 3 (with practical)
The importance of soil microbiology. Nature of soil microorganisms and their influence on soil fertility. Soil organic matter. Nitrogen transformations of phosphorus, potassium, carbon, sulphur, and micronutrients. Soil-borne pathogens and antibiotics in soils.

Soil Physics - 3 (with practical)
Physical constituents of soils. The physical properties of soil water systems. Soil texture, soil structure, bulk density, particle size distribution, soil water potential, hydraulic conductivity and water movement. Soil air, soil temperature and electrical conductivity. Soil physics in soil management. Methods of physical analysis.

Statistics II - 3
Design and analysis of field experiments.

Physical Chemistry - 3 (with practical)
Kinetic theory of gases and the derivation from it of simple gas laws. Vander Wall's equation.
Law of mass action and application to chemical equilibria. Elementary thermodynamics, eutrophy, and free energy. Catalysis, criteria of catalytic action.

Modern concepts of atomic structure. Radioactivity; properties of X-rays. Electrochemistry, including modern ionic theory and evidence on which it is based. Ionic and covalent bonding. Oxidation and reduction. Hydrogen ion concentration; pH value and its determination. Acids, bases, and buffers.

Colloidal chemistry; nature of colloids and practical uses. Dialysis and peptization.

Textbook: Physical Chemistry by Scott L. Kittsley. Third Edition, 1969. Barnes and Noble, Inc. New York.

Soil Chemistry - (with practical)

Analytical Methods for Soil and Plant Analysis - 3 (with practical)

Soil Survey and Mapping - 3 (elective) (with practical)

Soil-Plant Relationships - 3 (elective) (with practical)

Soil Seminar - 1 (one term of Year 5 and 6, required)

Review and reporting of current scientific literature concerning soils. Review of M.Sc. thesis plans and reporting results.

b. Specialization in Plant Sciences, Sub-Specialization in Agronomy

FOURTH YEAR B.SC.

For this specialization each student must complete, in addition to the courses required of all students by the University, the following courses which are required by the Specialization:

A. Courses listed as electives in Year III, but required for the Specialization (taken in Year IV, if not previously)

1. Plant Physiology
2. Plant Pathology or Weed Science

B. Other required courses for Year IV (either career employment or advanced study and research option)

		Credits
1.	One course in Agronomy	3
2.	One course in Soils	3
3.	One course in Horticulture	3
4.	One course in Plant Breeding	3
5.	One course in Crop Protection	3

PLUS THE FOLLOWING FOR THE RESPECTIVE OPTION:

C. Career employment option

Electives, unless the courses listed in A above were not taken in Year III, in which case they must be taken in Year IV and the electives taken in Year III can count in this place (no less than 6 credits must be outside Plant Sciences)	15

D. Advanced study or research option

1.	Chemistry II	3
2.	Statistics II	3
3.	Electives (same as statement C) no less than 6	9
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MINIMUM TOTAL CREDITS FOR FOURTH YEAR		30

c. Specialization in Plant Sciences, Sub-Specialization in Horticulture

FOURTH YEAR B.SC.

For this specialization each student must complete, in addition to the courses required of all students by the University, the following courses which are required by the Specialization:

A. Courses listed as electives in Year III, but required for the Specialization (taken in Year IV, if not previously):

1. Introduction to Breeding Methods in Crops or Chemistry II
2. Plant Physiology
3. Plant Pathology

B. Other required courses for Year IV (either career employment or advanced study and research option)

		Credits
1.	One course in Agronomy	3
2.	One course in Horticulture	3
3.	One course in Plant Breeding	3
4.	One course in Soils	3
5.	One course in Crop Protection	3
6.	Plant Science elective	3

PLUS THE FOLLOWING FOR THE RESPECTIVE OPTION:

C. Career employment option

1.	Extension Methods or Agricultural Communications	3
2.	Agricultural Development in Pakistan	3
3.	Electives, unless the courses listed in A above were not taken in Year III, in which case they must be taken in Year IV and the electives taken in Year III can count in this place (no less than 6 credits)	6

D. Advanced study or research option

1.	Mathematics II	3-6
2.	Chemistry II	3-6
3.	Statistics II	3-6
4.	Electives (same statement as C) no less than 6	6

MINIMUM TOTAL CREDITS FOR FOURTH YEAR 30

d. Specialization in Plant Sciences, Sub-Specialization in Horticulture

M.SC. CURRICULA

The following proposed curriculum is based on the assumption that the student has a B.Sc. (Hons) in the respective specialization, and that the student is admissible for graduate study.

FIRST YEAR

Required Courses

		Credit
1.	Advanced Plant Physiology	3
2.	Basic Laboratory Research Methods	3
3.	Statistics and Field Plot Design	3
4.	Plant Breeding of Horticultural Crops	3
5.	Electives	6

Elective Courses

Free electives	6

SECOND YEAR

Research and thesis (6-8 credits suggested)	6
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MINIMUM TOTAL GRADUATE LEVEL CREDITS	30

e. Specialization in Plant Sciences, Sub-Specialization in Soils

M.SC. CURRICULA

The following proposed curriculum is based on the assumption that the student has a B.Sc. (Hons) in the respective specialization and that the student is admissible for graduate study.

FIRST YEAR

Required Courses	Credit
1. Statistics II - Design and Analysis of Field Experiments	3
2. Physical Chemistry	3
3. Analytical Methods for Soil and Plant Analysis	3
4. Soil Seminar	1

Elective Courses

Enough other soils courses or supporting courses to make a total of 21 to 23 credits during the first year of the M.Sc. program

SECOND YEAR

Soil Seminar	1
Research and thesis (6-8 credits suggested)	6-8
MINIMUM TOTAL GRADUATE LEVEL CREDITS	30

3. FACULTY OF ANIMAL HUSBANDRY

a. Curricula and Courses for B.Sc. and M.Sc. in Animal Husbandry

B.Sc. in Animal Husbandry

The student must complete all University-wide required courses plus the specifically required courses in Animal Husbandry and at least 13 credits in elective courses in Animal Husbandry. The elective courses must include at least two of the four livestock management courses. The total number of courses in Animal Husbandry required for a B.Sc. is 45 credits.

M.Sc. in Animal Husbandry

For admission to the M.Sc. program in Animal Husbandry a student must have earned a B.Sc. in Animal Husbandry and meet the University requirement for admission to the graduate program.

To obtain a M.Sc. in Animal Husbandry, a student must take at least 30 credit hours of which a minimum of 15 must be at level 5, and conduct research for a thesis. The selection of courses and their research topics is to be under the direction of an advisor from the Faculty of Animal Husbandry.

The following courses are listed in five levels. Those at levels 1, 2, and 3 are for undergraduate credit only. The 4th level courses may be taken by undergraduate and graduate students while the 5th level courses may only be taken by students admitted to the graduate program.

b. Courses in Animal Husbandry

Level	Credit	
1 Required	3	Introduction to Animal Husbandry The application of genetic, anatomical, physiological and nutritional principles for the improvement of animal production. An overview of dairy, meat animal, wool and poultry industries of Pakistan with emphasis on how milk, meat, wool and poultry products are produced and distributed. 2 one-hour lectures, 1 two-hour practical.
2 Required	3	Animal Nutrition Basic principles of animal nutrition including classification of nutrients and their application to farm animals and the human. 3 one-hour lectures.
2 Required	3	Animal Hygiene and Disease Prevention Principles of prevention and control of infections, nutritional and parasitic disease of farm animals.
3 Required	3	Forage Crops Utilization Harvesting and processing of forage crops for utilization by livestock. Grazing systems, methods of making and storing hay and silage. 2 one-hour lectures, 1 two-hour practical
3 Required	3	Range Management Utilization of public grazing lands as related to livestock production, forestry and watershed management. Grazing practices and livestock stocking systems. 2 one-hour lectures, 1 two-hour practical
3 Required	3	Feeds and Feeding Principles of applied animal nutriton. Ration formulation to meet specific nutritional needs of all chosen livestock. Evaluation of composition of feeds and cost of nutrients. Prerequisite: Animal Nutrition 2 one-hour lectures, 1 two-hour practical
3 Required	3	Animal Breeding The application of basic principles of genetics and breeding systems to the improvement of farm animals and poultry. 3 one-hour lectures.

3 3 Required

Animal Physiology

Physiology of domestic animals. Functions of mammalian organisms are discussed using the organ system approach. Differences in the functions of monogastric, ruminant and avian species are presented.
2 one-hour lectures, 1 two-hour practical

3 3 Required

Meat, Poultry and Milk Products

Processing and distribution including inspection, grading, processing methods, storage and preservation to provide the consumer with a high quality nutritious product. To be taught in collaboration with Food Technology.
2 one-hour lectures, 1 two-hour practical

3 3

Meat Technology

A general approach to meat utilization, cutting and merchandising meat. Quality control, student participation in the transformation of live animals through slaughter and carcass fabrication into food products. To be taught in collaboration with Food Technology.
1 one-hour lecture, 2 two-hour practicals

4 4 Required

Reproductive Physiology and Artificial Insemination

Comparative anatomy and physiology of the male and female reproductive systems of domestic animals; hormones, reproductive cycles; mating behavior; gestation and parturition; sperm physiology; collection and processing of semen; artificial insemination, pregnancy tests; disease.
3 one-hour lectures, 1 two-hour practical.

4 4

Dairy Cattle and Water Buffalo Management

Application of the principles of breeding, physiology, nutrition and economics to management of a profitable dairy herd. Breeds of cattle and water buffalo, selection and breeding systems; feeding practices; housing; milking practices and quality milk production.
Prerequisite: Animal Breeding, Feeds and Feeding
3 one-hour lectures, 1 two-hour practical

4 4

Sheep and Goat Management

Application of the principles of breeding, physiology, nutrition and economics to management of sheep and goats for meat, milk and wool production. Selection and breeding systems, grazing and herding practices, feeding, housing, marketing practices, disease control.
Prerequisite: Animal Breeding, Range Management, Feeds and Feeding
3 one-hour lectures, 1 two-hour practical

4 3 Draft Animal Management

Selection and management of bullocks, donkeys, mules and horses for draft. Special emphasis on harness practices, feeding practices and health.

Prerequisite: Animal Physiology and Animal Nutrition

2 one-hour lectures, 1 two-hour practical

4 4 Poultry Management

The application of science and technology to the breeding, feeding, housing and management of poultry on both the small farm and large commercial operation in the production of poultry meat and eggs.

Prerequisite: Animal Breeding; Feeds and Feeding

3 one-hour lectures, 1 two-hour practical

4 3 Ruminant Nutrition

Physiology and microbiology of digestion in the ruminant, and biochemical pathways of utilization of the absorbed nutrients for production purposes.

Prerequisite: Animal Nutrition, Animal Physiology, Microbiology, Chemistry II

2 one-hour lectures, 1 two-hour practical

4 3 Poultry Nutrition

Physiology of the avian digestion system and biochemical pathways of utilization of the absorbed nutritients for production purposes.

Prerequisite: Animal Nutrition, Chemistry II

2 one-hour lectures, 1 two-hour practical

4 4 Meat Science

Fundamental biological principles that influence growth composition, processing, preservation and quality of meat and meat products

Prerequisite: Chemistry II, Microbiology

3 one-hour lectures, 1 two-hour practical

4 3 Physiology of Lactation

Anatomy and physiology of milk secretion; endocrine control; milk precursors and synthesis; milk composition; physiology and mechanics of milking, mastitis control

2 one-hour lectures, 1 two-hour practical

4 2 Principles of the Use of Medicaments in Animals

Review and discussion of various methods for administration of medicine to animals, the mode of action of commonly used drugs and other chemical agents, possible adverse effects of therapeutic treatment and methods to neutralize the effect of overdose or incorrect use of medicine. The course

is offered by individual arrangement with the major advisor and the appropriate instructor.
Prerequisite: Biochemistry

4 2 Principles of Wool and Hair Production
Discussion of factors affecting wool and hair production, ideal types of animals, production utilization, export and domestic consumption. The course is offered by individual arrangement with the major advisor and appropriate instructor.
Prerequisite: Sheep and Goat Production

4 2 Environmental Aspects of Animal Management
Animal-environmental interactions (incl. thermal, air, microbic, photic, sound and behavioral factors) as bases for prescribing practical environments for production of animals.
Prerequisite: Animal Physiology; Microbiology

4 2 Recent Advances in Artificial Insemination
Discussion of topics relevant to the most recent development in artificial insemination including evaluation, processing, preservation, storage and transportation of semen and estrus defection and insemination techniques. The course is offered by individual arrangement with the major advisor and the appropriate instructor.
Prerequisite: Reproductive Physiology and Artificial Insemination

4 2 Reproductive Physiology of the Post-Partum Animal (primarily ruminants)
The course is designed to give the student in-depth knowledge of the postparturient reproductive health emphasizing sizes of normal and abnormal genital tract involution, sanitary requirements and the onset of normal cyclicity. Half of the course will consist of discussion and literature review and half of practical training and observation in the livestock barns. The course is offered by individual arrangement with the major advisor and the appropriate instructor.
Prerequisite: Reproductive Physiology and Artificial Insemination

4 2 Techniques of Microbiology
This is a practical course emphasizing collection of specimens for microbiologic examination and the laboratory techniques used for isolation and identification of microorganisms of significance for animals and animal products. The course is offered by individual arrangement with the major advisor and the appropriate instructor.
Prerequisite: Microbiology

Courses offered in the Graduate Program (M.Sc. Degree):

Level	Credit	Course Title and Description
5	2	Statistical Genetics and Breeding Plans Selection theory, including maternal effects, selection methods, estimation of heritability and genetic correlation, genetic results of selection, selection for more than one trait, breeding plans, applications to farm animals. Prerequisite: Mathematics; Statistics
5	2	Progeny Testing in Farm Animals Review and discussion of the principles of progeny testing, methods and applications to farm animals. Prerequisite: Animal Genetics; Statistics
5	2	Concepts of Disease Prevention Discussions and literature review of disease as related to host, agent and environmental factors affecting disease occurrence, prevention and control measures. The course will be offered by individual arrangement with the major advisor and the appropriate instructor. Prerequisite: Microbiology; Biochemistry
5	3	Mineral and Vitamins in Animal Nutrition Basic and applied principles of mineral and vitamin metabolism. Emphasis on metabolic functions, reaction mechanisms and interrelationships. Prerequisite: Biochemistry; Poultry Nutrition or Ruminant Nutrition
5	2	Current Topics in Poultry Nutrition Discussion and literature review of current problems in poultry nutrition. The course will be offered by individual arrangement with the major advisor and the appropriate instructor. Prerequisite: Poultry Nutrition
5	2	Recent Advances in Ruminant Nutrition Discussions and literature review of current research problems and techniques. The course will be offered by arrangement with the major advisor and the appropriate instructor. Prerequisite: Ruminant Nutrition; Microbiology
5	2	Energy and Protein Utilization Energy and protein utilization including digeston, absorption, and metabolism as related to domestic animal production. Prerequisite: Biochemistry; Poultry Nutrition or Ruminant Nutrition

5	2	Advanced Endocrinology Seminar, lectures, student reports and discussions of recent advances in endocrinology. The course is offered by arrangement with the major advisor and the appropriate instructor. Prerequisite: Reproductive Physiology; Artificial Insemination
5	2	Recent Advances in the Pharmacologic Control of Reproduction Review and discussion of the principles for artificial control of the estrous cycle (incl. out-of-season breeding in sheep) and the initiation of parturition. The course is offered by individual arrangement with the major advisor and the appropriate instructor. Prerequisite: Biochemistry; Reproductive Physiology and Artificial Insemination
5	2	Avian Physiology The course is designed to give the student in-depth knowledge and training in this area. It includes discussion, literature review and practical training. The course is offered by individual arrangement with the major advisor and the appropriate instructor.
5	2	Recent Advances in Male Reproduction This course consists of lectures, student reports, discussion and literature review of current problems in male reproduction including the evaluation of semen and reproductive efficiency. The course is offered by individual arrangement with the major advisor and appropriate instructor. Prerequisite: Reproductive Physiology and Artificial Insemination; Biochemistry
5	2	Research Methods in Animal Science The course is designed to give the student practical training and experience in research techniques, related to animal nutrition, environmental physiology, meat science, reproductive physiology incl. artificial insemination. The course is offered by individual arrangement with the major advisor and appropriate instructor. Prerequisite: Biochemistry; Mathematics; Statistics
5	0-9*	Thesis Research

*Total for the degree

5 1-2 Seminar

Discussions of current research and literature in any topic of animal science selected in consultation with the major advisor.

c. Specialization in Animal Husbandry

FOURTH YEAR B.SC.

For this specializtion each student must complete, in addition to the courses required of all students by the University, the following courses which are required by the Specialization:

A. Courses listed as electives in Year III, but required for the Specialization (taken in Year IV, if not previously):

1. Animal Breeding
2. Animal Physiology
3. Animal Production elective

B. Other required courses for Year IV (either career employment or advanced study and research option):

	Credits
1. Forage Crop Utilization	3
2. Range Management	3
3. Feeds and Feeding	3
4. Milk, Poultry and Meat Products	3
5. Reproductive Physiology and Artificial Insemination	4
6. One of the following (other than Year III An. elec.)	
Dairy Cattle and Water Buffalo Management	
Sheep and Goat Management	3-4
Draft Animal Management	
Poultry Management	
7. Animal Husbandry elective	3-4

PLUS THE FOLLOWING FOR THE RESPECTIVE OPTION:

C. Career employment option

Electives, unless the courses listed in A above were not taken in Year III, in which case they must be taken in Year IV and the electives taken in Year III can count in this place (no less than 6 credits)	6-8

D. Advanced study or Research option

Electives (same statement as C) no less than 6	6-8

MINIMUM TOTAL CREDITS FOR FOURTH YEAR	30

4. FACULTY OF ENGINEERING APPLICATIONS AND FOOD TECHNOLOGY

a. Agricultural Mechanization Courses

(1) Required Course, 1st term, 2nd year.

Engineering Applications to Agriculture. Application of a variety of engineering techniques and principles to agricultural problems. Topics covered include: drafting, building planning and framing, surveying, soil and water control, simple electrical circuits, electric motors, principles of engine operation, and farm machine operating principles. Two lectures and one laboratory per week. Prerequisite: Mathematics I or F.Sc. (pre-engineering). 3 credits.

(2) Elective Course, 1st term, 3rd year.

Shop Practices. This is primarily a laboratory course and will provide hands-on experience in such workshop areas as: tool identification, use and maintenance: metal working including welding; and woodworking. One lecture and two laboratory periods per week. Prerequisite: Third year standing. 3 credits.

(3) Elective Course, 2nd term, 3rd year.

Farm Power and Machinery. Tractor selection, operating principles and component systems, and servicing and maintenance; operating principles of various types of farm machines and study of their proper adjustment and servicing. Two lectures and one laboratory period per week. Prerequisite: Engineering Applications to Agriculture. 3 credits.

(4) Courses for Specialization in Engineering Applications (Agr. Mech.)

A. Advanced Farm Power
Advanced topics in tractors and their power units including power transmission and traction and operator environment.
Two lectures and one laboratory per week.
Prerequisite: Farm Power and Machinery. 3 credits.

B. Farm Machinery Mechanisms.
Understanding the specifications, actions and design limitations of fundamental farm machinery machanisms.
Two lecture and on laboratory per week.
Prerequisite: Farm Power and Machinery. 3 credits.

C. Building Materials, Building Planning and Construction.
A general course in farm building planning and construction including space layout, materials selection and specification, and construction procedures.

Two lectures and one laboratory per week.
Prerequisite: Engineering Applications in Agriculture.
3 credits.

D. Crop Processing and Storage.
Methods and equipment for processing, preserving quality and safe storage of crops. Applications of electricity in crop processing and handling.
Two lectures and one laboratory per week.
Prerequisite: Engineering Applications in Agriculture.
3 credits.

E. Soil and Water Control.
Selection and layout of drainage, and irrigation systems for water conservation. Irrigation requirements and scheduling. Soil properties important in irrigation and drainage. Use of drainage to remove excess moisture and improve saline and alkali soils. To be taught in cooperation with the Soil Science Department.
Two lectures and one laboratory per week.
Prerequisite: Engineering Applications in Agriculture.
3 credits.

F. Farm Power and Machinery Management.
Efficient management and operation of farm machines considering economic, time, material and energy efficiencies.
Two lectures and one laboratory per week.
Prerequisite: Engineering Applications in Agriculture and Introduction to Computers. 3 credits.

G. Solar Energy Applications in Agriculture.
Collection and utilization of solar energy in various agricultural applications.
Two lectures and one laboratory per week.
Prerequisite: Senior or graduate standing in agriculture.
3 credits.

H. Modifying Building Environment.
Heating and cooling needs, heating, cooling, ventilating and lighting systems.
Two lectures and one laboratory per week.
Prerequisite: Engineering Applications in Agriculture.
3 credits.

I. Advanced Soil and Water Control.
Advanced topics in drainage, irrigation and erosion control.
Two lectures and one laboratory per week.
Prerequisite: Soil and Water Control. 3 credits.

J. Advanced Shop Practices.
Additional practice and coverage of more complicated procedures of welding, metal work, and finished carpentry.

One lecture and two laboratories per week.
Prerequisite: Shop Practices. 3 credits.

K. Advanced Crop Processing.
Equipment for such operations as drying, refrigerating, cleaning, sorting and treating agricultural crops and products.
Two lectures and one laboratory per week.
Prerequisite: Crop Processing and Storage. 3 credits.

L. Special Problems in Agricultural Mechanization.
The student selects a problem of special interest in Agricultural Mechanization. Under the direction of an advisor he thoroughly investigates the problem, perhaps conducts some experiments or tests and prepares a detailed report.
One conference per week.
Prerequisite: Senior standing in Agricultural Mechanization. 3 credits.

(5) Courses for M.Sc. Curriculum in Agricultural Mechanization

Seminar in Agricultural Mechanization.
Course will consist mainly of students in the course exploring various agricultural mechanization topics and then reporting orally to the rest of the class and in writing to the instructor.
Three class meetings per week.
Prerequisite: Graduate standing in Agricultural Mechanization. 3 credits.

b. Specialization in Engineering Applications and Food Technology, Sub-Specialization in Agricultural Mechanization

FOURTH YEAR B.SC.

For this specialization each student must complete, in addition to the courses required of all students by the University, the following courses which are required by the Specialization:

A. Courses listed as electives in Year III, but required for the Specialization (taken in Year IV, if not previously):

1. Shop Practices
2. Farm Power and Machinery

B. Other required courses for Year IV (either career employment or advanced study and research option)

	Credits
1. Six Specialization courses in Agricultural Mechanization	18

PLUS THE FOLLOWING FOR THE RESPECTIVE OPTION:

C. Career employment option

1. Accounting or Business Management	3
2. Electives, unless the courses listed in A above were not taken in Year III, in which case they must be taken in Year IV and the electives taken in Year III can count in this place (no less than 6 credits)	9

D. Advanced study or research option

1. Advanced Computers or Advanced Statistics	3
2. Special Problems in Agricultural Mechanization	3
3. Electives (same statement as C) no less than 6	6
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MINIMUM TOTAL CREDITS FOR FOURTH YEAR	30

c. Specialization in Engineering and Food Technology, Sub-Specialization in Food Technology

FOURTH YEAR B.SC.

For this specialization each student must complete, in addition to the courses required of all students by the University, the following courses which are required by the Specialization:

A. Courses listed as electives in Year III, but required for the Specialization (taken in Year IV, if not previously):

1. Food Safety and Environmental Sanitation
2. Raw Materials
3. Chemistry III
4. Food Engineering

B. Other required courses for Year IV (either career employment or advanced study and research option)

First Term	Credits
1. Food Processing I	5
2. Food Microbiology	3
3. Food Nutrition and Chemistry	3
Second Term	
1. Food Processing II	5
2. Quality Control	3

PLUS THE FOLLOWING FOR THE RESPECTIVE OPTION:

C. Career employment option

Electives, unless the courses listed in A above were not taken in Year III, in which case they must be taken in Year IV and the electives taken in Year III can count in this place (no less than 6 credits)	11

D. Advance study or research option

1. Industrial Chemistry or Physical Chemistry	4
2. Advanced Biochemistry or Human Nutrition	4
3. Electives (same as statement C) no less than 6	3
MINIMUM TOTAL CREDITS FOR FOURTH YEAR	30

d. Specialization in Engineering Applications and Food Technology, Sub-Specialization in Agricultural Mechanization

M.SC. CURRICULUM

The following proposed curriculum is based on the assumption that the student has a B.Sc. (Hons) in the respective specialization, and that the student is admissible for graduate study.

FIRST YEAR

Required Courses	Credit
1. Advanced Computers of Advanced Statistics (if not in B.Sc.)	3
2. Research Orientation and Methods (not necessarily Ag. M.)	3
3. Seminar in Agricultural Mechanization	3
4. Four Agricultural Mechanization courses not taken earlier	12
Elective Courses	
Free electives	9

SECOND YEAR

Research and thesis (6-8 credits suggested)	6
TOTAL GRADUATE LEVEL CREDITS FOR M.SC.	36

5. FACULTY OF RURAL SOCIAL SCIENCES

a. Courses in Agricultural Economics

Two courses being proposed to be taught in the Agricultural Economics area are new in concept and therefore are described in some detail. Other courses are of a more standard content and thus are listed by title and brief description only.

Introductory Agricultural Economics
Overview of land and other agricultural inputs in Pakistan and the NWFP. Micro and macro economics concepts used in understanding how the economic system functions.

Management of the Farming System
Interrelationships of produciton disciplines, external forces and non-economic factors in the farmer decision-making process. (See attached topic listing)

Farm Management
Application of micro economic concepts in evaluating alternative used of farmer resources. Organization of farm resources to optimize returns within the external and internal constraints faced by the farmer.

Credit and Finance
Credit as a management tool, sources of farm credit, cost of credit, factors in analyzing a loan, loan supervision and collection.

Agricultural Marketing
The marketing system and how it works. Marketing functions and needed changes, domestic and export markets, and market regulations.

Agricultural Marketing and Prices
Ways to increase farm income by changing marketing institutional arrangements, pricing arrangements, efficiency in market functions and expansion of domestic and international markets.

Cooperatives and Agricultural Development
Principles of cooperative organizations. Requirements for success in input supply, marketing, and consumer cooperatives. Pakistan experience with cooperatives, comparisons with other countries. Special study of NWFP cooperatives.

The Farm as a Socio-Economic Unit
Problems faced by farmers in making decisions. Interdisciplinary approach to show how sound decision making will improve

farm income. Barriers to farmer acceptance of these recommendations. (See attached statement of proposed course)

Micro Economics

The use of economic principles to identify farm firm problems to make rational decisions in allocating resources and in determining product mix. Distribution of income from economic activity to the factors of production, consumer theory.

Macro Economics

National and international monetary and fiscal policies as they effect income, income distribution, employment, inflation, prices and markets.

Intermediate Micro Economic Theory

Price determination, output levels, resource use, product and resource mix under different competitive conditions and market structures.

Intermediate Macro Economic Theory

Analysis of effects of domestic and international shocks to the economy; costs and benefits of government policies to insulate the economy from such shocks.

Accounting

Accounting principles and practices employed in business to maintain accurate records to reflect profit and loss, cash flow, equity ratios and tax liability.

Agricultural Development Problems in Pakistan

Nature of problems facing Pakistan agriculture including size of farm, land fragmentation, credit and finance, availability of purchased inputs, marketing and regulations.

Agribusiness Management

Role of off-farm organizations (private, public, cooperative and parastatal) in providing purchased inputs and in marketing products. Problems in managing facilities, capital and personnel to make this system more effective.

Project Design and Analysis

Statement of problem, developing of alternatives, development of appropriate data to analyze problems and, after analysis of data, making recommendations for action including cost-benefit projections under different assumptions concerning resource productivity and prices of inputs and outputs.

Farm Records and Decision Making

Types of records farmers need to make better decisions. Applications of data from these records in making decisions to improve resource productivity by using simple complete budgets and partial budgets as well as by using linear programming.

Management of the Farming System

A required course for B.Sc. students (second term of the second year).

Interrelationship of agricultural disciplines, external forces and non-economic factors in the farmer decision-making process.

Topics

1. Complex environment in which decisions are made.

2. Total farm vs enterprise as decision-making unit.

3. Interrelationship of many disciplines in making decisions.

4. Selecting crop rotations.

5. Subsistence crops, cash crops and horticultural crops.

6. The triple function of livestock-power, food for family and source of income.

7. External forces in the decision process.

8. Non-economic factors in the decision process.

9. How changing price-cost relationships effect decisions.

The Farm as a Socio-Economic Unit

An interdisciplinary course for one term during the fourth year of B.Sc. program.

Objectives of the course:

1. Provide students with recognition of the way the various courses taken fit together to help solve the individual farmer's problems. To show how the various disciplines each make a contribution, and that any one discipline seldom provides the answer.

2. Provide the faculty with a more precise feeling for the trade-offs when making decisions at the farm level. This will further support the need for joint research and coordination of teaching efforts to solve problems of the agricultural sector of the NWFP economy.

Target Audience:

1. For 3 years on an experimental basis, include 6 students from each of the 4 agricultural faculties, along with one staff member from each of the 4 faculties.

2. As a special problem comes up outside the technical expertise of any of the 4 faculty members, other faculty would be invited to participate in the discussion. Each week students would be expected to read and discuss particular problems with appropriate faculty.

3. After the term is completed, the participating faculty and students would evaluate the course to make recommendations on how it can be improved for the following year.

4. After 4 years, follow up with the graduates who participated in the program and the staff who participated. This would include the students and 7 faculty members plus the other faculty who had made contributions.

The faculty participating would be on a rotating basis. For the first year terms would be as follows:

Animal Husbandry	1 year
Engineering Applications and Food Technology	2 years
Plant Sciences	3 years
Rural Social Sciences	4 years

A faculty member could not succeed himself for at least 4 years. So at the end of the first year the animal husbandry faculty would designate a new member, the other departments would follow in rotation.

The coordination for the first year would be from Plant Science. The rotation would be: Plant Sciences, Rural Social Sciences, Animal Husbandry and Engineering Applications and Food Technology.

NATURE OF COURSE

For the decision making unit it is assumed the land resource and the available labor is fixed.

Two "typical" farms would be used each term. But the location and available crops, water etc. would be changed each year. One farm would be about 2.5 acres and the other about 15 acres.

The following are illustrative of the problems to be developed. (The class would involve a discussion in which both faculty and students would freely participate.)

1. Alternative crop successions for multiple cropping.

2. Evaluation of labor balance of various alternatives.

3. Requirements for power for the various enterprises and for the farm unit. Source of this power (provided by farm or custom hire). Seed bed and cultivation recommendations.

4. How many hours per year must a 40 HP tractor be used to justify investment? What make and model should be selected?

5. Fertilizer recommendations for each crop. Yield response expected and costs and returns from various fertilizer recommendations. If a farmer has a limited amount of fertilizer available, how should he use it?

6. Where would the farmer obtain seed and fertilizer?

7. Availability of water along with cost, when to apply and how much to apply.

8. Where to market production, prices at alternative markets along with costs to reach these markets; hence net price to farmers.

9. How to prepare products for market.

10. For many Pakistan agricultural products there are seasonal price variations. For some perishable products such as fresh vegetables time of planting determines when product is harvested and price. How can this help farm income?

11. Can farm storage be used to take advantage of post-harvest price increases on storable commodities such as maize, wheat and other crops? Relationship between cost of storage and returns to storage is an important consideration.

12. What is the nature and amount of post-harvest losses for various crops in the system? How can these losses be minimized? What are the costs and benefits from alternative approaches?

13. How are products to be used for family consumption prepared for storage? Can this be improved and at what cost?

14. Six weeks after planting the crops, assume an outbreak of a plant disease. What can be dome to control this outbreak and how can such outbreaks be reduced in the future?

15. Assume an insect infestation of a crop a month after seeding; how can this be controlled?

16. What livestock are on the farm: cattle, buffalo, poultry, sheep, goats, etc. How are they managed? Is there a marketable surplus? Could this surplus be increased through better husbandry practices? If so, how?

17. Where is the market for livestock, milk, and eggs?

18. It is suggested at the first session the student would develop a detailed financial statement (balance sheet), estimated profit and loss statement, and cash flow statement for the two farms.

19. At the end of the course the student would again prepare the 3 sets of data as in item 18 in light of their discussion and recommendations.

20. How much credit would each farm need? Can the farmer obtain this credit? Where? Does the farmer have the repayment capacity to repay such a loan?

21. Assume the farmer has a wedding two weeks before the crop is harvested. What adjustments do you make in this program?

22. If the results from this exercise are so much better than in the real world, why? How can recommendations for improvement be adjusted so they are more acceptable?

Grading would be determined by classroom participation and a final report prepared by each student in which he emphasizes how problem solving at the farm level involves trade-offs between various alternatives within the constraints faced by the decision maker.

SOCIAL SCIENCE QUANTITATIVE METHODS I (4th year elective)

Introduction to the role of mathematical approaches to optimization in agriculture. Review of matrix algebra. Mathematical formulation of linear programming (LP) problems. Simplex method of solving LP problems. Introduction to LP package on the computer. Exercises to develop ability to use LP packages to solve farm and resource problems. Sensitivity analysis and economic explanation of optimum solutions and shadow values of constraining variables. Computer exercises to utilize sensitivity analysis to determine shadow values of scarce agricultural inputs. LP programming techniques applied to agricultural applications such as feed ration mixing, transportation routing and crop/livestock production mix.

SOCIAL SCIENCE QUANTITATIVE METHODS II (M.Sc.)

Review of linear programming (LP). Introduction to Lagrange multipliers, Kuhn-Tucker theorem, duality and revised simplex method as applied to agricultural problems. Economic explanations of primal and dual solutions and applied applications using LP computer package. Review of probability theory and farm decision making under uncertainty. LP programming techniques to solve farm decision problems incoporating uncertainty.

Review of regression analysis with emphasis on the application of single equation regression methods to problems in agriculture. Techniques include least squares estimators and maximum likelihood estimators. Also techniques for assessing and correcting for heterskedasticity, serially correlation, and multicollinearity in the data. Introduction to the use of binary independent variables.

PRODUCTION ECONOMICS (M.Sc.)

Analysis of agricultural production at the enterprise or farm level. Introduction to theory, estimation and utilization of response analysis in agricultural production. Review of calculus and econometrics with emphasis on partial differential equations, ordinary least squares and multiple regression. Alternative methods of measuring factors of production and agricultural outputs with particular emphasis on non-market inputs and outputs. Regression analysis to estimate response functions including firm production function. Mathematical development and economic interpretation of concepts of marginability. Relationship between marginal products and economic definition of maximum profit. Farm management and applications of production economics to determine profit maximizing input mixes. Evaluation of firm costs and size economics in agriculture. Utilization of production economics tools to improve farm management and decision making.

RESOURCE ECONOMICS (M.Sc.)

Introduction to welfare economics. Concepts of public and private goods. Methods of valuing non-market goods. Stock and flow concepts, and role of the market and government in allocation of natural resources. Principles of land economics. Contrasts and comparisons of pricing strategies for public and private land resources. Land conservation, zoning and optimal uses of land resources over time. Introduction to water resource economics. Unique properties of water resources including its figurative nature. Problems with water pricing and allocative schemes. Complementary and competitive uses of water. Conjunctive groundwater - surface water system. Free rider problems. Water quality issues and short-term versus long-term aspects of water resource development - harvesting, mining and water conservation. Application of water resource economic principles to water problems of Pakistan - large scale canal systems, river diversions, public and private tubewells and private irrigation systems.

SOCIAL SCIENCE RESEARCH METHODS (M.Sc.)

The use of the scientific method to research problems in the social sciences with particular emphasis on agricultural economics. Application and extension of theory with regard to the research problem including criteria for choosing between modeling options. Development of testable hypotheses and methods for gathering observations for testing them. Observational methods will encompass preparation of research instrument; sampling technique; processing, analysis and interpretation of data.

(1) Specialization in Rural Social Sciences
Sub-Specialization in Agricultural Economics

FOURTH YEAR B.SC.

For this specialization each student must complete, in addition to the courses required of all students by the University, the following courses which are required by the Specialization:

A. Courses listed as electives in Year III, but required for the Specialization (taken in Year IV, if not previously)

First Term	Credit
1. Farm Management	3
2. Agricultural Marketing	3
3. Project Design and Analysis	3
Second Term	
1. Credit and Finance	3
2. Agricultural Business Management	3
3. Farm Record Decision Making	3

PLUS THE FOLLOWING FOR THE RESPECTIVE OPTION:

B. Career employment option

Electives, unless the courses listed in A above were not taken in Year III, in which case they must be taken in Year IV and the electives taken in Year III can count in this place (no less than 6 credits)	12
Seminar	1

C. Advanced study or research option

1. Macroeconomics	3
2. Statistics II	3
3. Quantitative Methods I	3
4. Elective (same as statement B)	3
5. Seminar	1
MINIMUM TOTAL CREDITS FOR FOURTH YEAR	31

(2) Specialization in Rural Social Sciences
Sub-Specialization in Agricultural Economics

M.SC. CURRICULUM

The following proposed curriculum is based on the assumption that the student has a B.Sc. (Hons) in the respective specialization, and that the student is admissible for graduate study.

FIRST YEAR

First Term	Credit
1. Intermediate Micro Economics	3
2. Social Science Research	3
3. Production Economics	3
4. Resource Economics (land and water)	3
Second Term	
1. Intermediate Macro Economics	3
2. Quantitative Methods II	3
3. Agricultural Marketing and Pricing	3
4. Elective	3

SECOND YEAR

Research and thesis (6-8 credits suggested)	6
MINIMUM TOTAL GRADUATE LEVEL CREDITS	30

There will also be an M.Sc. program in Development Studies.

b. Rural Sociology Courses

Introduction to Rural Sociology - 3 credit hours (required for B.Sc. students in 2nd term of 3rd year)

I. Structure of Rural Society: Rural and urban differences; integration and interdependence of rural and urban areas; demographic, ethnic, linguistic, and cultural differences within rural areas; brief cross-national comparison of rural areas.

II. Rural Social Organization: Rural leadership and opinion leaders; power and influence in rural communities; types of local-based groups and organizations and their influence in rural affairs; status and class relationships in rural areas and variations across areas.

III. Rural Institutions: Importance of family and kinship in rural areas; importance of religious institutions; legal and administrative units, their jurisdictions and their functions; role of rural schools.

IV. Social Problems of the Rural Population: Definition of a "social problem"; determining needs of rural people; examination of ways of focusing and solving problems in agriculture and rural villages; defining "rural development"; review of past rural development efforts in Pakistan.

V. Rural Social Change: Definition of sociocultural change; speed of innovations in rural areas; sources and cha els of information used by farmers; types and roles of change agents; obstacles to change in rural areas; overcoming resistance to change.

Two additional courses are proposed as either electives in the third year or as part of a rural sociology specialization in the fourth year.

1. Rural Sociology Practical
2. Introduction to Population Studies

Additional courses to be taken for the rural sociology specialization will be selected from the Agricultural Economics offerings and from those offered in Extension Education and Communications.

It is not planned to offer an M.Sc. in rural sociology. The Institute of Development Studies has proposed an M.Sc. level program that will be of interest to those specializing in the

rural social sciences areas at the B.Sc. level. There is need for additional coordinated planning of M.Sc. level programs in the rural social sciences.

c. Extension Education

Extension Education is the dissemination of knowledge and research findings. Students majoring in this curriculum will blend subject matter knowledge such as plant and animal sciences, agricultural mechanization, and social science with courses in program planning and evaluation; leadership development; the adoption processes; and extension methods for conducting educational programs. They will also learn how youth organizations can lead to improved agriculture and rural living, as well as the development of boys and girls. Students taking the graduate courses will learn principles of supervision leadership development and administration.

Course titles include:

B.Sc. Level Courses	Credits
Agriculture Program Development and Implementation Required of all students	2
Disseminating Education through Extension	3
Program Planning and Evaluation	3

M.Sc. Level Courses	
Principles of Supervision and Administration	3
Advanced Program Planning and Evaluation	3

Agricultural Development and Implementation - 2 (required for all students - second year, 1st term)

The course introduces students to the principles of how people adopt practices and how to effectively develop a program to create change. This knowledge base will prove helpful to students who will be working with people and attempting to plan changes to improve agriculture and the environment in which people live.

Course content to include:

1. The Adoption Process

   a. five steps: awareness, interest, evaluation, trial and adoption
   b. stages of adoption: innovators, early adopter, early majority, late majority, and laggards

2. Program Planning Process

   a. problem identification - determining felt needs and unfelt needs
   b. setting goals
   c. developing a plan of action
   d. carrying out the plan
   e. evaluation of methods and results

Disseminating Education Through Extension - 3 (required for Extension Education majors - fourth year, 1st term)

The course introduces Agricultural Education principles and philosophy to students. The course includes discussions of resources available to assist in conducting educational programs and how to effectively use various methods on the job. The course should be particularly valuable to future extension professionals.

Course content to include:

1. Principles and philosophy of Agricultural Extension

   a. purpose of research and applied studies
   b. extension's role in interpreting and disseminating knowledge
   c. role of the change agent
   d. principle of "Learning by Doing"

2. History of Agricultural Education in Pakistan

   a. the British Policy (1880-1947)
   b. the National Policy (1947-date)

3. Staffing patterns and job responsibilities within the NWFP Agricultural Extension system

4. Disseminating knowledge and research through Extension

   a. personal contacts: farm visits, office visits, telephone
   b. mass media: newspaper, newsletters, radio, television, films
   c. group activities: tours, meetings, workshops
   d. publications, fact sheets, etc.
   e. demonstrations: method demonstration, result demonstration, demonstration on model farms
   f. Training and Visit Program (T & V)
   g. local interest groups: youth clubs, poultry association, tobacco growers, etc.

5. Resources to assist in disseminating educational information

   a. research results
   b. applied studies results

c. specialists
d. various publications, charts, fact sheets, and audio visual material prepared for field extension workers
e. facilities and equipment available at the local level

Program Planning and Evaluation - 3 (required for Extension Education majors, fourth year, 2nd term)

The course teaches the principles of program planning and program evaluation including the identification and use of local leaders in planning, implementation and evaluation.

Course content to include:

1. Principles of Program Planning

   a. identifying local leaders
   b. developing local leadership
   c. identifying needs (felt needs vs unfelt needs), distinguishing between symptoms and problems
   d. writing a Plan of Work (POW): situation, problem, program, and expected results

2. Using local program planning groups

   a. role of local leadership groups: Local Bodies Government, village councils, Union Councils, district level chairman

3. Principles of Program Evaluation

   a. planning evaluation as programs are planned
   b. evaluating teaching effectiveness
   c. determining rate of adoption
   d. measuring program impact
   e. accountability - informing the public and leaders of program accomplishments and impact

Youth Organizations - 3 (for undergraduate students)

The course introduces the role of youth organizations in improving agriculture, home economics, and rural living. The course teaches what such programs as 4-H (Head, Heart, Hands, and Health) around the world can do to develop boys and girls including their leadership skills, practical subject knowledge and citizenship.

Course content to include:

1. Projects where boys and girls "learn by doing"

2. Influence upon other family members (adults) as they learn from youth

3. Activities and programs which help youth develop and learn leadership skills

4. How to organize youth clubs

5. Obtaining and developing local leaders

Principles of Supervision and Administration - 3 (for graduate students)

This course is designed to help students learn how to effectively administer an educational program or agricultural business. Personnel supervision, motivation, and performance appraisal will be included. Extension administrators and Agricultural Officers who are supervising field assistants should gain valuable knowledge from this course in preparation for professional employment.

Advanced Program Planning and Evaluation - 3 (prerequisite: Program Planning and Evaluation) (for graduate students)

This is an advanced course in program planning and program evaluation. Students will plan a program using local leaders. They will assist in implementation and evaluation of methods and possible impact.

(1) Specialization in Rural Social Sciences
Sub-Specialization in Extension Education

FOURTH YEAR B.SC.

For this specialization each student must complete, in addition to the courses required of all students by the University, the following courses which are required by the Specialization:

A. Courses listed as electives in Year III, but required for the Specialization (taken in Year IV, if not previously):

1. Shop Practices
2. Farm Power and Machines
3. Agricultural Communications Programs

B. Other required courses for Year IV (either career employment or advanced study and research option)

		Credit
1.	Agricultural Communications	3
2.	Agricultural Economics	3
3.	Horticulture	3
4.	Crop Production	3
5.	Animal Production	3
6.	Extension Education	9

PLUS THE FOLLOWING FOR THE RESPECTIVE OPTION:

C. Career employment option

1.	Animal Production (in addition to B.5 above)	3
2.	Plant Protection	3

D. Advanced study or research option

1.	Research Methods	3
2.	Quantitative Analysis (see Social Sciences for exact course)	3
		--
	MINIMUM TOTAL CREDITS FOR FOURTH YEAR	30

(2) Specialization in Rural Social Sciences
Sub-Specialization in Extension Education

M.SC. CURRICULUM

The following proposed curriculum is based on the assumption that the student has a B.Sc. (Hons) in the respective specialization, and that the student is admissible for graduate study.

FIRST YEAR

Required Courses

		Credit
1.	Extension Education - Principles of Supervision and Administration	3
2.	Extension Education - Advanced Program Planning and Evaluation	3
3.	Rural Sociology elective	3
4.	Communications elective	3
5.	Advanced course in computers	3

Elective Courses

Free electives	9

SECOND YEAR

Research and thesis (6-8 credits suggested) (Research report may be substituted for thesis)	6
MINIMUM TOTAL GRADUATE LEVEL CREDITS	30

d. Agricultural Communications

Introduction to Agricultural Communications - 3 credits (a required course for all B.Sc. students - first term of third year) (2 lectures/1 laboratory)

Introduce communication concepts, systems and skills as they relate to agricultural and rural affairs in the Northwest Frontier Province and Pakistan. Analyze the role of communication in rural development, and in human decision-making. Provide skills in agriculture-related writing, speaking and audio-visuals.

Content:	Class Hours
The communication process	2
Agricultural communication in Pakistan	4
Importance	
Types and sources of agricultural information	
Major channels for agricultural information	
How persons gather, process and use information in agricultural decision-making	4
Elements of agricultural communication planning	2
Writing to communicate	18
Common problems in agriculture-related writing	
Elements of reading ease	
Elements of comprehension	
Presenting written information	
Research reports	
Proposals	
Summaries	
Face-to-face communication in agriculture	30
Dynamics of personal relations	
Planning and preparing speeches and presentations	
Prepared speeches	
Extemporaneous speeches	
Demonstrations	
Audio-visual support for face-to-face communications	
Kinds of audio-visual aids	
Strengths and limitations of various aids	
Preparation of audio-visuals	
Audio-visual equipment and its operation	
Effective presentation of audio-visuals	
TOTAL	60

Agricultural Communication Programs - 3 credits
(required course for B.Sc. students electing to major in Agricultural Communications; elective course for other B.Sc. students) (2 lectures/1 laboratory)

Prerequisite: Introduction to Agricultural Communications

Introduce principles and practices involved in analyzing communication situations, and planning and carrying out agricultural communication programs at local and other levels. Emphasize ways to coordinate face-to-face communication with the use of mass media such as newspapers, magazines, radio and television. Introduce skills in using mass media for agricultural communications.

Content:	Class Hours
Planning agricultural communication programs Identifying problems and opportunities Analyzing communication situations Setting communication goals Conceiving communications program plans	10
Managing agricultural communication programs Coordinating face-to-face and mass media efforts	4
Organizing communication	2
Working with newspapers and other print media Characteristics of print news media Agricultural content of print news media Methods for preparing and submitting agricultural information to print news media	16
Working with radio Characteristics of the radio medium Agricultural programming on radio Methods Radio program development Writing for radio Producing radio program materials On-air techniques	16
Working with television and other motion media Characteristics of the television medium Writing for television Program development Visuals for television On-air presentation techniques	8
Evaluating agricultural communication programs	4
TOTAL	60

AGRICULTURAL COMMUNICATIONS COURSES FOR SPECIALIZATION

(Each course requires Introduction to Agricultural Communications and Agricultural Communication Programs as prerequisites)

Students specializing in communications will select from these courses during their fourth year. Each term will include 9 to 12 hours of communications and 6 to 3 hours of electives.

Agricultural Publications - 3 credits
The role of print communication in agricultural and rural development. Types and functions of agricultural publications. Principles and practices concerning production of agricultural publications: selection of content appropriate to specific audiences and purposes; organization of content; writing and editing; illustration, design and layout; production, printing, binding and distribution processes.

Agricultural Uses of Audio-Visual Media - 3 credits
Audiences for agricultural broadcast programming in Pakistan and the role of radio listening and television viewing in rural communities. Principles and methods in planning, producing and presenting rural radio and television programming. Functions, structure and operations of rural listening and viewing groups. Non-broadcast uses of audio cassettes, videotape, film and other audio-video technologies in agricultural communication.

Systems and Media for Agricultural Communications - 3 credits
Communication functions and operations of major systems by which information moves within Pakistan agriculture, and between rural and urban sectors of society: family and community networks, extension systems, mass media, libraries, rural organizations, religious bodies, schools, marketing systems and others. Characteristics and roles of specific media used in agricultural communications, including traditional media, print media, audio-visual media, and new communications technologies and others.

Design and Graphics - 3 credits
Applications of perception and design principles in all kinds of visual communication, with emphasis on rural audiences. Analysis of visual meaning. Advanced methods in the use of visual formats, color, type, composition, illustration techniques and other aspects of effective graphic communication. Organization and operation of a graphics unit.

Personal Communication - 3 credits
Role and patterns of personal communication in rural Pakistan, especially as related to agricultural and rural development. Principles and practices involving speeches, demonstrations, meetings, and other formats for group communications. Kinds of audience feedback and ways to encourage, interpret and use feed-

back. Principles and techniques of listening. Planning, preparation and use of aids for personal communication; handouts, slides and other projected visuals; poster and other static visuals; live objects and other active visuals; models; and others. Techniques for evaluating effects of personal communication activities.

Print Communications - 3 credits

Principles and skills in planning, gathering information, organizing information, writing, editing, producing, printing, and distributing various kinds of printed materials for purposes and audiences related to agriculture and rural affairs. Organization and operation of a print communication unit, including distribution systems.

Agricultural Photography - 3 credits

Principles and practices in composing, lighting, using filters, processing film and prints, and using other techniques and equipment for special effects and needs. Selected agricultural uses of still photography, including close-up and time-lapse photography, livestock photography and others. Role and use of color photography in agriculture including planning and production of slide-sound programs. Evaluation of photography materials in terms of quality and communication effectiveness. Organization and operation of a photography unit.

Agricultural Communications Research - 3 credits

Role, importance and scope of communication research as a foundation for agricultural communications planning. Aspects of situation, audience and media analysis. Principles and techniques in problem identification, research design, literature review, data collection (including sampling, instrument design, measurement, interviewing, other aspects), data analysis, interpretation and reporting of results. Orientation to existing research literature about agricultural communication in Pakistan.

Agricultural Communication Planning and Management - 3 credits

Principles and methods of planning and managing individual agricultural information programs at local and other levels. Analysis of situations, audiences and media; selection of communication objectives; planning of communication strategies; organization and management of communication programs; monitoring and evaluation of results. Organizational management concepts and techniques in organizing, programming, staffing, financing, equipping, evaluating and otherwise managing an agricultural communications organization.

Rural Broadcasting - 3 credits

Specialized uses of radio and television for communicating with rural audiences in Pakistan, and with the general public concerning rural affairs. Advanced skills in planning, producing, and presenting rural programming in various formats: news, interviews, demonstrations, dramatizations, documentaries, and others. Advanced practices in selecting and using visuals, lighting and editing for television. Advanced practices in using

sounds in creative and functional ways. Techniques to stimulate audience participation; measure listenership and evaluate effectiveness of rural programming; and organize and operate rural listener and viewer groups. Organization and management of a rural program service for radio and television.

Special Project in Agricultural Communications - 3 credits

Through this project, the student will demonstrate competency in applying communications concepts and methods to an agriculture-related problem or opportunity. The project will be suited to specific communication and agriculture interests of the student. The student will (1) submit a written proposal which identifies a communication problem or opportunity, explains the significance of it, sets a communication goal and outlines the student's communication approach; and (2) submit a final report and finished communications materials that are appropriate to the communication goal.

Agricultural Communications Internship - 4 credits

Prerequisites: Introduction to Agricultural Communications
Agricultural Communication Programs
Third Year B.Sc. completion

An individualized, two-part learning program will combine advanced study of agricultural subject matter and rural audiences with (1) field-level communication planning and (2) preparation of appropriate communication materials. The student will work with resource persons and others, as needed. The student will demonstrate competency in communication analysis, agricultural communication program planning, and preparation of materials for use in individual, group or mass communication.

APPENDIX B

THE NEED FOR STRENGTHENING THE AGRICULTURAL TRAINING INSTITUTE (ATI)

INTRODUCTION

The facilities, curriculum, teaching methodology, staff facilities and other resources of the Agricultural Training Institute (ATI) are grossly inadequate to prepare field assistants as competent extension personnel who can extend and teach farmers to utilize improved technology. Only this conclusion can be reached by review of background documents for this design mission, an M.Sc. thesis which evaluated the ATI, (M. M. Afzal, 1982) and through discussions with the Principal of the ATI and the Director of the Extension Department. There is widespread agreement that the curriculum is too theoretical, with little practical skill training; that the majority of the teaching staff are not interested in teaching and are poor teachers; and there are no longer any facilities for practical "hands-on" training in field crop production, animal husbandry or farm mechanics.

Is seems clear that if the extension system is to improve over the long run, the training of front-line extension workers must be substantially improved. Furthermore, if the training of field assistants could be upgraded to the diploma level, this would qualify them for NPS 11 which would result in improved pay and status. The consequence would be to attract much better candidates into extension and, with better training, a more competent cadre of extension workers would result.

To upgrade field assistant training to the diploma level, the ATI would need to be affiliated with either the NWFP

Agricultural University or another educational body (probably the Board of Secondary Education), rather than being solely a service unit of the Extension Department. The complete upgrading of the ATI is beyond the scope of this proposed USAID-supported project that has as its primary focus the strengthening of the NWFP Agricultural University. However, it must be recognized that the poor quality of personnel coming into extension, combined with poor training and the lack of opportunity for career advancement, is creating a weak link in the technology transfer system. Unless this improved training need is addressed, the outrech efforts of the strengthened Agricultural University will be less than fully effective.

MANPOWER REQUIREMENTS

According to the Director of Extension, there are approximately 585 field assistants in extension. In addition, there are about 410 technicians and other sub-professional personnel in the agricultural sector who need similar types of intermediate level training (i.e. 2 years technical training after matriculation). Therefore, based on preliminary data made available by the Institute of Development Studies at UA, there are approximately 995 intermediate personnel in the agricutural extension sector of NWFP.

In analyzing past trends, this cadre of personnel grew at a net rate of 7% per annum over the past 13 years. If a conservative wastage rate of 5% is assumed for attrition (according to a preliminary draft of a study being conducted by Development Alternatives, Inc., the current wastage rate runs upwards of 20%,

probably due in large part to the low rank of Field Assistants and lack of opportunity for career advancement), the NWFP will need 120 new agricultural field assistants and technicians per year over the near future to meet current demands. Furthermore, if the Department of Extension adopts the Training and Visit System of Extension in the near future, this expanded effort will require at least 500 more field assistants in addition to annual replacement requirements. Also, there may be an expanded need for technicians in agricultural research, the Agricultural University and other agricultural agencies. Furthermore, the projections detailed above are only for agriculture and do not include assistants in animal husbandry and other extension-type positions.

The ATI has a current intake of 50 agriculture trainees and 10 animal husbandry trainees per year. The actual annual average output of these two year programs is only 38 and 9 respectively, and the Principal indicated that only one-half of these students would join extension as Field Assistants. Therefore, there is currently a minimum projected shortfall of about 80 agricultural field assistants and technicians per year. It would appear that agricultural extension, agricultural research and other agricultural agencies must either hire unqualified individuals (i.e. with training in a non-agriculture area) or curtail program growth, which was clearly the case during 1981-83 when intermediate manpower growth dropped to 1.6% per annum.

In addition to the need for more personnel with intermediate level training in agriculture, the quality of that training must

be substantially improved. As mentioned earlier, a three year diploma level course is clearly necessary to improve the quality of training provided to recruits into extension and related fields, as well as to provide a sufficient salary grade to attract and keep better quality personnel. The following sections address some of these perceived training problems and suggest some possible approaches that might be used to strengthen ATI.

PRE-SERVICE TRAINING OF FIELD ASSISTANTS

CURRICULUM

It is proposed that the curriculum of the ATI be organized around the crop growing season and livestock production cycles, and that each student get "hands-on" experience growing the important food crops and/or livestock using recommended improved technology. In addition, appropriate agricultural mechanization skills should be taught, as well as appropriate learning experiences in Extension Education, Agricultural Communications, Rural Sociology, Farm Management and Record Keeping.

If a three year diploma course were offered, the objective would be for each student to fully participate in on-farm field experiences for 2 crop years (both Kharif and Rabi seasons). The first year would focus on learning production skills, while the second crop year would utilize these skills in the context of conducting several demonstration plots. During the third year, students would spend time off-campus working directly with farmers in a pilot project area.

In the first crop year, students would be in charge of carrying out all farm practices on their individual plots of

approximately 1/4 acre. They would grow the important food crops (including some vegetables) in a similar proportion to that of a farm family operating a small, intensively cultivated farm. Each trainee would keep production records and accounts in a farm manageme t record book.

At the beginning of the first school year, students would be assigned plots by random and one of the first tasks would be to collect soil samples and test the soil to determine fertility requirements. Classroom teaching and practicals would then be organized around the farm production process. For example, first the combination of crops on a typical small farm would be discussed followed by land/seedbed preparation, with students then developing a farm plan and preparing their land for planting. Different varieties of each crop would be compared in the classroom, including factors such as their responsiveness to fertilizer and disease resistance; as well as essential cultural practices (such as plant population, date of planting, timing of irrigation, etc.). Trainees would then decide which varieties they would grow on their respective plots, determine the level and type of fertilizer they would apply (computing the amount needed for each crop in their plot). Trainees would then proceed through the growing season, carrying out recommended practices and finally harvesting each crop.

Trainees would purchase on credit all inputs, including seed, fertilizer, pesticides, etc., from the farm store and all farm products would be sold back to the farm store at prevailing prices to repay the cost of inputs, plus interest. Students would also be assessed a rental charge for the land and any power

machinery used. Any profits that would accrue above costs, would belong to the students so there would be a real incentive to maximize production/income. In the process, a direct by-product would be to maximize learning. In addition, students would be evaluated on their production plots periodically throughout the season, including the appropriateness of production practices followed as well as the productivity/ profitability of their plots. Their farm management record book would also be evaluated. In addition, students would be evaluated on classroom lectures/discussions through periodic examinations. Trainees would be assigned a locker where they would keep work clothes, basic farm tools, etc.

Second year trainees would also be in charge of individual plots, however the objective during the second year would be to conduct several demonstrations, such as varietal trials, fertilizer demonstrations, and/or the effect of different cultural practices (e.g plant population x different fertility levels) on productivity. At the end of each season, trainees would learn how to accurately measure yields within different treatments in their demonstration plots. A field day would be held, when each trainee would describe each demonstration, including the results obtained from individual treatments.

Third year trainees would work directly with farmers in a pilot area near the Institute, and in internships working with experienced extension personnel. They would also need to complete courses in complementary areas such as extension methods and rural sociology, as well as courses in agricultural

mechanization (tractor/implement maintenance and repair), and animal husbandry production.

TEACHING METHODOLOGY

To implement the type of curriculum described above would imply and require a problem-solving methodology of instruction. Problem areas (instructional units) would be appropriate for the growing season and be selected and taught just prior to the need for this information by trainees in their plots. In this manner there would be direct and immediate applicaton of knowledge and skills acquired in the classrooms. Furthermore, students would determine themselves which practices they would follow and see first-hand the consequences of their decisions and efforts. As particular production problems (such as insect/disease problems) would arise during the growing season, the class would immediately consider the problem, possible solutions and actually implement a particular solution.

The problem-solving method of teaching involves the active participation of both the teacher and trainees, and would be ideally suited to the curriculum being proposed here. The teacher guides the learning process, in which trainees identify specific problems or types of knowledge/skills they will need to know or be able to do to carry out a specific production practice. Examples of typical problem areas for a crop such as wheat include "selecting wheat varieties", "fertilizing the wheat crop", "irrigating wheat", "controlling pests in wheat", "harvesting wheat," etc. After trainees identify the important problems in a particular instructional area, they would investigate

different solutions to each problem, utilizing extension bulletins, research results and books. After students have investigated the problem in detail, class discussion would be used to consider the range of alternative solutions, with the most appropriate ones being noted. Following this classroom activity students will be expected to use their own best judgement as to what practices they would use on their own individual plots. This teaching methodology can be used for all classes being covered in the proposed curriculum.

IN-SERVICE TRAINING OF FIELD ASSISTANTS

If the pre-service training program for field assistants was upgraded to the diploma level, an in-service training program for current field assistants would need to be initiated, both to improve and up-date their production skills and knowledge, as well as to qualify them for GPS 11. The current number of field assistants stands at about 585, therefore it is proposed that about 50 current field assistants be retrained each year. this level of upgrading will enable extension to maintain its on-going programs and still recycle all field assistants through the one-year program in about 6-7 years (assumes a conservative attrition rate of 5-6%/year). After existing field assistants have been recycled, these additional places could be utilized for the pre-service program.

It is recommended that the in-service course be highly practical, combining many of the features of years one and two of the pre-service course. Since these field assistants are experienced and more mature workers, it is assumed that their

absorbtive capacity for new agricultural knowledge and skills would be higher and they could move more rapidly through the necessary material. Again it is recommended that a problem solving methodology of instruction be employed with the direct application of new knowledge and skills in the field. In-service trainees would be assigned about one-half acre of land for their production and demonstration plots, utilizing small tillers whenever possible to save time. This latter recommendation would also enable them to become experienced with the small tillers that are being rapidly introduced into the NWFP as labor becomes more scarce and expensive (due largely to external migration). In-service trainees would also receive any profits that accrued above all direct production costs, including a land rental charge.

RESOURCES AND FACILITIES REQUIRED

To implement a three year, diploma level training program for 125 agriculture and 25 animal husbandry trainees each year, plus another 50 places for a one year in-service training course, (total student capacity would be 500) would require approximately 100 acres of land for student plots, plus animal husbandry facilities (poultry, dairy and small ruminants) for group projects. First and second year students, plus in-service trainees, would require hand tools for field work, plus small tillers, backpack sprayers/dusters, harvesting equipment etc., which trainees would use as needed for a small rental charge.

There would need to be a farm store where trainees could purchase seeds and other inputs (on credit), check out equipment and sell their farm products (which could be made available to

the school cafeteria, sold to faculty or sold locally). If a student suffered a loss, he would not by expected to pay the difference, however, any net profits would go directly to the student, as this would result in their being highly motivated to use the most optimal combination of inputs to maximize production and income. In addition, a variety of production and income related awards should be given to outstanding students at the end of each year.

In addition to the land requirement, animal husbandry facilities, the farm store and a trainee work area, there should be an agricultural mechanization shop that would accommodate 25 students at one time. In this shop, areas such as equipment maintenance, adjustment and repair, the use of wood and metal working tools to build small projects would be covered.

In addition to the above facilities, classroom and housing facilities would be needed for 500 trainees, including six large classrooms for 60-65 students each, nine smaller classrooms for 30 students each, a library, an audio-visual center, plus offices for the principal and instructors, etc. At least 5 vehicles would be needed to supervise trainees while they are working with farmers and on internships in the third year.

THE_STAFF_AND_STAFF_DEVELOPMENT

The staff would be organized by departments, including: Crop Production (6); Horticulture (2); Animal Husbandry (3); Farm Mechanization (3); Farm Management (2); Agricultural Extension and Communications (incl. Rural Sociology) (4); and Islamic Studies (1).

Although all technical instructors would be expected to provide in-the-field instruction, direction and supervision of students, a farm manager and a farm store manager would be needed to coordinate and facilitate practical instruction on the school farm. The head instructor for each area should have a B.Sc. in the appropriate field of study and, as a part of a staff development program, should obtain an M.Sc. degree in Agricultural Education. This M.Sc. degree should include about half of the student's course work in his/her own teaching area, emphasizing production courses. The remainder of this time should be spent in professional teaching skill development, including an 8-week internship at a community or junior college in the U.S. The remainder of the staff should probably take a second B.Sc. in Agricultural Education in the U.S., again emphasizing their technical teaching areas, as well as gaining background and experience using the "problem solving" method of teaching.

SUMMARY

The upgrading of the Field Assistants to create a more competitive employment level is urgent. Now, they are losing about half of the graduating classes to other employment. The current facility and its curriculum is not at all suited to the purpose as outlined in the foregoing statement. If the T & V model is applied to other districts the need for trained Field Assistants will grow rapidly. Therefore, it appears that one of the most pressing manpower training needs in agriculture is to train sufficient numbers and higher quality Field Assistants.

Although this is not the focus of the University of Agriculture, the role of field assistants is critical to the success of extension and the Agricultural University's outreach goals. The University should make the status and training of FA's one of their concerns, even if they are not directly involved. If the proper conditions could be established, the Agricultural University could render a very real service and secure indirect benefits to its outreach objectives by assuming the role of training Field Assistants. This would be especially true, if the training for FA's is upgraded to the diploma level. The key conditions follow:

1. The training of Field Assistants should be accomplished in a separate facility. This is probably essential to keep it clear that the training is not the same as for B.Sc.'s.

2. The commitment to develop a new and upgraded faculty should be a pre-condition. A separate and adequate budget for the establishment and operation of such a Field Assistant training facility should accompany the transfer so that the University is not compelled to divert resources from its major mission to the development of the new ATI.

3. The University must have the ability to manage and service the Center without serious diversion of its attentions and energies.

Under these conditions there would exist several advantages and disadvantages.

Advantages

1. The University would immediatly become an important component of developing an improved extension system in the NWFP of Pakistan by becoming responsible for nearly all of Extension's manpower training. (An expanded program would also provide well-trained technicians for agricultural research and other agricultural agencies.)

2. The performance of this function would help to establish a framework in which the Extension Department would have a stake in the Agricultural University that should be beneficial in establishing the various types of linkages that need to exist.

3. The University is in the best position to bring about the types of reforms that are needed in the ATI, especially if it can be upgraded to diploma level.

4. The training of FA's would help insure the University's relevance and create a close relationship to the cadre of Field Assistants.

5. The affiliation of ATI with the AU should facilitate the particulation of courses and the return of capable diplomates to AU to pursue a first degree. This would begin to break down the rigid barriers between professional and sub-professional extension personnel.

DISADVANTAGES

1. The training would be partially below university level since the curriculum would be more technical and less scientifically oriented.

2. The Agricultural University is assuming a large restructuring and management responsibility under this proposed project and this additional assignment could strain the University's administrative capacity.

3. The risk is high that the additional budget and facilities would not be provided to develop a first-class training center and that "bleed off" might occur.

4. The University is funded by the University Grants Commission, while ATI is a provincial unit. This might create some problems of budgeting and administration.

The possibility of developing an upgraded ATI as a part of the University would seem to have several salutory benefits to the University's Outreach function, and that the University is more likely to do a high quality job of training FA's than under the current structure. Therefore, the matter might be carefully pursued or at least this alternative kept open as a possibility. It would seem equally clear that the University should not assume the responsibility for ATI without having the needed resources to expand it and appropriately upgrade it to carry out its critical functions.

APPENDIX C

TELECOMMUNICATIONS PROPOSAL FOR THE NWFP AGRICULTURAL UNIVERSITY

Introduction

This proposal was developed through the combined efforts of the faculty and staff at the NWFP-AU. Without their cooperation and assistance, it would have been literally impossible.

In addition, interviews and premise visits were made to PARC, NARC, FAO, USAID/Islamabad and Peshawar, U.S. Embassy, Pakistan Telephone and Telegraph, Peshawar and Haripur, and Pakistan Cable, Limited.

Over 150 pages of data were compiled through 79 interviews. Basic system design was developed around existing needs and long-term objectives. The recommendations will satisfy both issues.

Thanks are conveyed to the Design Team for their cooperation and assistance and their patience during my frequent questioning periods. It was essential to determine the methodology to integrate the telecommunications system into the overall project without detracting from the Design Team's goals. This has been achieved, and the recommendations will facilitate the introduction of the new curriculum, new buildings, and operational changes that will take place in the next several years.

Present System Analysis

There are presently nine (9) telephone lines scattered throughout the campus. These lines are used primarily to make and receive off-campus calls. Incoming calls to those personnel and staff members without a phone require a peon to fetch them.

Delays in getting to the phone are costly both to the called party and the person making the call.

Toll abuse on long distance calls is controlled by securing the phone with a lock. If this method is not employed, a distinct danger of unauthorized use will and has been experienced; e.g. Hostel #6 had over Rupees 22,000 in long distance in one month.

The intercom system installed in 1967 worked for two (2) days before it malfunctioned. Inspection of the equipment indicates that the transformer burned out due to a power overload.

The quality of the on-campus wiring for telephones is unacceptable. (On one line alone there were over sixteen splices in the circuit.) This combination of splicing and open wire strung haphazardly throughout the campus is both unsightly and provides a low quality of service. The frequent outages of phone service is directly attributed to the poor quality of the cable and phone installations.

There is no telephone communication to the farm. The delays in getting messages to and from the farm are often hours and, on occasion, days. The farm manager spends upwards of three man hours a day traveling to various meetings because of the absence of a telephone. In addition, members of the staff are constantly trying to communicate with the farm to check on projects and experiments. The number of total hours lost due to the lack of adequate communications is in excess of 50 man hours a day. This figure is a conservative estimate based on the interviews conducted.

Although peons are used to convey messages, approximately 80% of all on-campus communication is done on a face-to-face basis. At least 75% of these conversations could be conducted over the phone if it was available. Time savings would be approximately 100 man hours a day.

Recommendations

Install a fully electronic, digital Private Automatic Branch Exchange (PABX) immediately upon approval of the project. This will have an immediate impact on productivity and operational efficiency of the NWFP-AU. Results of the telecommunications system PABX will be the recovery of approximately 150 professional man hours a day, which equates to over 4,600 professional man days in an academic year. Valuable time that can be applied to education, research, outreach and administrative duties would be saved.

Administrative offices, department heads, faculty and selected staff functions and offices should have immediate access to the telecommunications system. There are presently 78 locations on campus that have been identified for this purpose. Provision should be made to meet the future needs of the University. Growth will take place at approximately 12% a year.

Overall management of the system should be controlled through the Office of the Vice Chancellor or Deputy Vice Changellor, while the budgeting and daily management functions will be provided through the Director of Finance. Maintenance and installation functions should be provided through the office of Public Works. When the Learning Resources Center is completed

and staffed, the personnel from Public Works should be transferred to the new Center work zone.

All cable serving the campus should be buried between buildings unless temporary needs are required, such as in the case of crossing the nullah. Building cable should be installed in conduit where possible in existing buildings. If cable cannot be placed in conduit, then it should be placed in discreet locations and wall conduit flashing should be installed both to protect the wire and to improve the esthetics. All telephone set locations will be wired for two pair to anticipate future telephone and terminal needs. Telephone cable termination closets are to be provided in each building to facilitate wiring, additional services, convenient access to installations, and ease of maintenance.

PABX and all sets are to be Touch-Tone[T] for rapid dialing, ease of operation, and possible future computer entry systems. PABX has built in Touch-Tone[T] to rotary dial conversion unit to the Pakistan Telephone and Telegraph network.

The PABX equipment telephone room should be located on the second floor of the Administration wing in the former photo lab that is now serving as a tea-making and storage room. This room will need to be screened and access made available only to the telephone maintenance and installation staff. The floor of the room must be sealed with cement sealer and the walls painted with a latex paint to reduce dust. A thermostatically-controlled air conditioner should be installed (80° F.) to provide climate

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[T]Registered A.T.&T. Trademark

control as well as dust control. A drop ceiling of tile with a ten-foot clearance should be installed to reduce the volume of climate-controlled area. A six-foot cabinet with a lock should be installed in the room for storage of tools, electronic cords, telephone sets, cable, and miscellaneous telephone equipment.

The telephone console is the heart of the system, and all incoming calls will be distributed by the console attendant. The console should be located within a reasonable distance of the PABX telephone room (less than 1,000 feet). The console attendant will be responsible for verifying the telephone bill and submitting billing information to all University departments.

Toll calls will be tabulated by a Station Message Detail Recorder in conjunction with an electronic printer. All off-campus calls will be identified by station number, department, time called, length of call, and called number. This record will be available to identify toll abuse and to verify if the local telephone company billing is accurate.

Emergency power and line voltage regulating should be provided to protect the PABX and prevent loss of service due to power surges and failures. Two (2) hours of power will be provided with the emergency power system. Voltage regulator will insure 230 volts to power units.

System Requirements by year

1984 - 10 trunks - 78 stations
1985 - 11 trunks - 87 stations
1986 - 12 trunks - 97 stations
1987 - 14 trunks - 118 stations
1988 - 16 trunks - 128 stations
1989 - 20 trunks - 143 stations

OPTIONS

Both Option I and Option II are designed to meet and satisfy the proposed recommendations. The metal PABX recommended in both cases is only different in its equipped capacity. All system, station, and console attendant features are exactly the same.

Although Option I eliminates the spiral effect of inflation, the security problem can offset that benefit if the spare telephone sets are lost or stolen. Since all the electronic cords will be stored and locked in the equipment cabinet, they will be safe from pilferage.

The additional system equipment that needs to be added to Option II can be installed in two to three days without any disruption in service. During year two of the project, when cable placing is going on, the additional equipment can be installed.

All PABX equipment can be ordered at any time via Telex or mail. Delivery will generally be by air freight unless otherwise specified.

USAID is requested to assist in the obtaining of tax concessions on all equipment shipped into the country.

Option I - 1st Year Costs

1. Mitel SX 200 (20 trunks x 144 stations)
   Required components:

Basic system	$ 5,400
Common control	2,600
Generic 216.	7,700
Electronic printer	2,090
Console.	3,360
EIA 232 cable.	100
2 equipment shelves and cable.	2,140
18 line cards (8 stations per card) @ 1,260. .	22,680
5 trunk cards (4 trunks per card) @ 1,480. . .	7,400

2 quad receiver cards @ 2,040.		4,080
144 Touch-Tone telephone sets @ 80		11,520
Thermostatically-controlled air conditioner. .		1,200
Complete set of engineering manuals.		160
Complete set of tools - test set		500
Subtotal	$71,930	

Spare components:

Quad receiver card		$ 2,040
2 line cards @ 1,260		2,520
Trunk card		1,480
Tone card.		960
Console card		850
RAM/COS card (16K)		2,400
Static board		200
Console face mate.		200
Console hand set		90
Complete set of engineering manuals.		160
Complete set of tools - test set		500
10 Touch-Tone telephone sets @ 80.		800
Subtotal	$12,200	
Total Mitel equipment cost		$83,130

2. Project fees:

Project management overhead.		$40,000
Salaries, benefits, and bonus (150 man days @ 250)		37,500
Administration		
Training		
Engineer		
PABX technician		
Cable technician		
Transportation (4 x 4,000).		16,000
Per diem en route and in-country (150 man days @ 62).		9,300
Administrative expenses (local transport, Telex, telephone, etc.)		5,000
Subtotal	$102,800	

3. Cable:

Buried		$17,600
Inside wiring.		8,900
Telephone closets, punch down blocks & pedestals		4,300
Subtotal	$30,800	

4. Local in-country costs:

Labor.		$ 2,500
Miscellaneous construction materials		4,000
Subtotal	$ 6,500	

5. Air freight and shipping estimate:

Air	$ 7,500
Sea	5,000
Subtotal	$12,500
Total costs Option I 1st Phase	$240,730

OPTION II

1. Mitel SX 200 (12 trunks x 80 stations)

Required components:

Basic system	$ 5,400
Common control	2,600
Generic 216	7,700
EIA 232 cable	100
10 line cards @ 1,260	12,600
3 trunk cards @ 1,480	7,400
Quad receiver card	2,040
80 Touch-Tone telephones @ 80	6,400
Thermostatically-controlled air conditioner	1,200
Complete set of engineering manuals	160
Complete set of tools and test set	500
Complete set of tools - test set	500
Subtotal	$45,230

Spare components:

2 line cards @ 1,260	2,520
Trunk card	1,480
Tone card	960
Console card	850
RAM/COS card (16K)	2,400
Static board	200
Console face mate	200
Console hand set	90
Complete set of engineering manuals	160
Complete set of tools - test set	500
10 Touch-Tone telephone sets @ 80	800
Subtotal	$12,200
Total Mitel equipment cost	$57,430

2. Project fees:

Project management overhead	$35,000
Salaries, benefits, and bonus (130 man days @ 250)	32,500
Administration	
Training	
Engineer	
PABX technician	
Cable technician	
Transportation (4 x 4,000)	16,000

Per diem en route and in-country (130 man days @ 62).		8,060
Administrative expenses (local transport, Telex, telephone, etc.)		4,750
Subtotal	$ 96,310	

3. Cable:

Buried		$12,000
Inside wiring.		8,900
Telephone closets, punch down blocks & pedestals		3,700
Subtotal	$24,600	

4. Local in-country costs:

Labor.		$ 2,500
Miscellaneous construction materials		3,500
Subtotal	$ 5,500	

5. Air freight and shipping estimate:

Air.		$ 5,000
Sea.		4,000
Subtotal	$ 9,000	

Total costs Option II 1st Phase. $192,840

Option I - Follow-up years

1985 - Install additional cable for new buildings	$ 60,000
1986 - Install additional cable for new buildings plus cross the nulla with permanent cable Move PABX to new permanent location Install sets as required	100,000
1987 - Install sets as required. Follow up on systems performance.	30,000
1988 - Install sets as required	---
1989 - Follow up consultation on system. Project needs for next five to ter years.	38,000
1990 - Install sets as required	---

Subtotal	$228,000	
First year costs	240,730	
Option I total 7-year cost		$468,730

Option II - Follow-up years

1985 - Install additional cable for new buildings	$ 60,000
1986 - Install additional cable for new buildings plus cross the nulla with permanent cable Move PABX to new permanent location Install sets as required	170,000
1987 - Install sets as required. Follow up on systems performance.	30,000
1988 - Install sets as required	---
1989 - Follow up consultation on system. Project needs for next five to ten years.	38,000
1990 - Install sets as required	---
Subtotal	$298,000
First year costs	192,840
Option II total 7-year cost.	$490,840

Personnel Requirements

The following personnel will be required when the system is installed:

Title	Number	Department
Console Attendant	1	Department of Finance
Electrical Engineer	1	Department of Works
Telephone Technicians	2	Department of Works
Part-time Console Attendants	4	Various departments

People can be trained from the existing work body for the positions of Console Attendant and Telephone Technicians. An electrical engineer is presently available with the Works Department who could assume an additional telephone communications role.

Telephone Technicians will be required full-time during the installation phase. Upon completion of installation, they can be assigned part-time telephone duties; approximately 25% of work

time for various installation, maintenance, and repair work. A schedule should be made to check on system operations, air conditioning, and dust control.

A Console Attendant will be responsible for daily management and operation of console. The attendant will know how to contact telephone technicians for repair service.

Part-time Console Attendants will have the additional role of teaching new personnel how to use the telephone system before they are assigned a telephone.

Training

1. Staff Training

Staff will be instructed through the following comprehensive on-site training program:

A. Five (5) NWFP-AU staff members will attend a two-day training program to become certified training instructors.

B. All certified NWFP-AU training instructors will assist Project Team in conducting staff training.

C. All staff members will attend a six (6) hour training session.

D. All system and station user features will be explained and demonstrated.

E. All staff members will experience and demonstrate station features.

F. A system directory will be published including all department and staff telephone numbers.

G. Training pamphlets including all system and station instructions will be provided each telephone user and an ample supply for future needs.

H. New employees will be trained by a certified NWFP-AU training instructor on telephone operation during their orientation and before being assigned a telephone.

2. Maintenance Installation Personnel Training

This training will be conducted at NWFP-AU by certified PABX, Station Installers, and cable technicians. A minimum of three (3) NWFP-AU personnel from the Works Department should be assigned to maintenance and installation training. An electrical engineer and two qualified electronic technicians comprise the personnel requirement. Personnel will be trained over a three-week period in the following disciplines.

A. PABX Installation

B. PABX Maintenance

C. PABX Programming

D. PABX Formatting

E. PABX Trouble-shooting

F. Telephone Set Installation

G. Telephone Set Maintenance

H. Telephone Set Repair

I. Cable Installation

J. Cable Maintenance

K. Cable Repair

L. Electronics Printer Maintenance

The three (3) personnel will be part of the project installation team and receive further on-the-job training as well.

Two complete volumes of system technical manuals will be provided for NWFP-AU maintenance installation personnel.

3. Console Operations - PABX Attendant

A minimum of three (3) people should be trained to operate the console. Each person will attend a two-day training program by a

certified PABX instructor. One person will need to be assigned as the permanent PABX attendant and the others will provide back-up service.

Training programs will consist of the following:

A. Console Operation

B. Console Alarm Systems

C. Console Trouble-shooting

D. Night System Operation

E. Power Failure Operation

F. Telephone Etiquette

General Description

The SX 200 consists of a single cabinet (containing the switching circuitry and the system power supplies) and a cordless desk-type attendant console equipped with push-button dial pak and electronic control keys. Connections between the equipment cabinet, the console, and the distribution frame are made, using connecterized 25 pair cables.

Noiseless operation, exceptionally small size, and environmental tolerance allow a wide choice of locations for the equipment cabinet. A north-facing room with a thermostatically-controlled air conditioner (80 ^{o} F.) will be installed to maintain temperature tolerance and provide filtering and humidity control. Ceiling in the room will be dropped to 10 feet to redude environmental control needs.

The modular design and functional packaging of the SX 200 system permits rapid location and replacement of defective equipment. Current malfunctions are detected by diagnostic routines

automatically initiated by the Control Processing Unit (CPU). Diagnostic routines through the use of the Mitel Action Procedures (MAP) locate the defective circuit card or assembly and indicate to service personnel the required field replaceable unit. Diagnostic routines and miantenance procedures do not interfere with users not affected by the malfunction. Because the system employs only electronic circuits, preventive maintenance is not required. Spare circuit packs are provided in the proposed systems. Additional circuit packs can be ordered through the Mitel Service Center in Cairo.

SYSTEM SPECIFICATIONS

Mitel PABX System Specifications

1. Physical description of PABX:

   Height - 38 inches (960 mm)

   Width - 23.5 inches (600 mm)

   Depth - 27.5 inches (700 mm)

   Weight - 290 pounds (131.7 kg) fully equipped weight

2. Mitel SX 200 Electrical Specifications

   Station Loop Limit - 1200 ohms including set

   Maximum number of Ringers per line - 5

   Ringing - 90V, 20Hz, immediate ringing (option of 17Hz or 25Hz)

   Standard - 1s on, 3s off
   Special - 0.5s on, 0.5s off, 0.5s on, 2.5s off

   Ring Trip - during silent or ringing period

   Dial Tone - 350/440Hz, continuous

   Transfer Dial Tone - 350/440Hz, 3 bursts of 100ms on/off, then continuous

   Busy Tone - 480/360Hz, interrupted at 60ipm

Special Busy Tone - 350/440Hz, interrupted at 60ipm

Standard Ringback Tone - 440/480Hz, 1s on, 3s off

Special Ringback Tone - 440/480Hz, 0.5s on, 0.5s off, 0.5s on, 2.5s off

Callback - 6 rings of standard ring

Reorder Tone - 480/620Hz, interrupted at 120 ipm

Conference Tone - 440Hz, 1 burst of 1s

Camp-on Tone - 440Hz, one burst of 200ms for station camp-on
400Hz, two bursts of 100ms on, 50ms off, 100ms on for trunk camp-on

Override Tone - 440Hz, one burst of 800ms followed by a 200ms burst every 6s

Crosstalk Attenuation - 75dB minimum

Insertion Loss,
- Station-to-Station - 5dB +/- 0.5dB at 1004Hz
- Station-to-Trunk - 0.5dB +/- 0.3dB at 1004HZ
- Trunk-to-Trunk - 0.5dB +/- 0.3dB at 1004Hz
- Tie Trunk to Station on Non-VNL Truck - 2.5dB +/- 0.3dB at 1004Hz

Longitudinal Balance - 54dB minimum

Return Loss - 14dB minimum

Idle Circuit Noise - 16BrnC maximum

Impulse Noise - No counts over 46dBrnC

Envelope Delay Difference 200us maximum

System Impedance - 600 ohms nominal for lines
600 or 900 ohms nominal for trunks

Traffic Capacity - 7.5ccs/line minimum at 100 lines at P = 0.01

Primary Power - 100-125V, 47-63Hz, 4A maximum

Central Office Trunk Loop Limit - 1600 ohms

Maximum Distance of Console from Equipment - 1000ft. (300 m) of 26AWG cable

Operating Environment - 0° C. to 40° C., 10% to 90% relative humidity

SYSTEM FEATURES

Area Central Office Code Restrictions: The PABX has the ability to identify 6-digit codes, and to allow or deny calls to those destinations on a trunk group and station class of service basis.

Automatic Station Release: Stations which do not hang up at the end of a call, or which go off hook and do not dial for a predetermined length of time, are released from the common equipment.

Call Forwarding - Busy: This automatically reroutes Direct Inward Dial (DID) calls to the attendant when the called station is busy. This feature may also be enabled on a per station basis so that all calls to that station will be rerouted when the station is busy. Calls can be rerouted to any other station.

Call Forwarding - Don't Answer: This automatically reroutes Direct Inward Dial (DID) calls to the attendant when the called station does not answer within a predetermined time. This feature may also be enabled on a per station basis so that all calls to the station will be rerouted if not answered within a predetermined time. Calls can be rerouted to any other station.

Console-less Operation: The PABX may be operated without a console. Incoming trunk calls are handled using the Fixed Night Service or Trunk from Any Station feature, in conjunction with Station Call Transfer.

Contact Monitoring with Display: Lines may be assigned a class of service so that detection of a contact closure across the Tip and Ring will cause an alarm to be signaled to the attendant, together with a readout of the alarm circuit.

Diagnostic Circuitry: The PABX contains circuitry which continually checks idle circuits for fault conditions. If fault conditions are detected, an alarm is raised and a display identifies the fault.

Dictation Access: Access to centralized dictation equipment is provided via special trunks.

Direct In Lines: A trunk may be assigned to a station so that incoming calls on a trunk ring the station directly. The station is the same as any other PABX station in all other respects.

Direct Inward System Access: This feature allows an outside caller to gain access to all PABX features by dialing in on a special trunk. A security code is then dialed which causes the PABX to return PABX dial tone. The outside caller must use a Touch-Tone phone.

Discrimination Ringing: Two types of ringing are provided, to distinguish between inside calls and outside calls.

Failure Transfer: Failure transfer provides automatic transfer of 12 Central Office trunks to predetermined stations in the event of a failure which causes a complete loss of system switching capability.

Fixed Night Service: This feature allows the attendant to assign stations to trunks for night service. During night service, incoming calls on these trunks will be routed directly to the station assigned by the attendant.

Flexible Station Numbering Plan: The PABX numbering scheme is completely flexible as long as no conflicting first digits are used.

Immediate Ring: Ringing is applied to a called PABX station as soon as it is determined that station is idle. There is no delay caused by waiting for the ringing cycle.

Lockout Alarm Attendant: When an extension goes off-hook, and remains off-hook for an extended period, the extension circuit becomes locked out and causes a minor alarm signal to show on the attendant console. The same conditions may also arise as a result of a faulty circuit.

Mixed Station Dialing: The PABX can accommodate both Touch-Tone and rotary dialing stations simultaneously.

Multiple Console Operation: Up to 2 attendant consoles may be used by the PABX.

Multiple Trunk Groups with Overflow: The PABX can accommodate up to 12 trunk groups, which may be arranged so that a call to a trunk in a busy trunk group will be rerouted to the overflow trunk group.

Music On Camp-On: Calls which are camped on to busy stations by the attendant receive music. The music source is customer provided.

Music On Hold: Customer-supplied music may be applied to circuits waiting for call completion under Camp-On or Hold condition.

Night Service - Automatic Switching: If the attendant is absent from the console, an incoming trunk call ringing on the console for longer than a predetermined time will cause the PABX to automatically switch into night service.

Outgoing Trunk Callback: This facility allows the attendant or an extension, who obtains a busy signal after dialing the trunk access code, to be automatically connected to the trunk group when a trunk in that trunk group becomes free.

Outgoing Trunk Camp-On: If a busy condition is encountered when accessing a trunk, a station user may camp on the trunk group by remaining off-hook. As soon as a trunk in the group becomes free, the station user will be connected to it.

Power Failure Restart - Battery Hold: When the primary power fails, the PABX customer data memory is maintained by an on-card reserve battery.

Power Failure Restart - ROM/PROM: The PABX operating program is contained in PROM memory which is unaffected by power failures.

Processor Changes - Administration Panels: PABX configuration changes can be made on-site from an administrative panel.

Processor Changes - Attendant Consoles: The attendant's console may be used to input new PABX data (COS changes, number changes, etc.) to the processor.

Ringing Time-Out: To prevent an unattended extension from receiving incoming rings for extended periods this feature inhibits ringing in excess of five minutes.

Station DTMF to Rotary Dial Conversion: The PABX can convert Touch-Tone signals from stations to dial pulses for rotary dial Central Offices on outgoing trunk calls.

Station Message Detail Recording: Details of calling and called numbers, as well as date and time for all outgoing calls, can be recorded and made available at a PABX output.

Station Transfer Security: If a trunk call is transferred from one station to another, and the second station does not answer within a predetermined time, the trunk call is routed to the attendant.

System Alarm Indication: The attendant has visual indications of MAJOR, CONSOLE, and MINOR alarm conditions.

Tandem Trunking: Trunk to trunk connections through the PABX are possible without attendant assistance.

Test Line: A test line is available for maintenance personnel which can be used for trouble shooting and system feature testing.

Tie Trunks: Tie trunks are available for connection to other PABX's.

Toll Restriction: Stations may be restricted from making toll calls. The PABX detects toll calls by looking for the digits 1 or 0 in the first or second digit position after the trunk access code or by detection of a toll reversal.

Traffic Measurement: The PABX can provide traffic information such as peg counts and usage to a terminal/printer.

Transfer Dial Tone: This distinctive tone is received in place of regular dial tone when an extension flashes to put an established call on Hold in order to Park, Consult, or Transfer the call.

Trunk Answer From Any Station (TAFAS): This is a night servide feature which permits any nonrestricted station to answer an incoming call by dialing a special access code. Incoming trunks may be split into 3 groups for this feature, with each group having its own access code and common bell or chime.

Trunk to Trunk Connections - Station: A station which is already connected to an outside trunk can use the Consultation hold and Add-on features to connect another trunk circuit to the original call.

Vacant Code Intercept: All calls to unassigned codes are automatically reouted to reorder tone or to the attendant.

Vacant Number Intercept: All calls to unassigned station numbers are automatically routed to reorder tone or to the attendant.

Variable Timeout Capability: Most PABX timeout intervals may be varied by appropriate input commands to the processor.

Voice Paging: The attendant and station users have access to customer provided voice paging equipment.

STATION FEATURES

Automatic Callback - Busy: This allows an extension upon encountering a busy extension or access code to have the call completed when the busy number becomes free.

Automatic Callback - Don't Answer: This facility enables an extension to be connected to an extension which does not answer by dialing a special code. When the desired party subsequently makes and finishes a call both the original and desired parties are automatically connected and rung.

Broker's Call: An extension can hold an existing call while originating a call to a third party. Once established the originator can alternate between the calls without either of the other parties being privy to the others conversation. Should the originator hang up with the party on hold the extension will be rung back and connected to the held party.

Call Forwarding - Busy: Internal calls made to an extension, which happens to be busy, are arranged to be forwarded either to another selected extension or to the attendant's console. In the case of an incoming trunk call the call is directed to the attendant's console as a "Dial 0" call.

Call Forwarding _ Don't Answer: Internal calls made to an extension, which does not answer within a preselected time period, are arranged to be forwarded either to another selected extension or to the attendant console. In the case of incoming trunk calls the call appears to the attendant console as a "Dial 0" call.

Call Forward - Follow Me: This feature allows an extension user to have all incoming calls rerouted to any selected number within the PABX.

Call Forward System Inhibit: Selection of this option enables Call Forwarding Busy (Sytem, DID) and Call Forwarding Don't Answer (System, DID) on extensions with this option in their class of service.

Call Park: A station user may "park" the party to whom he is connected by flashing the switch hook, dialing a special code, and hanging up. The call can be retrieved from the parking station by going off hook, or may be retrieved from any other station-- see Remote Access of Parked Call.

Classes of Service: The PABX provides 16 classes of service which may be assigned to stations to allow or deny access to system features.

Date Security: This is a class of service which provides the station user with security against any audio intrusion on calls (eg. camp-on tone, override).

Dial Call Pickup: A station user can dial a special code to answer any incoming call ringing on a station in the station user's predetermined pickup group.

Direct Outward Dialing: Stations users can gain access to Central Office trunks by dialing an access code.

Directed Call Pickup: A station user can answer calls ringing at another station by dialing a special pickup code plus the ringing station's number.

Executive Busy Override: Stations with this class of service can, upon encountering a busy signal after dialing a station number, dial a special code and enter into the conversation. A warning tone is applied to the conversation to indicate the override condition.

Flash for Attendant: This feature allows a station user who has an established call, to flash the switchboard and automatically be connected to the attendant console. The call appears on the console as a "Dial 0" Call.

Flexible Station Controlled Conference: Stations users may set up conferences with up to 7 conferees, without attendant assistance. The conferees may be stations or trunk parties, as long as at least one conferee is a PABX station.

Hold Pick-Up: A station with this feature in its COS may pick-up a call held at the attendant console by dialing the required access code plus the number of the Hold Button being used.

Master Number Hunting: Hunting through a group of stations to find a free station only occurs when the master number of the hunt group is dialed.

Meet-Me Conferences: This conference is assigned an access code, and stations dialing the access code at the pre-arranged tine are connected to the conference.

Remote Access of Parked Call: Calls which have been parked by a station can be retrieved remotely by dialing the Directed Call Pickup code plus the station number.

Secretarial Hunting: This feature allows one station to be the common last station in two or more station hunting groups.

Speed Calling: Station users may use abbreviated codes for frequently called numbers. The PABX provides up to 100 codes which may be assigned to frequently called numbers.

Station Camp-On: If a station user, upon encountering a busy signal after dialing a station number, remains off hook for a predetermined time, the PABX will automatically camp the station user on the busy station and give the busy station a tone to indicate the camp-on condition. When the busy station hangs up, the PABX rings the station and connects the originating station user to it. Station users may also camp-on outgoing trunks and features.

Station Hunting - Circular: Stations may be arranged in groups with a master number for each group. When the master number is dialed, the PABX will hunt through the group for a free station. The hunt starts where the previous hunt stopped, (i.e. the stations next in sequence after the previous hunt) thus providing some degree of call distribution. If all stations in the group are busy, the calling party receives busy tone.

Station Hunting - Terminal: Calls to the master number of a terminal hunting group will always hunt for a free station in the group in a fixed sequence beginning with the first station in the sequence and hunting through until a free station is found. If all the stations in the group are busy, the calling party receives busy tone.

Station Over-Ride Security: This feature is a class of service which provides security against Executive Busy Over-Ride.

Station to Station Dialing: Stations can call other stations directly without attendant assistance.

Through Dialing: Stations may gain access to Central Office parties through the attendant by dialing "0". The attendant can select an outgoing trunk and connect the station to it, allowing the station to dial the desired number, or the attendant can dial the number and then connect the station to the trunk.

Transfer/Add-on/Consultation Hold - All Calls: Stations may consult with another party while on any call (except an attendant call) by flashing the switch hook and dialing the required number. The other party to the call is held during this time and is excluded from the conversation. The station user may transfer the consulted party to the held party by hanging up. The consulted party may also be added-on to the held party and the original station, (forming a 3-way conversation) by the original station flashing the switch hook a second time.

ATTENDANT FEATURES

Attendant Camp-On with Indication: When the attendant extends an incoming call to a busy station, the incoming call is "camped-on" the busy station. The busy station hears a tone, informing him that a call is waiting. When the busy station hangs up it is rung and connected to the incoming call.

Attendant Conference: The attendant has the ability to set up a conference of up to 7 parties, at least one of which must be a PABX station.

Automatic Recall: This feature causes calls completed through the console to recall to the attendant if they are unanswered within a predetermined time.

Station Busy Lamp Field: This feature, which is part of hte console, provides a display of the free or busy status of all the PABX stations.

Busy Over-Ride: The attendant can use this feature to break into an existing connection. A warning tone is applied to indicate the over-ride connection.

Busy Verification: The attendant can check the free/busy status of any station by using the busy lamp field.

Class of Service Display: Whenever the attendant is connected to a station, the console provides a display of that station's class of service.

Console Switched Loop: The attendant console is of a switched loop design. Incoming calls appear on special loops, not on individual trunks.

Control of Trunk Group Access: This feature allows the attendant to temporarily change access to certain trunk groups so that

trunk groups with dial access can be made to intercept the attendant.

Digital Clock: A digital clock is built into the attendant console.

Direct Paging: The attendant has direct access to customer provided voice paging equipment via a button on the console.

Incoming Call Identification on Switched Loop: Displays on the console allow the attendant to identify every type of call that appears on the switched loop.

Individual Trunk Access: The attendant can access each trunk individually by dialing the special access code assigned to each trunk.

Lockout: The attendant cannot re-enter an incoming Central Office call completed through the console unless recalled by the station user.

Lockout with Secrecy: If the attendant is recalled by a station user on a Central Office call, the Central Office party is excluded from the conversation when the attendant answers, allowing the PABX station to consult privately with the attendant.

Music On Hold: Parties placed on hold by the attendant receive music. The music source is customer provided.

Serial Call: If an incoming trunk call wishes to be connected to several people in sequence, the attendant can arrange that after each station hangs up, the trunk party recalls the console.

Station Number Display: When the attendant is connected to a PABX station, the console provides a display of each trunk circuit.

Trunk Busy Lamp Field: This feature which is psart of the console display indicates the free or busy status of each trunk circuit.

Trunk Group Busy Indicators: The console provides indicators which show a busy condition for up to 10 trunk groups.

Trunk Number Display: Whenever the attendant is connected to a trunk, the console provides a display of the trunk number.

Trunk to Trunk Connections - Attendant: The attendant has the ability to connect an incoming trunk to an outgoing trunk through the console.

Two-Way Splitting: The attendant is able to consult privately with either party of a call that appears on the console.

APPENDIX D

ADMINISTRATIVE ANALYSIS

The administration of this project component involves both external and internal elements. The external elements can be defined as those relationships between and among the U.S. Government, as represented by the U.S. Agency for International Development, the U.S. contracting institutions, and the NWFP Agricultural University. The internal elements concern the relationships between and among the faculty and staff of the NWFP Agricultural University, Federal and Provincial bodies and other agricultural institutions within the Province. The rationale for the administration of both elements is described below.

A. External Elements

This project component was designated as a Title XII activity to be implemented in the collaborative assistance mode. This presumes a very close collegial working relationship among AID, the contracting university, the A&E contractor, and the host-country implementing institution. The administrative mechanisms suggested for this project component are consistent with this requirement.

A resident direct-hire AID officer stationed in Islamabad will serve as USAID Project Officer and Mission representative for the overall Agricultural Education, Research, and Extension Project. He will constantly monitor the progress of the project, interacting directly with contractors and host-institution personnel to assure that the activities conducted at the NWFP Agricultural University are consistent with the project component's

design, the Mission's development strategy for Pakistan, and the U.S. Government's overall foreign policy objectives. He will provide administrative guidance to the TA and A&E contractors and will be the official liaison with the Government of Pakistan. The USAID Project Officer, providing at least half time to this component, supplemented by the AID Project Committee and AID support staff will assure USAID/Pakistan's capacity to meet its responsibilities under this component.

The TA contractor's chief of party will have principal responsibility for the day-to-day administration of technical assistance inputs. He will be supported by a team of resident technical assistance advisors, augmented by carefully selected TDY's. He will interact chiefly with the senior administrative staff of the NWFP Agricultural University and will report regularly to the USAID Project Officer.

The A&E contractor will have resident staff responsible for construction supervision. The Chief of Party will report directly to the Vice Chancellor and coordinate closely with the University Director of Public Works.

The Vice Chancellor of the NWFP-AU is the chief administrative officer for that institution and will be the manager of this Project Component. His role is more fully discussed in the section on the internal administrative elements which follows.

The USAID Project Officer, the Chief of Party, and the Vice Chancellor will form the core of a joint project component-management advisory team, the final composition of which remains to be determined, but the number of which should not exceed

seven. Additional members of the joint team may include faculty from the Agricultural University, representatives of NWFP agricultural and other institutions and organizations, resident representatives of the A & E contractor, resident TA advisors, farmers, and/or private sector individuals. The joint team may provide the forum for regular assessment of progress and will advise on the implementation of specific objectives of the institutional development activity. The joint team will provide a continuation of the collegial pattern employed in the design of this component and will promote the continuity of commitment and interest necessary to the long-term success of this project component.

Supporting the TA contractor's field team at the University of Illinois will be a person designated as Campus Coordinator who is experienced in the administration of institutional development projects. Linkages between the University of Illinois at Urbana-Champaign, the lead institution, and Southern Illinois University at Carbondale will be maintained through the establishment of the NWFP Project Work Group (PWG), comprised of not more than five persons who participated in the project design. A PWG representative will participate in the regular assessment conducted in-country by the joint management advisory team. The PWG will link the operational requirements of the project component to institutional resources at the respective campuses, and such other organizations as may be required, to supply the inputs required for success.

Thus, an administrative mechanism will be established that will integrate the principals into a coordinated, effective, collaborative management team.

B. Internal Elements

1. Authorities

The NWFP Agricultural University is the implementing organization for this institutional development activity. The Ordinance establishing the University was published February 4, 1981, and the University started functioning in June of the same year in the premises of the former Faculty of Agriculture of the University of Peshawar. In setting forth the corporate authority of the University, the statutes cited 25 separate powers. They may be summarized as follows:

(a) To provide for instruction and research and an advancement in dissemination of knowledge in agriculture, basic sciences, Islamic and Pakistan studies and social sciences, and such other allied subjects as may be prescribed.

(b) To prescribe courses of studies to be taught in the University.

(c) To hold examinations and to award and confer degrees, diplomas, certificates and other academic distinctions.

(d) To confer honorary degrees or other academic distinctions.

(e) To confer degrees on persons who have conducted independent research.

(f) To provide special training courses for persons who are not students of the University.

(g) To accept examinations from other institutions as equivalent to examinations of the University.

(h) To cooperate with other universities or public authorities in such manner and for such purposes as it may determine.

(i) To create posts in connection with teaching, research, extension, administration, training, and for other purposes related thereto and to appoint persons thereto.

(j) To recognize any teacher of an affiliated college as a University teacher.

(k) To affiliate and disaffiliate Colleges of Agriculture.

(l) To admit Colleges of Agriculture to its privileges and to withdraw such privilege under prescribed conditions.

(m) To inspect Colleges of Agriculture associated or seeking association with it.

(n) To institute and award fellowship, scholarships, bursaries, medals and prizes.

(o) To establish teaching departments, faculties, centers of excellence, workshops, laboratories, museums, and other centers of learning.

(p) To control the residence of the students of the University and to institute, maintain, and approve any place as hostels or lodgings for students.

(q) Supervise and control the discipline of students, promote extracurricular and recreational activities and promote the health and general welfare of the students.

(r) To take disciplinary action against and impose penalty on students.

(s) To charge and receive such fees and other payments as it may determine.

(t) To receive and manage property transferred, grants, bequests, trusts, gifts, donations, endowments, and such other contributions made to the University, and invest any funds from these cited sources in such matters it may deem fit.

(u) To make provision for research and advisory services and enter into arrangements with other institutions or public bodies.

(v) To enter into, carry out, vary, or cancel contracts.

(w) To provide for the printing and publication of research and other works.

(x) To authorize and agree to the mobility of qualified staff among universities, research organizations, and the government or corporate bodies.

(y) To do all such other acts or things, whether incidental to the powers aforesaid or not, as may be necessary to further the objects of the University as a place of education, learning, and research.

The Governor of the NWFP is the Chancellor of the University. It is the Vice Chancellor, however, who is responsible for the day-to-day administration of the University. He is the principal executive and academic officer of the University and holds all powers necessary to exercise control and enforce discipline over all officers, teachers and other employees and students of the University. Among his powers are the following:

(a) To create and fill temporary posts.

(b) To sanction expenditure provided in the approved budget.

(c) To sanction by reapportionment a limited amount of money for unforeseen items not provided in the budget.

(d) To appoint examiners for all examinations of the University.

(e) To make such arrangements for the audit of papers, marks and results as he may consider necessary.

(f) To direct employees of the University to take up such assignments in connection with teaching, research, examination and administration, and such other activities of the University, as he may consider necessary.

(g) To appoint employees up to grade 16 of the National Pay Scales.

(h) To delegate any of his powers under the Ordinance to an officer or other employees of the University.

(i) To exercise his discretion to refuse privileges of the University to an individual.

(j) To exercise and perform such other powers and functions as may be prescribed.

2. Finance

The Agricultural University is a provincial institution, but like other institutions of higher education, it derives much of its financing from the University Grants Commission (UGC), a body of the Federal Ministry of Education. Although by statute the University can receive funds, gifts, etc., from any source, it is from UGC that funds for most of the salaries of the teachers come. Changes in staff size or composition are generally done in consultation with UGC. The UGC also funds major capital outlays.

The development of the Agricultural University budget follows a stylized pattern. The fiscal year of the University is July 1 - June 30. Some months before the fiscal year begins, Departments develop requests which are forwarded to the Finance and Planning Committee, chaired by the Vice Chancellor, which is responsible for the development of the University budget. Upon approval of the Syndicate, the budget is advanced to the Federal Ministry of Education through UGC, who carefully review the budget requests, normally sending a representative to the AU campus for detailed (line-item by line-item) review. After resolution, UGC folds the AU budget request into its overall budget and requests allocation from the Federal Ministry of Education. UGC allocates funds directly to the AU, releasing the recurrent budget in quarterly installments.

The capital budget is developed in a similar process and is allocated in three to four installments.

The budget process appears to be fairly mechanical. Central administration of the AU prepare the financial requirements for the current posts. Departmental requests primarily reflect operational needs and, in some cases, staff additions. Radical changes in budgets in a given year are treated as "special" requests outside the recurring budget that is presented by the AU. These are usually included in a supplementary request and added to the regular recurring budget request in the following year. Such special requests are usually for amounts of Rs. 200,000 or less. Internally, the approved budget is allocated back to Departments in accordance with their requests. Lapsing salaries for unfilled posts are retained by central

administration and are generally used to reduce the annual deficit, although in some instances the Vice Chancellor may use these funds to support a new activity in a Department.

The University also receives other funds to support its activities. UGC and the Federal Ministry of Education may make special grants for specific projects. For example, in 1981-82 the University received Rs. 1,233,000 in non-recurring special grants from UGC, as well as special grants from the Provincial Government, the University of Peshawar, the Federal Ministry of Education, and PARC. Additionally the University realized almost a million rupees from its own resources, e.g. tuition, farm income, sales, and other fees. The total income of the University available for 1981-82 was roughly Rs. 12.4 million. The UGC regular and additional grant totalled approximately Rs. 6.8 million, or slightly more than half the total.

The annual budget process is satisfactory, well understood by those at NWFP-AU who prepare, defend, and administer it, and is fully applicable to the requirements of the expanded program.[D-1]

[D-1]Getting the expanded program approved for implementation follows a similar process in the early stages but then expands to involve additional GOP and other provincial entities. The project approval process is initiated by the Vice Chancellor and staff through the preparation of a PC-1. The PC-1 is submitted to the Ministry of Education through the UGC. It is then submitted to the Planning Commission which distributes copies to all affected Federal Agencies and to the Provincial government for comment. All comments are analyzed and consolidated by the Working Group created by the Planning Commission to review the project. This package then goes to the Ecomonic Committee of the National Economic Council (ECNAC) for final approval. With approval, funding is authorized, and allotted through the normal recurrent and capital budgeting process.

3. Management

The project component design proposes establishment of several senior administrative positions. These include a Deputy Vice Chancellor, Director of Instruction, Research and Outreach, and Directors of the two new units to be established, the Learning Resources Center and the Center for Continuing Education. There is sufficient authority provided by the University Ordinance to permit this action. Chapter II, Section 4, "Powers of the University", (i), provides authority "to create posts in connection with teaching, research, extension, administration, training, and for any other purposes related thereto and appoint persons thereto." Further, Chapter III, Section 10, "Vice Chancellor," cites among the Vice Chancellor's powers "to delegate, subject to such conditions, if any, as may be prescribed, any of his powers under this Ordinance to an officer or other employees of the University," and also "to direct teachers, officers and other employees of the University to take up such assignments in connection with teaching, research, examination and administration, and such other activities in the University, as he may consider necessary for the University." Thus, there are no constraints to the establishment of such posts or the delegation of authority to act.

The administrative structure of the Agricultural University, then, will be quite similar to the structures of many Colleges of Agriculture in the United States. The chief academic and executive officer will work through a deputy and senior administrative officers for the principal functions of the University. Deans of

Faculties will report to the Vice Chancellor and work closely with the Deputy Vice Chancellor and Directors for Instruction, Research and Outreach. Department Heads will be responsible for individual faculty members within their departments and will report directly to Deans of Faculties. This system of administration will involve faculty and staff in the decision-making process at appropriate levels. It will insulate senior staff from having to be consulted on relatively minor matters which can be handled at lower levels. It will free the time of the senior administrative staff to concentrate on policy issues as opposed to day-to-day operational matters.

The NWFP-AU, and this project, is extremely fortunate to have Dr. G. M. Khattak as its Vice Chancellor at a major point in the institution's brief history. He is a man of intelligence and vision who espouses a style of shared leadership that is in keeping with his character. There is no question in the minds of the Design Team members that he is the right man, in the right place and at the right time to give leadership to the Agricultural University. A more detailed description of the strengths of leadership and the potential for its further development at NWFP-AU is found in Chapter 10.

Much, but not all, of the new institutional leadership will be generated from among the faculty currently serving the Agricultural University. Some of the more senior staff are prepared to assume new leadership roles, particularly those who were educated in the U.S. land grant university system several years ago. For others, particularly some of the more junior and mid-career staff, additional training and experience must be acquired

before taking on senior policy roles in the institution. The general leadership capacity of the faculty is also treated in Chapter 10.

In summary, the new administrative structure will be characterized by extreme competence at the top and more than adequate senior level officers at the functional level, with faculty developing skills that will be administratively as well as technically useful to the institution through the staff development program described in Chapter 6.

4. An Expanded University Staff

A principal output of this component is an expanded staff with improved capabilities to carry out agricultural instruction, research, and outreach activities for the benefit of the citizens of the NWFP, particularly those small farmers of the agriculture sector. The current staff must be augmented and persons must be selected to fill the several senior administrative posts referred to in the previous section on management. While it is anticipated that some of these senior posts may be filled from among the current University staff, it will be necessary to fill some of these posts with outside recruitment. Some persons may be identified for senior posts but require additional training, either of a technical or administrative nature, before they can effectively carry out their responsibilities. Part of this training will be provided by resident technical assistance personnel, but most of it will require study tours of varying durations. Candidates for these and other faculty posts can be drawn from a number of sources other than current faculty, including

the Research and Extension Departments of the Province, other agricultural institutions within and without the Province, through such means as the Pakistan Agricultural Research Council Talent Pool, and from the brightest graduates of the University itself. The supply of manpower will be sufficient in terms of numbers and the opportunities for training under this project component will assure effective and orderly staff development to provide the necessary technical and administrative skills.

5. Linkages to Provincial Organizations

Because of its expanded mission to participate in the improvement of the quality of agricultural research relevant to the citizens of the Province and the dissemination of useful information to farmers and organizations that support agriculture, the University will impact on the Provincial Departments of Agricultural Research and Extension. The impact will be mutually beneficial. The departmental research and extension officers are, by an overwhelming percentage, graduates of the Agricultural University when it was first a Department of Islamia College, then later a Faculty of the University of Peshawar. These officers reacted with warmth and fondness when referring to their alma mater. Without exception, the Design Team reports that officers at experiment stations throughout the Province, extension officers and others, reacted positively and favorably to suggestions of increased cooperative working relationships with the Agricultural University. The senior directors for research and outreach will be key actors in the development of effective linkages between the campus and the field research and extension staff. The support of the Governor of the Province and other officials

will be necessary to promulgate formal linkages and we are confident that this support will be forthcoming. The informal linkages, however, are in place and are, to a degree, operational.

The above analysis of the various elements of administration suggest that the administrative structure proposed, the present quality of administrative leadership, and the training proposed to enlarge and strengthen the administrative/management staff of the AU should facilitate the realization of project component objectives.

APPENDIX E

ECONOMIC ANALYSIS OF THE NWFP AGRICULTURAL UNIVERSITY COMPONENT

An agricultural university can be described as a multi-product firm. This firm produces resident and nonresident instruction, research, extension, certification and a myriad of other social functions. In contrast to the relatively straightforward economic analysis of revenue-producing projects, evaluation of the mixed outputs of a university becomes extremely complex. Some of the benefits produced are private; others are social. Benefits, whether private or social, may overlap as in the case of instruction or research. The benefits often directly affect a specific group of people in society and there may be second-round indirect effects. While many of the benefits are short-run, others clearly have lasting implications. A substantial portion of the benefits are nonmonetary and therefore defy straightforward quantification.

However, where extensive efforts have been made to document the benefits flowing from investment in higher education it has been possible to show that returns to higher education investment are as high or higher than return to investment in physical capital. A 1980 study by the World Bank Education Department[E-1] found that returns to higher education in developing countries were 14.9 percent versus 12.8 percent for return to physical capital projects. The 14.9 percent is an average for 11 developing countries with a range from 8.0 percent in Colombia to 23.0

[E-1] George Psacharopoulos, "Higher Education in Developing Countries: A Benefit-Cost Analysis". Staff Paper No. 440, World Bank Education Department, November 1980.

percent for Mexico and Venezuela (see Table E.1). Of course, it must be emphasized that there exist comparability problems both within and between countries but there is no reason to suppose that biases exist in only one direction. There are almost as many problems in estimating returns to investment in physical capital as in estimating returns to human capital.

There is an extensive body of research analyzing the returns to investment in agricultural research and extension. These have been assembled by Ruttan.[E-2] Rates of return for developing countries are in the range of 40 to 60 percent of 24 separate studies in developing countries, one-third reported rates of return above 75%, half were 50% and below, with only four studies reporting returns below 25% (see Table E.2).

One study reported on Pakistan. Pray[E-3] calculated the social rate of return on investments in crops research in Punjab between 1947 and 1975 to be over 30 percent.

The NWFP Agricultural University component is primarily an institution-building activity. The NWFP-AU is to be expanded and developed into an agricultural university capable of educating B.Sc. and M.Sc. agricultural graduates of substantially higher calibre than the present graduates. The University is to expand its research activities in order to create improved technological packages for increasing agricultural production in the NWFP and

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[E-2] Ruttan, V. W., Agricultural Research Policy, University of Minnesota Press, 1982.

[E-3] Pray, Carl, "The Economics of Research in British and Pakistani Punjab 1905-1975," Ph.D. theses, University of Pennsylvania, 1978.

Table E.1

Return to Higher Education and Physical Capital in Selected Countries

Country	Rate of Return (%)	
	Higher Education	Physical Capital
Mexico	23.0	14.0
Colombia	8.0	2.0
Venezuela	23.0	16.7
Chile	16.3	15.0
Brazil	14.5	10.0
India	12.7	17.5
Philippines	11.0	10.5
Ghana	16.5	8.0
Kenya	8.8	18.8
Uganda	12.0	10.0
Nigeria	17.7	23.0
United States	9.7	9.7
Canada	14.0	12.9
United Kingdom	8.2	8.6
Netherlands	5.5	16.8
Belgium	9.3	4.4
Developing Countries Average	14.9	12.8
Developed Countries Average	9.3	10.5

Note - Returns to physical capital refer to irrigation, hydroelectric and highways projects.

Table E.2 Summary Studies of Agricultural Research Productivity

Study	Country	Commodity	Time Period	Annual Internal Rate of Return (%)
Index Numbers				
Griliches, 1958	USA	Hybrid corn	1940-1955	35-40
Griliches, 1958	USA	Hybrid sorghum	1940-1957	20
Peterson, 1967	USA	Poultry	1915-1960	21-25
Evenson, 1969	South Africa	Sugarcane	1945-1962	40
Barletta, 1970	Mexico	Wheat	1943-1963	90
Barletta, 1970	Mexico	Maize	1943-1963	35
Ayer, 1970	Brazil	Cotton	1924-1967	77+
Schmitz and Seckler, 1970	USA	Tomato harvester, with no compensation to displaced workers	1958-1969	37-46
		Tomato harvester, with compensation of displaced workers for 50% of earnings loss		16-28
Ayer and Schuh, 1972	Brazil	Cotton	1924-1967	77-110
Hines, 1972	Peru	Maize	1954-1967	35-40[a] 50-55[b]
Hayami and Akino, 1977	Japan	Rice	1915-1950	25-27
Hayami and Akino, 1977	Japan	Rice	1950-1961	73-75
Hertford, Ardila, Rocha, and Trujillo, 1977	Colombia	Rice	1957-1972	60-62
		Soybeans	1963-1971	79-96
		Wheat	1953-1973	11-12
		Cotton	1953-1972	none
Fox, 1977	Malaysia	Rubber	1932-1973	24
Peterson and Fitzharris, 1977	USA	Aggregate	1937-1942	50
			1947-1952	51
			1957-1962	49
			1957-1972	34
Wennergren and Whittaker, 1977	Bolivia	Sheep	1966-1975	44
		Wheat	1966-1975	−45
Pray, 1978	Punjab (India), Punjab (Pakistan)	Agricultural research and extension	1966-1976	34-44
		Agricultural research and extension	1948-1975	23-37
Scobie and Posada, 1978	Bolivia	Rice	1957-1964	79-96
Pray, 1980	Bangladesh	Wheat and rice	1961-1977	30-35
Regression Analysis				
[illegible] 1963	Japan	Aggregate	1880-1938	35
Griliches, 1964	USA	Aggregate	1949-1959	35-40
Latimer, 1964	USA	Aggregate	1949-1959	not significant

Source: Ruttan, V.W., Agricultural Research Policy.

Study	Country	Commodity	Time Period	Annual Internal Rate of Return (%)
Peterson, 1967	USA	Poultry	1915-1960	21
Evenson, 1968	USA	Aggregate	1949-1959	47
Evenson, 1969	South Africa	Sugarcane	1945-1964	41
Barletta, 1970	Mexico	Crops	1943-1963	45-95
Duncan, 1972	Australia	Pasture improvement	1948-1969	58-68
Evenson and Jha, 1973	India	Aggregate	1956-1971	40
Chen, 1975 (reported by Knudson and Tweeten, 1979)	USA	Aggregate	1939-1948	41-50[c]
		Research and extension	1949-1958	39-[illegible]
			1959-1968	32-39[c]
			1969-1972	28-35[c]
Bredahl and Peterson, 1976	USA	Cash grains	1969	[illegible]
		Poultry	1969	[illegible]
		Dairy	1969	[illegible]
		Livestock	1969	47[d]
Kahlon, Bal, Saxena, and Jha, 1977	India	Aggregate	1960-1971	63
Evenson and Flores, 1978	Asian-national	Rice	1950-1965	32-39
			1966-1975	73-78
	Asian-International	Rice	1966-1975	74-102
Flores, Evenson, and Hayami, 1978	Tropics	Rice	1966-1975	46-71
	Philippines	Rice	1966-1975	75
Nagy and Furtan, 1978	Canada	Rapeseed	1960-1975	95-110
Davis, 1979	USA	Aggregate	1949-1959	66-100
			1964-1974	57
Evenson, 1979	USA	Aggregate	1868-1926	35
	USA	Technology oriented	1927-1950	95
	USA	Science oriented	1927-1950	110
	USA	Science oriented	1948-1971	45
	Southern USA	Technology oriented	1948-1971	130
	Northern USA	Technology oriented	1948-1971	95
	Western USA	Technology oriented	1948-1971	95
	USA	Farm management research and agricultural extension	1948-1971	110

to make a significant contribution toward improved extension and outreach programs in the NWFP. In addition, over the next decade the NWFP-AU will assume planning, coordinating, and administrative responsibility for Provincial agricultural research which, combined with strengthening activities involving the Extension Directorate, will result in a fully integrated program of instruction, research, and outreach.

The ultimate goal is to increase agricultural yields and intensity in the NWFP. Improvement and intensification of agricultural production is dependent upon the appropriateness of the technology available to farmers which is a function of both the quality and quantity of agricultural research and outreach staff working in the Province. Both quantity and quality are the direct responsibility of NWFP-AU as the only training institution in the Province for professional level agricultural manpower. Alternatives to the NWFP-AU for training professional agricultural manpower are examined.

Because of the site-specific nature of agricultural research, "importing" research from outside of the NWFP is sometimes useful for providing basic tools but not for the site-specific applied technology required by farmers. A research establishment must exist in the NWFP to create, field test, and modify appropriate technological packages through applied and adaptive research. In addition, there also has to be an outreach and extension system within the NWFP to transfer these research results to the growers.

An alternative to the development of a research capability at NWFP-AU might have been an effort to try to improve the quality

of the Research Directorate of the Department of Agriculture. Yet given the poor state of research within the Research Directorate and its narrow focus it can be argued that an effort to foster research within the integrated framework of an agricultural university offers potential for a much higher payoff, both in terms of research results and outreach activities and the higher quality it infuses into the instruction program.

In the case of the outreach component of the NWFP-AU, it is not intended as a substitute for the Extension Directorate of the Department of Agriculture but as a complementary, strengthening mechanism for that Directorate as well as the specific outreach activities of the NWFP-AU.

The following analysis is presented in two sections. First is an analysis of technical manpower requirements for NWFP agricultural development, the options for providing this trained manpower, and their comparative costs. Second is an analysis of potential quantifiable project benefits compared to project costs.

A. Manpower Supply/Demand

It is impossible to expect to increase agricultural production in Pakistan, and the NWFP in particular, without developing a large core of well-trained agricultural scientists. It is estimated that no more than 250 Ph.D. level research scientists are presently working in all of Pakistan[E-4] with

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[E-4] Amir Mohammed. "Agricultural Research System of Pakistan." PARC, Islamabad, 1982.

less than 20 of these stationed in the NWFP.[E-5] Within the Provincial agricultural sector in the NWFP there are presently 273 university-trained research posts sanctioned in the NWFP. However 49 (18%) of these posts are vacant. Similarly of 100 posts sanctioned for the Farm Water Management Research Programme 15 (15%) are vacant. Other provincial entities such as the Agricultural Training Institute and the expanding Agricultural University also have empty posts requiring more than 40 university level trained personnel. In addition the Pakistan Agricultural Research Council and the National Agricultural Research Centre are in the process of rapidly expanding their pool of university and post-graduate trained scientists. PARC, for example, is creating a Talent Pool of about 600 agricultural scientists that would be available for assignments in various projects of PARC including those in the headquarters, at research institutes and provincial governments and universities. This Talent Pool will require more than 100 post-graduate trained agricultural scientists from the NWFP. PARC has estimated that the requirements for additional research manpower in the agricultural sciences under the Sixth Five Year Plan would be:

Sub-Sector	Ph.D.	M.Sc.	B.Sc.	Total	Short-term
Crop Sciences	35	250	75	360	50
Natural Resources	15	35	25	75	40
Animal Sciences	45	125	25	195	40
Social Sciences	15	30	15	60	40
Miscellaneous	15	40	10	65	30
	125	480	150	735	200

[E-5] Liz Wily. "Manpower in the NWFP Government With Special Reference to the Agricultural Sector." Development Alternatives, Inc., Peshawar, April 1983.

These figures do not include substantial requirements, especially at the B.Sc. and M.Sc. levels, for agricultural extension, nor the requirements for university teaching.

In order to fill the vacancies in the NWFP requiring graduate and post-graduate agricultural scientists three options exist: (1) create more seats at the agricultural universities in the Punjab and Sind; (2) send candidates for higher education to quality institutions in Asia or the West; and/or (3) strengthen the ability of the Agricultural University in the NWFP to educate more and better quality B.Sc. and M.Sc. graduates. All of these alternatives have certain positive attributes and, in fact, are not mutually exclusive. However, in terms of cost effectiveness and long-term economic and social development goals of the NWFP it can be argued that strengthening the Agricultural University is an absolute must.

(1) In spite of investment in the universities of agriculture in the Punjab and Sind in the 1960s and 1970s the quality of education and research at these institutions is, at best, marginally acceptable. These institutions presently do not offer the quality of education required nor, focused as they are on Indus River Plain large-scale canal irrigated systems, are they able to teach agricultural skills appropriate to the varied ecological conditions found in the NWFP. In addition, without a major increase in facilities, these institutions could not absorb the required number of students. Thus, while sending additional students to the agricultural universities in the Punjab and Sind is relatively inexpensive, it is inadequate both in terms of numbers required and in terms of levels and kinds of skills obtained.

Based on past experience it is very unlikely these graduates would return with the tools and motivation needed to improve agricultural production in the NWFP.

(2) Sending students to premier agricultural institutions in Asia such as the University of Philippines - Los Banos, the Asian Institute of Technology in Bangkok, and the University Pertanian - Serdang in Malaysia has an intrinsic appeal but again, while the quality of education would be higher, they do not offer a means of teaching the appropriate skills needed for the diverse agricultural conditions of the NWFP. Unfortunately, given the state of political relations between India and Pakistan, it is not realistic to try to send students to India, even though the crops and conditions would be much more appropriate for Pakistan conditions. However, in some disciplines training at the M.Sc. level in the Philippines, Malaysia, and Thailand provides both quality education at a relatively inexpensive cost and an excellent screening mechanism to identify candidates to send for Ph.D. level training. Training in the West is necessary at the Ph.D. level and over the next decade, in some disciplines, at the M.Sc. level. Yet, the exposure to modern Western agricultural practices does not automatically equip the student with the agricultural skills needed for the diverse mixed farming systems of the NWFP.

(3) Expansion and strengthening of the NWFP-AU provides the most logical means of expanding the available pool of manpower, particularly at the B.Sc. and M.Sc. levels, required to improve

agricultural teaching, research and outreach in the NWFP. In addition, as the Agricultural University also will play a critical coordinating and catalyzing role, the presence of a dynamic teaching, research and outreach institution in the heart of the Province offers an opportunity for the introduction of a much wider set of new ideas in such diverse areas as food technology, nutrition, village sanitation, women's programs and farmer training courses. It will be also possible to utilize the University's staff and facilities for continuing education and in-service training.

B. Cost Comparison

In terms of participant costs per student educated, Table A presents a rough comparison of actual annual education costs per student for various geographical locations. Of course, it must be recognized that the quality of education varies substantially from location to location.

The costs in Table E.3 are actual participant costs and do not include any government subsidies, which may be quite significant. After improving and expanding the NWFP Agricultural University the actual costs to students may or may not increase but clearly the costs of operation by the government will increase substantially. Assuming an eventual annual output of around 300 B.Sc. and 75 M.Sc. graduates it is estimated that the annualized cost[E-4] for producing a graduate or post-graduate agricultural scientist will be approximately $2,600 per year. This cost is in the same range as sending students to India and is 1/3 to 1/4 the cost of

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[E-4] Using a 12% present value factor and a 30 year life.

Table E.3. Estimated Annual Costs per Higher Education Student by Location - Five Year Average

Location	Cost per Student* (1981 US$)
Average of 58 Poorest LDCs[a]	$1,138
University of Philippines - Los Banos[b]	7,000
Asian Institute of Technology	10,000
U.S. Land-Grant Universities[b]	15,000
University of Agriculture - Faisalabad	1,325
University of Peshawar - NWFP[c]	1,200

*These costs usually do not include air travel and shipment of personal affects.

[a]George Psacharopoulus. "The Economics of Higher Education in Developing Countries." Comparative Education Review, June, 1982.

[b]Ford Foundation, Southeast Asian Regional Office, Bangkok (internal files).

[c]Salma Sami. "Cost of Education of Boarders in Peshawar University." Institute of Development Studies, Publication No. 137, July 1980.

sending students to other quality institutions in Asia. This is two times the cost of sending students to Faisalabad, but given the poor quality of education, limited number of seats and provincial restrictions on educational exchange this is not really a viable alternative.

ANALYSIS OF BENEFITS AND COSTS

The ultimate goal of this component is to increase agricultural production and farm income. Increased income in agriculture from a given land and water resource base results from higher yields, shifts to higher value crops, and increased cropping intensity. In order for these changes to occur it is necesary both for new technology to be generated and for it to be diffused to agricultural operators.

No attempt has been made to quantify the expected increase in agricultural output and productivity resulting directly from the project. Such an effort, to be credible, would have required an uneconomic use of design manpower resources. An equally useful approach, and the one used, is to estimate the increase in agricultural sector revenue required to retire the project costs.[E-7] The project is designed to impact on both the cropping and livestock sub-sectors of NWFP agriculture. For simplicity, the following analysis takes only crop yield increases for comparison with project costs. This is a very conservative approach since it does not consider the changes in cropping mix and intensity, nor the livestock sub-sector.

A. Present Value Estimators

The aggregate value of all major crops grown in NWFP, averaged for the three years 1977-80, is $300 million (see Table E.4). A one percent increase in yields, assuming average acreage and prices, would generate $3 million in farm revenue. The present value (PV) at 12 percent discount over a 20 year period is $18.5 million.

The total capital outlay for this component as indicated in the PID is $48.5 million. This outlay is spread over the first seven years of project life. Annual operating costs of the NWFP-AU are estimated at $1 million after four years. In addition, farm production costs are estimated at one-third of gross revenue, based on farm budgets in IBRD Report No. 2179a-PAK, Annex 1,

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[E-7] Suggested in AID Handbook 3, Appendix 3E, para C.5.

Table E.4. 3-Year Average Acreage, Production, Yield, Price, and Gross Value of Major Crops, NWFP, 1977-78, and 1979-80.[a]

Crop	Area (000 ha)	Production (000 MT)	Yield (kg/ha)	Price[b] (Rs./MT)	Value (000 Rs.)
Maize	336	417.2	1,242	1,587	662,105
Rice	67	97.7	1,458	1,764	172,269
Sorghum	33	14.9	458	1,273	19,015
Millet	26	11.1	429	1,751	19,494
Sugarcane	92	3,580.6	38,800	158	566,046
Tobacco	30	45.6	1,507	9,020[d]	411,312
Wheat	716	745.6	1,042	1,447[c]	1,078,946
Gram	117	30.8	263	2,123	65,386
Barley	60	48.1	809	1,686	81,090
Oilseeds[e]	49	25.1	514	2,904	72,977
Fruits	17	205.4	12,000	1,116[d]	229,260
Vegetables	22	295.7	13,600	1,562[d]	461,821
TOTAL					3,839,616

[a]Source: "Development Statistics of NWFP," Planning and Development Department, Bureau of Statistics, Government of NWFP, 1980. Preliminary data for 1980-81 were too erratic to be used.

[b]Prices are annual average wholesale procies for the Karachi market. Price data for NWFP were not available. Karachi prices are considered suitable for the purpose at hand. Source: "Pakisan Agriculture Data Book," O/ARD, USAID Mission, Pakistan, June 1982, Table 10.2

[c]Wheat prices are the arithemetic average of Maxi Pak, Dara (Lahore), and C-591 (Lahore).

[d]These prices taken for IBRD Report No. 217a-PAK, Annex 1, Table 16. 1977-78 prices were inflated by 10% to aproximate the 3-year average of the other commodities.

[e]Includes rapeseed and mustard.

Table 19. These cost and revenue streams are assembled in Table E.5, discounted at 12 percent.

The present value of a four percent yield increase is $74 million. The present value of the aggregated cost streams is $63.7 million. Revenues are somewhat in excess of costs. Interpolation shows that a 3.5% increase in yields would just balance all costs.

A more conservative assumption regarding the timing of yield increases, for example, achieving a four percent yield increase in year five instead of year three, reduces revenues to just about balance costs at a four percent yield increase. To retire project costs requires an increase in value of farm output to $12 million by year five of the project.

B. Yield Potentials

A four percent, or even higher, increase in yields is only a fraction of potential increases[E-8]. However, yield increases attributable to the project must be over and above those that would have occurred without the project. In the NWFP wheat yields have followed an increasing trend, changing from about 560 kg/ha in 1970-71 to 1000 kg/ha in 1979-80. Over the same period, rice yields increased from 1220 kg/ha to 1560 kg/ha and barley from

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[E-8]The IBRD report on the Mardan SCARP project cited above indicated potential increases under irrigation in the Vale of Peshawar to be: 140% for sugarcane; 300% for maize; 150% for wheat; and 40% for tobacco. One major sub-area of the Mardan SCARP project is to be treated with only improved surface drainage and an intensified agricultural extension program. With only these limited inputs yield increases expected were: maize, 40%; wheat, 47%; tobacco, 7%; sugarcane, 20%; and fruits and vegetables about 10%. These are well above the overall 4% yield increase required to retire project costs.

Table E.5. Estimated Present Value of Project Related Cost and Revenue Streams.

	COSTS ($ million)						REVENUE	
Year	Capital	Operating	Farm Production	TOTAL	PV factor @ 12%	PV	Farm Receipts	PV
1	4	.7	0	4.7	.893	4.2	0	0
2	7	.8	2	9.8	.797	7.8	6	4.8
3	14	.9	4	18.9	.712	13.5	12	8.5
4	8	1.0	"	13.0	.636	8.3	"	7.6
5	6	"	"	11.0	.567	6.2	"	6.8
6	6	"	"	11.0	.507	5.6	"	6.1
7	3.5	"	"	8.5	.452	3.8	"	5.4
8		"	"	5.0	.404	2.0	"	4.8
9		"	"	"	.361	1.8	"	4.4
10		"	"	"	.322	1.6	"	4.0
11		"	"	"	.287	1.4	"	3.6
12		"	"	"	.257	1.3	"	3.2
13		"	"	"	.229	1.1	"	2.8
14		"	"	"	.205	1.0	"	2.4
15		"	"	"	.183	.9	"	2.0
16		"	"	"	.163	.8	"	2.0
17		"	"	"	.146	.7	"	1.6
18		"	"	"	.130	.6	"	1.6
19		"	"	"	.116	.6	"	1.2
20		"	"	"	.104	.5	"	1.2
TOTAL						63.7		74.0

670 kg/ha to 800 kg/ha. However, yields of other major crops have essentially stagnated. Maize yields changed only slightly from 1100kg/ha to 1260 kg/ha; sugarcane from 38 to 39 MT/ha; and sorghum, tobacco, and oilseeds showed essentially no change (see Appendix G, NWFP Agriculture).

Even though wheat yields are able to maintain this same trend, yields will still be below the average for Pakistan and the potential exists for even greater yield increases. Maintaining the yield trend for rice would result in yields substantially above the current Pakistan average since NWFP rice yields (1460 kg/ha) are not far below Pakistan's average (1580 kg/ha). Barley yields in the NWFP are above the Pakistan average.

Project activities and resources will assist in maintaining these trends. However, these crops can be omitted and the analysis focused only on those with stagnant yields. The annual value of output for maize, sugarcane, tobacco, sorghum, and oilseeds averaged about $133 million for the 1977-78 to 79-80 period. A yield increase of 10% for these crops would more than retire project costs, i.e. would yield more than the required $12 million (see above). Similarly, to generate this amount by maize alone would require about 25% increase in yields on the entire maize acreage or doubling the size on only one-fourth of the maize acreage.[E-9]

[E-9] The total value of maize output (Table 2) is $52 million at yields of 1.24 MT/ha and a price of Rs. 1,587/MT. Raising an additional $12 million would require 1.56 MT/ha times 336,000 ha times Rs. 1,587/MT = Rs. 832 million/12.8 = $65 million. Or, 84,000 ha x 2.48 MT/ha plus 252,000 ha x 1.24 MT/ha works out to $64.5 million.

Maize yields are currently (1978-80 average) 1.2 MT/ha. Yields at the Cereal Crops Research Institute (CCRI) are 6 MT/ha. Experimental yields in the Swat Valley are 8 MT/ha. A substantial yield gap presently exists between the yields of farmers generally, and yields obtained on experimental/demonstration plots on farmers' fields. These plots, with crops grown under the same biological conditions, but using known, modern agronomic practices reveal a gap of around 63 percent for maize (and 69 percent for wheat).[E-10]

In the short-run reducing these and other yield gaps should be the main thrust of applied and adaptive research and outreach programs in NWFP. These programs cannot be carried out with the now antiquated teaching, research and outreach structure of the NWFP. The project will educate the scientists required; provide a flow of better trained manpower for the agricultural establishment, generally; organize and carry out more adaptive and applied research; and develop and implement additional outreach programs.[E-11] These activities will produce more than the minimal yield increases required to retire project costs.

C. Conclusion

The purpose of the above analysis and discussion was not to determine whether an agricultural university should be established in the NWFP, nor to determine whether investments in improving the NWFP-AU would have a higher return than other

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[E-10]Grant for Improving the Production of Maize and Wheat. Submitted by Government of Pakistan and Centro Internacional de Mejoramiento de Maiz y Trigo (CIMMYT) to U.S. AID, January, 1983.

[E-11]See the maize improvement program detailed in Chapter 3.

investments that AID or the GONWFP might make in the agricultural sector.[E-12] The University exists, it is clearly not doing an adequate job of manpower development, technology improvement, nor outreach. The purpose has been to determine whether the costs of the proposed improvements in the functioning of the NWFP-AU could be expected to yield benefits greater than those costs. This has been established, albeit indirectly, to the satisfaction of the Design Team.

A continuing problem plaguing the analysis has been the inadequacy, or absence in many cases, of appropriate and accurate data. To determine whether, and to what extent, the Project achieves the results described above, it is proposed that a rather comprehensive benchmark survey be undertaken to detail the current situation on NWFP farms with regard to yields, crop and livestock production practices, cropping patterns, cropping intensity, use of improved seeds, fertilizer, pesticides, and other improved technology. A similar survey could then be taken following project completion to document project accomplishments, or lack thereof (see Evaluation Plan, Section IV of the PP.)

[E-12]See Economic Analysis Guidelines, AID Handbook 3, Appendix 3E.

APPENDIX F

SOCIAL SOUNDNESS ANALYSIS

I. INTRODUCTION

The North-West Frontier Province (NWFP) of the Islamic Republic of Pakistan has a land area of 39 thousand square miles with a total population of around 13 million. It is estimated that about 85% of the population live in some 6-7 thousand villages scattered throughout the rural areas. The overall literacy rate in NWFP is about 21%.

There are 4.5 million acres of cultivated land in NWFP with about 35% irrigated and 65% under rainfed conditions. Average size of land-holding ranges from less than one acre in the Mardan District to over 12 acres in D. I. Khan District. Some of the major crops are wheat, maize, sugarcane and sugarbeets, tobacco and a diverse range of horticultural crops.

Administratively the NWFP consists of 5 Divisions which are broken down into 12 Districts (Peshawar, Mardan, Kohat, Abbottabad, Mansehra, Kohistan, Bannu, D. I. Khan, Chitral, Dir, Swat, and Malakand). In addition to these areas under provincial administration, the NWFP also includes tribal areas in the west. These areas are administered either by the Federal Government (FATA - Federally Administered Tribal Areas) and include 7 districts (Bajaur, Mohmand, Khyber, Orakzai, Kurram, North Waziristan and South Waziristan). In addition many of the some 2.8 million Afghan refugees also currently reside throughout the NWFP.

The NWFP Agricultural University (NWFP-AU) is the primary institution of higher learning for the agricutlural sciences in the Province. The University traces its institutional roots back to 1930 when agriculture was first introduced into the curriculum of the Islamia College at Peshawar. In 1951 the University of Peshawar was founded and received assistance from the Ford Foundation (beginning in 1953) and USAID (from 1954, in collaboration with Colorado State University). At that time agriculture was only a department, but in 1970 agriculture was established as a full Faculty within the University of Peshawar. Finally on June 14, 1981 the University of Agriculture was founded as a separate entity. This steady, forward movement to strengthen higher agricultural education in NWFP demonstrates the importance of agriculture in the Province and the commitment to its intelligent development through education, research and outreach.

Major Thrust of the Project

The main objective of this project is to build onto Provincial and Federal commitment to higher agricultural education, research and extension by substantially strengthening the NWFP-AU. This strengthening process includes the improvement of the undergraduate and post-graduate education programs, and the equally important task of building strong programs of research and outreach that are responsive to the needs of the agricultural sector in the NWFP.

In the education area, a new undergraduate curriculum has been developed that provides for a sound academic background in years one and two, and increasing numbers of electives and

specializations in years three and four. The school year will be broken into two terms, with periodic student evaluation during and at the end of each term. The objective of all these changes is to maximize student learning. These changes should result in a substantial improvement over the current system.

In the research area, experimental land is available for faculty and post graduate student research, but is not being effectively utilized at the present time. Part of the reason for this lack of research is lack of time to conduct experiments. By restructuring the academic curriculum and giving faculty specific responsibilities for research, as a percentage of their appointments, and with the University more strongly enforcing the requirement of research publication being needed for promotion, both the incentives, resources and responsibility will be on each faculty member to engage in significant research activities.

The proposed outreach program of the NWFP-AU will add a significant new dimension to the University. A sizeable number of faculty in departments will have partial outreach appointments and will be expected to produce technical publications and materials that will be directly useful to field workers in extension and allied agencies. In addition, through the Center for Continuing Education, the products of research will be disseminated to extension workers and the private sector through in-service workshops and training courses in all agricultural fields.

As detailed in the project paper, these new and/or strengthened functions of the NWFP-AU will be accomplished through a number of major project inputs, including faculty training and development, particularly through post-graduate education programs in

the U.S.; new buildings, facilities (including a new Learning Resources Center, Center for Continuing Education, and research laboratories), equipment and vehicles; technical assistance (including both short- and long-term advisors); a new academic structure involving four Faculties, which should improve program coordination and resource allocation; and lastly a new communication system.

These substantial project inputs will be introduced into a Province and society that is highly dependent on agriculture as the primary form of economic activity and a society that has adapted to the different agro-ecological zones of the Province. The socio-cultural environment for the Province will be briefly examined next.

II. SOCIO-CULTURAL CONTEXT[1]

The NWFP is characterized by considerable economic and agronomic variety. Agro-ecological adaptations range from nomadic pastoralism among the Gujjard and Kohistanis of the highlands in the north of Swat to settled field crop agriculture in areas of Mardan and date and banana cultivation in D. I. Khan and Bannu.

Combined with the agro-economic diversities there are considerable differences in the socio-cultural context of agricultural production and other aspects of daily life

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[1]This section draws very heavily on the comprehensive Social Soundness Annex prepared by Development Alternatives, Inc. in the project paper for the Gadoon Area Development Project. Since this statement was based on eight weeks of extensive field work in the Province and on the recommendation of USAID/Islamabad officials, the relevant sections on the socio-cultural context have been utilized here, rather than to duplicate much of the same field work.

throughout the Frontier. It is difficult to generalize about Pathan social structure as conditions vary considerably from one clan, or sub-tribe of Pathans to another and even between the settled and tribal members of the same clan there is wide diversity of customs and practices. There are areas, for example, such as parts of Upper Swat where the majority of farmers are small-scale, owner-cultivated living in extended families with the women working alongside of men in potato production while in other areas there are a number of very large landowners that keep their wives in seclusion.

Most of the Frontier is characterized by a range of types of relationships of inequality and by unequal access to productive assets. Despite several land reform acts, there is still a tendency toward skewed distribution of land ownership, with 80-90 percent of the farms being less than 12 acres. Although there is a legal ceiling on the number of acres any one individual can own, registration of land through a number of family members and other mechanisms allows very large landowners, Khans or Nawabs, to continue to control vast acreages. Increasingly, as these landlords turn toward modern farming methods, tenancy eviction is becoming more common with the only option for tenants that wish to remain in the area to work as paid agricultural laborers. However, in other areas landlords are selling their land to tenants as the tenants, working alongside their wives, are better able to utilize the land and thus receive a higher return from agricultural activities.

Despite the advent of the formal local bodies scheme - union councils and district councils to which members were elected in

1979 - the traditional village-level *jirgas* or meetings of the clan and/or sub-tribal elders are still the main form of local community decision-making body. *Jirgas* make decisions about water use in irrigated areas, settle a variety of disputes, may form the base for the organization of a formal cooperative of one or another type and generally surface and solve community conflicts. With the decline of the rigidity of clan and sub-tribe, membership in *jirgas* has broadened. However, there are still some villagers who are disallowed from participating in the *jirga*, although its decisions will probably apply to them as well.

These generalizations about Pathan social and political structure apply in Dir, Swat, Mardan, Charsadda, parts of the plains immediately surrounding Peshawar City and some of the southern districts, including Kohat. However, they do not apply to Chitral where the population is non-Pathan and where traditional social organization is characterized by more democratic and less-hostile relationships. Similarly, they do not apply to all parts of Hazara District.

Just as socio-political organization varies considerably throughout the Frontier, so does the impact and interpretation of Islam. There are still divisions observable between *Khans* and *Mians* and *Pirs*--the descendants of Saints. There are also keenly-felt divisions between Sunnis and Shias in the southern districts and in Peshawar City. Similarly, in Chitral the Ismaeli-Sunni distinction may now become exacerbated.

Inheritance by women, or its lack of, is one of the most obvious indicators of the local differential interpretation of

Islam throughout the Frontier. In many parts of Swat or Dir, as well as Chitral, women do not inherit at all. In Mardan, however, some women do inherit as they do in Kohat and parts of the Peshawar plain. Divorce by (rather than of) women is another such indicator. In most parts of the Frontier women have no idea they can seek a divorce from their husbands under Islamic law and the law of the Republic.

Yet, with its remote locations and often archaic traditions, farmers in the Frontier are open to new ideas. Even in the absence of an effective agricultural extension service, new technologies, and especially new crops, are catching on very rapidly. Partly, this may result from progressive large farmers introducing new practices to their tenants but there is also a readiness to try anything new that looks promising. From potatoes to pears to persimmons or apples many producers are trying whatever appears to be profitable at the time. Hundreds of acres in Mardan and Charsadda have recently been taken out of tobacco and put under fruit tree saplings. This is both a result of the expected increased consumption and the perceived high costs of agricultural labor. Even smaller vegetable growers around Peshawar City are complaining about the high cost of agricultural labor.

III. BENEFICIARIES

There will be several groups of beneficiaries under this project. First and foremost will be the agricultural community in rural areas, particularly farmers and small-farm households. The overall goal of this project is to improve agricultural production, income, and quality of life of small-farm families.

This will be accomplished by concentrating on educating better qualified agricultural graduates, by encouraging more and better focused agricultural research and indirect outreach activities. Much of the outreach program will be through intermediary organizations, such as private input dealers, extension, Agricultural Development Bank and the Agricultural Development Authority, but other outreach thrusts will be aimed at direct interaction with small farmers. The substantially improved personnel from the NWFP-AU will have the capability to provide better technical information to farmers.

The second most important group of beneficiaries will be the young people of NWFP who wish to study agriculture and pursue agricultural careers. The expanded facilities, new learning resources, upgraded faculty, revised curriculum and restructured academic calendar will all contribute directly to an increase in number of graduates who have substantially improved academic and practical preparation and thus contribute more significantly to the agricutlural development of NWFP.

Within this category of direct beneficiaries are two subgroups worthy of mention. First, there is widespread agreement within the NWFP-UA that more women should be trained in the agricultural sciences. Therefore, special steps will be taken to recruit women for study at the University. A number of years ago women were enrolled in the Faculty of Agriculture, but in recent years women have not been encouraged to apply for admission. Clearly this negative atmosphere has now been reversed and there is widespread agreement within the faculty and from the Vice Chancellor that women will be actively recruited. Two members of

the Design Team focused specifically on programs and facilities that would be appropriate for women students and considered how to resolve problems women might face as students and faculty at the NWFP-AU.

Another sub-group of students that will continue to be recruited will be young people from the tribal areas and from Baluchistan. A specific number of places are reserved for these students and this number will grow along with the University. This is particularly important for Baluchistan as, even though it is a traditional agricultural area covering over 40% of the total land area of the country, it presently has no agricultural university to educate its promising young scientists. Students sent to agricultural universities in the Punjab and Sind have not returned with the type of skills needed for conditions in Baluchistan. The new curriculum at NWFP-AU should help to relieve this problem.

A third category of direct beneficiaries of this project will be the sizeable number of faculty that will receive training, particularly those that will pursue advanced degrees in the United States. By pursuing a program whereby they take their course work at quality U.S. educational institutions and then return home or to a third country (such as at an International Agricultural Research Center) to complete their dissertation research, will provide the best possible academic program while keeping their academic focus on the problems of Pakistan and the NWFP. Furthermore, by having them return home mid-way through their degree programs for data collection, the level of cultural

alienation that sometimes occurs during long absences abroad will be reduced.

Another group of direct beneficiaries will be all the agricutural agencies that serve the NWFP as well as other provincial and federal agencies and private agri-business firms and banks. These organizations will benefit in two ways. First, as they recruit almost exclusively from NWFP-AU, they will have available a much more capable manpower pool from which to draw future employees. Over time this should improve the quality of performance of these organizations that serve the agricutural sector in general and farmers and rural households in particular.

Second, through the planned outreach program of the University, agricultural extension should be an important beneficiary due to the improved coordination and development of technical recommendations for commodities grown in each agro-ecological zone, followed by the translation of these recommendations into extension materials (software) for use by field extension personnel, as well as the needed in-service training. In addition to providing technical support to extension, an effective outreach program should also feedback farmer concerns and needs to agricultural researchers - another direct beneficiary.

V. PARTICIPATION

In designing the project paper there was extensive participation involving not only University administrators and faculty, but also input was solicited and received from all facets of the agricultural sector from farmers up through the Secretariat for Agriculture. At the NWFP-AU the Design Team interacted regularly

and extensively with nearly every member of the University faculty. Since there was a team member for each academic department in the University, it was possible to become very well-acquainted with each faculty member, the courses taught, and the facilities available for research and instruction. In short, the team became intimately familiar with each department, including both their strengths and weaknesses.

From this analysis emerged a consensus among the faculty and the team as to how the curriculum should be structured and what resources (training, facilities, etc.) will be required to upgrade each department in the University.

Within the University setting, the weakest aspect of participation was with the University students. Unfortunately, courses were finished and students were involved in examinations. Therefore, there were too few opportunities to interact with students in each department. This is not to say that the team did not talk to students, only that the timing of the visit prevented extensive interaction with this important client group of the University. However, through casual interactions and by reviewing M.Sc. research experiments in progress, theses, etc., it was possible to get a good idea as to current student performance.

Outside the University the Team visited nearly every research station, some more than once. Visits were made to the Department of Extension, the Agricultural Training Institute, and several field trips were taken to see how extension was operating in the field, including visits with farmers. Visits were made to the Agricultural Development Bank, Agricultural Development

Authority, Cooperative Societies, and many other public agencies and private sector firms to discuss manpower needs and to learn their recommendations about how the Agricultural University and its programs should be strengthened.

VI. SOCIAL-CULTURAL FEASIBILITY

Since there was widespread involvement of the faculty in the planning process, it appears highly probable that most changes being recommended in the project paper will be implemented - many eagerly. There was a general attitude within the faculty that acknowledged many of the weaknesses within the present system and a desire to move to something better.

Some of the proposed curriculum changes will require significant revision of courses taught by individual professors and/or departments. However, the opportunity for many faculty to pursue post-graduate degrees in the U.S. and to learn new knowledge and skills seemed more than sufficient incentive to offset any perceived short-run negative effects of the proposed changes. In other words, there is recognition that when faculty return from studying in the U.S., they may not want to teach the same courses in the same way as before.

Acceptance of the many proposed changes in the structure of the academic year, curriculum, examination system, etc. by students is less easy to predict. Because students were only marginally involved in the planning process, and many of the proposed changes will come as a radical departure from the past, special efforts will be required to ease students into the transition to the new structure.

Certainly many of the improvements in the learning environment will be welcomed. However, other changes, such as a shift away from the system of external examiners may be viewed as introducing subjectivity into the evaluation process. Given the importance of education in securing better types of employment and the concomitant social and economic rewards, considerable pressure is placed upon students to achieve. Certainly the move to an internal examination system opens the way to direct professor-student conflicts over the question of fairness and preferential treatment.

Other changes will add considerably more rigor to the learning process and increase academic standards. While these changes will require students to study more outside the classroom, since they will also have fewer, but more interesting courses, these changes should be acceptable. Students will be informed about the forthcoming changes and their reactions carefully noted, to avoid transition problems. The Vice Chancellor is confident that the transition to the new curricula and teaching-learning process will be made smoothly (see his statement in Chapter 10).

The acceptance of women into the Univeristy may be slow initially, but is not anticipated to be a problem. In earlier years women were enrolled as students and there are currently two women faculty members. Clearly there is strong political support in the country for increased educational opportunity for females. This attitude is strongly supported by the Vice Chancellor and most faculty members. Both academic buildings and student housing

are being planned under the expectation that there will be a growing number of women enrolled at the University.

The expectation is that the number of women on the faculty will also increase, particularly in those areas of agriculture where women play dominant roles, such as animal husbandry post-harvest technology and human nutrition. In addition, it is expected that the outreach program will give special attention to disseminating information of primary concern to women. In all of these areas, the initial problem may be one of having too few women available for training in agriculture. As young women learn of the receptive environment for them at the University, it is anticipated that the supply of women applicants will increase. Furthermore, both agricultural research and extension have women on their respective staffs and based on discussions with these directors, there is good evidence to believe that women agricultural graduates will find employment.

VII. IMPACTS

It is quite likely that the successful integration of teaching, research, and outreach as proposed under this project will have spread effects of at least two dimensions. First, it should support efforts from some quarters to reverse the earlier GOP policy decision that separated agricultural research from the agricultural universities. Hopefully, their action will be taken before this project has matured to the point of making an incontrovertable case for integration. If not, successful execution of this project should help.

A second spread effect will be in developing an institution building model that can be applied in Baluchistan when an agricultural university is established there. Some exposure to the NWFP-AU will already have taken place since a number of seats are reserved for Baluchistan students at NWFP-AU. Thus, an opportunity will exist for replication of applicable ideas and experiences from this project in Baluchistan.

The impact of developing the NWFP-AU into an effective and vital institution will be felt beyond the life-of-project. The NWFP-AU plays a role that is uniquely different from that of agricultural universities in most developing countries and certainly different than any western agricultural university. The NWFP-AU is the source of professional level training in agriculture for the entire NWFP agricultural establishment - all GONWFP agriculturally related agencies, parastatals, and to a large extent the private sector. This is the result of a conscious policy of not hiring "outsiders" into NWFP agricultural agencies. One is struck by the fact that every research institute, research stations, the Extension Directorate, the Animal Husbandry and other Departments, the Agricultural Development Corporation, the Agricultural Bank and so on, are staffed, almost without exception, by graduates of NWFP-AU and its predecessors. This provides both a unique opportunity and an awesome responsibility. It also entails some risks as discussed below. The NWFP-AU, sitting astride the flow of professional agricultural manpower into the establishment, can have a major beneficial impact by raising the quality of its graduates as proposed under this project.

The intermediate and long-run impact on agricultural productivity and farmer income and welfare will come from the teaching role discussed above and from agricultural technology improvements and effective outreach.

Eduational opportunities at NWFP-AU are provided to disadvantaged social groups through reserved seats. At present, 20 seats are reserved for tribal students, 7 seats for Kasmir and Northern Areas, and 2 seats for Baluchistan students. It is intended to increase these reserved seats as the capacity of the University expands and as the demand increases, e.g. the reserved seats for students from Baluchistan will be increased to 20. A new program is being developed for women whose education will be integrated with that of men students, consistent with religious and cultural norms in the NWFP.

Traditional extension delivery techniques have a tendency to be "captured" by the more progressive and more influential farmers resulting in inequitable access to available technology. The mass communication techniques to be developed and used in the outreach program will provide more equitable access to new technology by the entire farming community.

While the unique character of the NWFP socio-culturally related practice that virtually avoids acceptance of non-NWFP people into the system and therefore provides a unique opportunity for the AU to raise the overall level of competence of the NWFP agricultural establishment and the eventual decline in quality of graduates from lack of infusion of new and different ideas. This should not be a problem for the first decade or so

since faculty will be exposed to various institutions, ideas, and ways of doing things through U.S. training.

Since changing NWFP hiring practices is not likely a very fruitful endeavor in the short-run, and there will not be a problem until the intermediate to long-run, i.e. substantially beyond the life of this project, it would behoove the NWFP leadership to begin to think about ways to cope with this prospective problem.

One obvious answer would be to outline the infusion of new ideas into the system through continued training outside NWFP - in other institutions in Pakistan, at the IARC's, and in the U.S. and other developed countries. Effective use in the NWFP of PARC's Talent Pool, even on temporary assignments, could infuse new ideas and new ways of doing things into the agricultural establishment.

The first step in working out a solution to this problem is recognition by NWFP leadership that it will be a problem. Then a deliberate course of action should be developed, consistent with local customs and values, that will provide the stimulation and growth in the system resulting from a continuous infusion of new ideas and the latest in applicable technology. Over the long-run, with this kind of effort, customs, values and hiring practices in NWFP may change.

VIII. ISSUES

It is expected that the recently adopted Islamic law will have a substantial effect on the agricultural sector, but scholars are unclear as to what will be the long-term consequences.

Therefore, it is too early to determine what indirect effects the Islamic law will have on the Agricultural University, as reflected back through the economic system. However, as Nazeer has pointed out, "The duty of an Islamic State does not end simply with the furnishing of opportunities to work. It must enlarge and improve the capacities of the individual citizen by means of education, vocational guidance and technical training."[22]

[22] Mian M. Nazeer, The Islamic Economic System: A Few Highlights, Essays in Islamic Economic Philosophy No. 2. Pakistan Institute of Development Economics, Islamabad, August 1981, p. 30).

APPENDIX G

AGRICULTURE OF THE NORTHWEST FRONTIER PROVINCE

A. The Environment

The NWFP lies in the extreme northwest of Pakistan. From southwest to northeast it is about 450 miles long and roughly 90 miles wide. Elevations vary from 500 ft. above sea level in southern D. I. Khan to 25,000 ft. in Chitral District (Hindu Kush range). Most of the cultivated land is in the valleys of the Indus, Kabul, and Kurram rivers, and in the D. I. Khan plain and the Bannu Basin.

The Kabul river, running west to east, picks up the Kunar, Dir and Swat rivers, which drain the Malakand and parts of Peshawar Divisions and the northern Agencies, before joining the Indus which drains the remainder of northeast NWFP, including Hazara and parts of Peshawar Divisions. Further south the Kohat, Kurram, and other tributaries of the Indus drain the remainder of the Peshawar Division, D. I. Khan, and the southern agencies (see Figure 3.1).

The climate of NWFP is classified as semi-arid to mediterranean. Rainfall in D. I. Khan and the southern Agencies ranges from 8 to 20 inches as one moves south to north (see Figure 3.2). The Peshawar plain has 14 to 26 inches while the southern portion of the Malakand Division ranges up to 44 inches. The highest rainfall (50+ inches) is in the eastern Hazara Division. There are other isolated high rainfall areas in mountainous areas in western NWFP. In the west rainfall tends to peak in the spring (March/April) whereas in the east (particularly the northeast)

there tends to be a bi-modal distribution caused by monsoonal influences.

B. Land Use

The total geographic area of the NWFP is 10.2 million ha, of which 7.45 million ha is in settled areas and 2.72 million ha in federally administered areas (see Table G.1). The total cultivated area in 1979-80 was 1.96 million ha comprised of 1.53 million ha net sown area and 0.43 million ha current fallow (see Table G.2). The total cropped area is 1.91 million ha including 0.38 million ha double-cropped, which about offsets the fallowed area. The total uncultivated area of 3.41 million ha includes 1.16 in culturable waste, 0.67 in forests, and 1.58 not available for cultivation (See Table G.2).

The total cultivated area has increased about 350,000 ha over the 1970-80 period with about 60% to net sown area and 40% to fallow. The amount of culturable waste has remained stable but the area "not available for cultivation" has declined. All in all, the data do not reflect a vigorous attempt at exploitation of available land resources (See Table G.2). This is further reflected in Table G.2h which shows land use intensity (cultivated area/culturable area) running 60 to 63 percent with perhaps a slight upward trend. Cropping intensity (cropped area/cultivated area) has varied from 97 to 105 percent but with no discernable trend.

C. Farms in the NWFP

There are 650,000 farms in NWFP and they are predominantly small. Nearly two-thirds (63%) are 2 ha or smaller, one-fourth

Table G.1. Land Area, Cultivated Area and Irrigated Area, 1980-81, in Districts and Divisions in Northwest Frontier Province, Pakistan

District/Division or Agency	Land Area[1] settled	Land Area[1] FATA*	Cultivated area[2]	% Cultivated	Irrigated area	% of cultivated irrigated
	thousand hectares					
Peshawar	400.2	26.2	195.6	46	137.0	70
Mardan	313.7		198.6	63	110.8	56
Kohat	701.1	17.1	159.4	22	24.7	15
Peshawar Division	(1,415.0)	(43.3)	(553.6)	(38)	(272.5)	(49)
Abbottabad	384.3		163.3	42	16.8	10
Mansehra	573.2		98.5	17	21.6	22
Kohistan	457.4		---	--	--	--
Hazara Division	(1,414.9)		(261.8)	(19)	(38.4)	(15)
D. I. Khan	900.5	323.0	371.3	30	104.6	28
Bannu	439.0	87.8	249.2	47	79.5	32
D.I. Khan Division	(1,339.5)	(410.8)	(620.5)	(35)	(184.1)	(30)
Swat	1,174.3		122.7	10	58.2	47
Dir	528.1		95.1	18	71.5	75
Chitral	1,485.1		18.1	1	16.4	91
Malakand	95.3		45.4	48	33.1	73
Malakand Division	(3,282.8)		(281.3)	(9)	(179.2)	(64)
Sub-total. Settled Areas	(7,452.2)		(1,717.2)	(22)	(674.2)	(39)
Bajaur		129.0	114.1	88	4.8	4
Mohmand		229.7	10.1	4	4.9	48
Khyber		257.7	14.8	6	13.3	90
Orakzai		181.3	16.1	9	0.1	1
Kurram		338.0	17.2	5	16.1	94
N. Waziristan		470.6	6.9	1	6.8	98
S. Waziristan		662.0	26.1	4	8.6	33
Sub-total, Agencies		(2,268.3)	(205.3)	(9)	(54.6)	(27)
Sub-total, Tribal Areas*		(2,722.4)				
TOTAL	10,174.6		1,922.5	19	728.8	38

*Federally Administered Tribal Areas (FATA)

[1]Source: Development Statistics of NWFP, Planning and Development Department, GONWFP, 1980.

[2]Source: Agriculture in Figures, Statistical section, ARI Tarnab, 1983, p. 112.

Table G.2. **Land Utilization in N.W.F.P.** (000 Hectares)

Year	Reported Area (3+8)	Cultivated Area			Cropped Area		Un Cultivated Area			
		Total (4+5)	Net Area Sown	Current Fallow	Total (4+7)	Area Sown more than once	Total (9+10+11)	Culturable waste	Forest	Not Available for Cultivation
1	2	3	4	5	6	7	8	9	10	11
1964-65	4233.1	1312.6	1152.2	160.4	1334.9	182.7	2920.5	1170.5	153.5	1596.5
1965-66	4634.4	1589.2	1281.4	307.8	1850.4	569.0	3045.2	1130.3	384.4	1530.5
1966-67	4749.0	1797.8	1212.6	585.2	1436.5	223.9	2951.2	1146.1	249.9	1555.2
1967-68	4323.7	1485.5	1235.6	249.9	1403.3	167.7	2838.2	1041.7	250.3	1546.2
1968-69	4694.0	1571.8	1221.5	360.3	1370.5	149.0	3122.2	1116.6	385.2	1620.4
1969-70	4759.2	1530.5	1269.7	260.8	1468.1	198.4	3228.7	1248.2	360.9	1619.6
1970-71	5161.8	1601.4	1289.9	311.5	1558.8	268.9	3560.4	1051.4	777.2	1731.8
1971-72	5011.9	1620.0	1345.8	274.2	1656.0	310.2	3391.9	1052.2	605.5	1734.2
1972-73	5090.4	1628.5	1391.2	237.3	1613.5	222.3	3461.9	1181.0	658.1	1622.8
1973-74	5185.6	1834.7	1547.9	286.8	1786.5	238.6	3350.9	1079.7	681.6	1589.6
1974-75	5190.4	1793.3	1448.2	345.1	1743.9	295.7	3397.1	1144.5	662.6	1590.0
1975-76	5190.5	1810.0	1443.0	369.0	1820.9	379.9	3380.5	1130.0	721.7	1528.8
1976-77	5190.6	1878.7	1518.1	360.6	1878.0	359.9	3311.9	1088.3	722.2	1501.4
1977-78	5186.7	1901.8	1470.8	431.0	1816.7	345.9	3284.9	1095.6	721.3	1466.0
1978-79	5186.8	1901.6	1514.7	386.9	1991.7	477.0	3285.2	1048.4	665.5	1571.3
1979-80	5355.4	1956.2	1530.0	426.2	1907.6	377.6	3399.2	1156.0	665.5	1577.0

Source:- Directorate of Agriculture Government of N. W. F. P.

Table G.2A Cropping Intensity and Land use Intensity in N.W.F.P.

Year		Intensity of Cropping	Intensity of Land use
1970-71	..	97.34	68.37
1971-72	..	102.23	60.62
1972-73	..	99.08	57.96
1973-74	..	97.37	62.95
1974-75	..	97.25	61.04
1975-76	..	100.60	61.56
1976-77	..	99.96	63.32
1977-78	..	95.52	63.45
1978-79	..	104.74	64.46
1979-80	..	97.52	62.66

Note: Cropping intensity = $\frac{\text{Cropped area}}{\text{Cultivated area}} \times 100$

Land use intensity = $\frac{\text{Cultivated area}}{\text{Culturable area}} \times 100$

Source: Compiled by Bureau of Statistics, N.W.F.P.

Total Culturable area includes the Cultivated area and Culturable waste area.

(24%) fall in the 2 to 5 ha range, eight percent in the 5 to 10 ha range, and the remaining five percent above 10 ha (See Table G.3).

The control of farm area by size category of farms is quite skewed. The smallest size category (0 - 2 ha) controls only 13% of the area in farms even though representing 63% of all farms. On the other end of the scale, 5% of the farms control nearly half (47%) of the area in farms. In the two middle sized categories, the percentages are more comparable (see Table G.3).

The distribution of farms by size in the Peshawar Division is similar to the NWFP. However, farms in the Malakand Division are smaller (84% 0-2 ha) and in the D.I. Khan Division substantially larger (27% 0-2 ha and 32% over 10 ha). This presumably reflects agro-climatic and topographic characteristics of the various Divisions.

D. Crop Production

1. Major Crops

The major food grains grown in NWFP based on gross value of output (See Table G.4) are wheat, maize, and rice in that order. Secondary food crops are barley, rapeseed and mustard, gram, and sorghum and millets in that order. Fruits and vegetables, collectively, rank next to wheat. Both sugarcane and tobacco occupy substantial acreages and contribute to gross farm receipts. Sugarcane ranks third behind maize, while tobacco ranks fifth behind vegetables.

Table G.3. Number of Farms by Size of Farm[1]

Division	Unit	All farms	0-2 ha	2-5 ha	5-10 ha	Over 10 ha
Peshawar	No.	219,707	127,055	68,599	19,317	4,736
	%		58	31	9	2
Hazara	No.	173,063	110,942	47,300	11,307	3,514
	%		64	27	7	2
D. I. Khan	No.	73,156	19,711	17,002	13,295	23,148
	%		27	23	18	32
Malakand	No.	183,641	153,741	22,711	5,253	1,936
	%		84	12	3	1
NWFP[2]	No.	649,567	411,449	155,612	49,172	33,334
	%		63 (13)	24 (23)	8 (17)	5 (47)

1 Refers to private farms. There are 48 government farms in NWFP.

2 The percentage figures for NWFP that are in parentheses are the proportion of total land in farms controlled by that size category. Such data were not available for Divisions.

Table G.3A Number of Farms by Size of Farm in N.-W. F. P and FATA.

District/Division/Agency	All Farms	Govt. Farms	Total Private Farms	Private Farms by Size: Under 1.0 Acres	1.0 to under 2.5 Acres	2.5 to under 5.0 Acres	5.0 to under 7.5 Acres	7.5 to under 12.5 Acres	12.5 to under 25.0 Acres	25.0 to under 50 Acres	50 to under 150 Acres	150.0 Acres and above
Peshawar	93,529	6	93,523	13,778	22,196	22,398	15,111	12,215	6,262	1,352	190	21
Mardan	77,847	5	77,842	8,162	18,155	19,259	12,771	12,09[illegible]	6,0[illegible]	1,091	238	57
Kohat	48,347	5	48,342	4,370	7,896	10,841	6,959	9,453	7,036	1,497	264	26
Hazara	1,73,074	11	1,73,063	24,568	41,387	44,987	25,224	22,076	11,307	2,635	801	78
Peshawar Division	3,92,797	27	3,92,770	50,878	89,634	97,485	60,065	55,834	30,624	6,575	1,493	182
D. I. Khan	33,408	13	33,395	888	1,344	1,856	2,385	4,008	6,669	7,148	7,214	1,883
Bannu	39,769	8	39,761	3,860	5,415	6,348	4,690	5,919	6,626	4,802	2,019	82
D. I. Khan Division	73,177	21	73,156	4,748	6,759	8,204	7,075	9,927	13,295	11,950	9,233	1,965
Swat	96,061	..	96,061	20,841	38,278	21,695	7,202	4,707	2,616	514	186	22
Dir	66,151	..	66,151	17,296	26,195	12,050	4930	2,635	2,064	492	340	129
Chitral	21,429	..	21,429	4,364	8,089	4,933	2,058	1,179	553	159	61	33
Malakand Division	1,83,641	..	1,83,641	42,501	72,562	38,678	14,190	8,521	5,253	1,165	587	184
N. W. F. P.	6,49,615	48	6,49,567	98,127	1,68,955	1,44,367	81,330	74,282	49,172	19690	11,313	2,331

Table G.4. 3-Year Average Acreage, Production, Yield, Price, and Gross Value of Major Crops, NWFP, 1977-78, and 1979-80.[a]

Crop	Area (000 ha)	Production (000 MT)	Yield (kg/ha)	Price[b] (Rs./MT)	Value (000 Rs.)
Maize	336	417.2	1,242	1,587	662,105
Rice	67	97.7	1,458	1,764	172,269
Sorghum	33	14.9	458	1,273	19,015
Millet	26	11.1	429	1,751	19,494
Sugarcane	92	3,580.6	38,800	158	566,046
Tobacco	30	45.6	1,507	9,020[d]	411,312
Wheat	716	745.6	1,042	1,447[c]	1,078,946
Gram	117	30.8	263	2,123	65,386
Barley	60	48.1	809	1,686	81,090
Oilseeds[e]	49	25.1	514	2,904	72,977
Fruits	17	205.4	12,000	1,116[d]	229,260
Vegetables	22	295.7	13,600	1,562[d]	461,821
TOTAL					3,839,616

[a]Source: "Development Statistics of NWFP," Planning and Development Department, Bureau of Statistics, Government of NWFP, 1980. Preliminary data for 1980-81 were too erratic to be used.

[b]Prices are annual average wholesale procies for the Karachi market. Price data for NWFP were not available. Karachi prices are considered suitable for the purpose at hand. Source: "Pakisan Agriculture Data Book," O/ARD, USAID Mission, Pakistan, June 1982, Table 10.2

[c]Wheat prices are the arithemetic average of Maxi Pak, Dara (Lahore), and C-591 (Lahore).

[d]These prices taken for IBRD Report No. 217a-PAK, Annex 1, Table 16. 1977-78 prices were inflated by 10% to aproximate the 3-year average of the other commodities.

[e]Includes rapeseed and mustard.

2. Crop Yields

Table G.5 reports crop yields for the period 1970-71 to 1979-80. There are some apparent inconsistencies in the data but, overall, they indicate a stagnant yield trend for maize, sorghum, sugarcane, and rapeseed and mustard. Wheat (500 kg/ha), rice (300 kg/ha), and barley (130 kg/ha) show the most substantial yield increases. Millets and gram are up slightly. Ignoring 1970-71 and 1971-72 data, which are about 45 percent higher than the remainder of the series, tobacco yields are also stagnant.

Table G.5A provides comparative yield data for Pakistan and Punjab Province and the U.S. and Asia for selected crops. Yield levels in NWFP compare favorably with Pakistan and Punjab Province. Except for wheat, which is about 50% higher for Pakistan and Punjab Province, NWFP yields run only slightly below yields in both Pakistan and Punjab Province. NWFP outyields Punjab Province in both rice and tobacco.

The substantially higher yield levels for rice, wheat, sugarcane, and oilseeds in the U.S. reflect some of the potential for increasing yields in NWFP. Rice, wheat, and sugarcane yields in Asia are higher than in the NWFP, whereas oilseed yields are comparable.

With the exception of wheat the NWFP-UA will have to look outside of Pakistan for genetic materials, cultural practices, or other factors to increase the productivity of NWFP agriculture. The IBRD Appraisal Report for the Mardan SCARP[9-1] gives yield

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[9-1] "Salinity Control and Reclamation Project (SCARP) Mardan," IBRD Appraisal Report No. 2179a-PAK, January 1979, pp. 7 and 8.

Table G.5. Yield per Hectare of Major Crops

Name of crop	Yield per hectare (kilogram)									
	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79	1979-80
Kharif										
Maize	1,115	1,099	1,062	1,236	1,249	1,310	1,219	1,224	1,241	1,260
Rice	1,222	1,088	1,261	1,260	1,257	1,341	1,350	1,333	1,482	1,559
Jowar (sorghum)	494	484	514	521	502	495	496	399	471	497
Bajra (millet)	381	322	332	309	380	385	376	429	434	425
Sugar cane	38,271	39,646	37,931	38,899	39,050	39,052	39,144	39,061	37,959	39,231
Tobacco	2,394	2,140	1,540	1,517	1,482	1,266	1,497	1,414	1,477	1,632
Rabi										
Wheat	561	741	854	876	882	933	992	989	1,047	1,088
Gram	228	235	336	313	344	343	403	403	190	206
Barley	674	682	717	731	760	770	761	817	811	797
Rape seed and mustard	480	487	571	576	533	521	525	525	531	481

Table G.5A. Comparative Yields in kg/ha

Crop	N.W.F.P. 3 yr. avg. yield kg/ha 1977-78 to 1979-80	Pakistan (overall) (1979-80)	Punjab Province (1979-80)	U.S. (1978-79)	Asia (1978-79)
Maize	1,242	1,248	1,291		
Rice	1,458	1,581	1,287	5,140	2,640
Jowar (sorg.)	458	588	555		
Bajra (millet)	429	494	534		
Sugar cane (MT)	39	38	39	85	50
Tobacco	1,507	1,561	1,403		
Wheat	1,042	1,563	1,598	2,301	1,500
Gram	263	278	245		
Barley	809	741	766		
Rapeseed and mustard	514	604	642	1,902	565

Source: "Pakistan: Agricultural Data Book," USAID, Pakistan, June 1982, Tables 2.11 and 2.22.

potentials under irrigated conditions for the Vale of Peshawar as follows:

Crop	Current yield (MT/ha)	Potential yield (MT/ha)
Sugarcane	31.25	75
Maize	1.25	5
Wheat	1.50	3.75
Tobacco	1.25	1.75

3. Cropping Patterns

NWFP agriculture heavily emphasizes wheat (53% of total acreage of major crops) and maize (25%). Six percent of Provincial major crop acreage is in sugarcane and two percent in tobacco, both high value crops. Rice has five percent. The remaining crops, including all fruits and vegetables lumped together, cover about two percent each (see Table G.6).

The Peshawar Division has a dominant place in Provincial agriculture, highlighted by 91% of the tobacco and 84% of the sugarcane acreage. It has about a third of the wheat, maize, and fruits and vegetables and nearly 40% of the sorghum and millet. This represents a well diversified crop agriculture.

Hazara, on the other hand, has a third of the maize acreage and a little over 10% each of the wheat and rice acreage. These three crops represent 96% of Hazara's cropped area.

Nearly half of Malakand's major crop area is wheat, one-fourth maize, and 16% in rice, which is two-thirds of the

TABLE C.6. PERCENTAGE DISTRIBUTION OF THE AREA OF MAJOR CROPS BY DIVISION (COL. A) AND PERCENTAGE DISTRIBUTION OF THE AREA OF MAJOR CROPS BY CROP FOR EACH DIVISION (COL. B), 1979-80

Division/Crop	Wheat		Maize		Rice		Sugarcane		Sorghum		Millet		Tobacco		Rape seed and mustard		All fruits and vegetables		Total	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Peshawar	34	50	35	24	3	*	85	14	24	1	57	2	91	5	25	2	30	2	37	100
Hazara	12	40	34	53	11	3	*	*	4	*	1	*	4	*	7	1	5	1	16	100
Malakand	17	48	19	24	66	16	6	2	--	--	--	--	5	1	27	4	32	5	19	100
D. I. Khan	28	70	5	6	10	2	6	2	72	7	42	5	*	*	40	6	24	4	21	100
FATA	9	66	7	23	10	6	3	3	--	--	--	--	*	*	1	*	6	2	7	100
NWFP	100	53	100	24	100	5	100	6	100	2	100	2	100	2	100	3	100	3	100	100

* Less than 1/2 of one percent.

-- None reported.

Provincial rice acreage. Fruits and vegetables occupy 5% of Malakand's cropped area which is a third of the Provincial area.

D. I. Khan has 28% of the Provincial wheat acreage but this is 70% of D. I. Khan cropped area. Sorghum and millet occupy 10% of D. I. Khan cropped area which is over 55% of the Provincial area. D. I. Khan has two-fifths of Provincial oilseed area and a fourth of all fruits and vegetables, including about 60% of Kharif vegetables.

The FATA cropping patterns are dominated by wheat (67%) and maize (23%), but they show a balance in other crops - rice (6%), sugarcane (3%) and fruits and vegetables (3%). No sorghum or millet is reported and only minor acreages of tobacco and oilseeds. The arable area in the Agencies is intensively cultivated in the small, narrow valleys. A number of the Agencies have more than 90% of the cultivated area under irrigation but only minor portions of the total area are cultivated (see Table G.1).

One significant characteristic of NWFP agriculture is the highly complex cropping pattern on individual farms, particularly irrigated farms. Three crops per year are grown in many areas, with intercropping of some crops in addition. Young orchards are intercropped with various cereals and forage crops. These complex cropping systems require a higher level of managerial competence than mono-cultural agriculture, and place a much heavier demand on the research and outreach system.

4. Crop Distribution

Some crops, such as wheat and maize, are widely distributed over the Province and grown in significant amounts in all

Divisions. Other crops are rather heavily concentrated in one or more Divisions, such as tobacco and sugarcane, of which 91 and 84 percent, respectively, are grown in Peshawar, or rice, 67% of which is grown in Malakand. Malakand also has a predominant place in fruits and vegetables, followed closely by Peshawar. Sorghum, millet and oilseeds are most heavily concentrated in D. I. Khan, followed by Peshawar. More specifically:

Wheat: Wheat acreage is distributed more widely over the Province than most other crops. About a third is in Peshawar, 28% in D. I. Khan, 17% in Malakand, with smaller acreage in Hazara (12%) and FATA (9%).

Maize: Maize acreage is also widespread but with significant concentration in Peshawar (35%) and Hazara (34%), and a substantial area (19%) in Malakand. Maize in D. I. Khan (5%) and FATA (7%) is minor.

Rice: Rice is heavily (67%) concentrated in Malakand, with the remainder about equally distributed in Hazara, D. I. Khan, and FATA.

Sugarcane: Most (84%) of the sugarcane is in Peshawar, with minor crops in the other Divisions.

Sorghum and Millet: The bulk (58%) of the sorghum and millet is grown in D. I. Khan. The remainder (40%) is grown in Peshawar.

Tobacco: Most (91%) of the tobacco is grown in Peshawar. Minor acreages are grown in Malakand (5%) and Hazara (4%).

Oilseeds: Rapeseed and mustard are widely distributed throughout the Province. D. I. Khan predominates with about 40%

of the acreage, followed by Malakand (27%), Peshawar (25%), and Hazara (7%).

Vegetables (Kharif and Rabi): Vegetable acreage is fairly widely spread throughout the Province, with concentrations in D. I. Khan (40%), Malakand (28%), Peshawar (23%), and the remainder about equally divided between Hazara and the FATA.

Fruits (Kharif and Rabi): Fruits are also widely distributed over the Province with most of the acreage accounted for by two Divisions - Malakand (38%) and Peshawar (35%). The remaining 28% is fairly equally divided between Hazara, D. I. Khan, and FATA.

E. Irrigation

Nearly half (47%) of all crops grown in NWFP are irrigated. Rice, tobacco, sugarcane, onion, and both Kharif and Rabi fruits and vegetables are 100 percent irrigated (See Table G.7, data for 1979-80). Potatoes are 85% irrigated, maize 58%, barley 23%, and sorghum and groundnut 18%. Only minor portions of other crops are irrigated.

The total area irrigated increased (17%) from 657,000 ha in 1970-71 to 768,000 ha in 1979-80. However, the total area of crops grown was increasing about parallel, leaving the proportion of crops grown that are irrigated essentially the same from 1970-71 to 1979-80 (calculated from Table G.7), i.e. 47%.

Of the total area under irrigation in NWFP, the Peshawar Division has 38%, Hazara 5%, and FATA 7%. The other half is evenly divided between D. I. Khan (25%) and Malakand (25%).

Table G.7. Area and Production of Different Crops Season-wise in NWFP for Irrigated and Un-irrigated Areas

Name of crop	1970-71 Irrigated A	1970-71 Irrigated P	1970-71 Un-irrigated A	1970-71 Un-irrigated P	1970-71 Total A	1970-71 Total P	1979-80 Irrigated* A	1979-80 Irrigated* P	1979-80 Un-irrigated A	1979-80 Un-irrigated P	1979-80 Total A	1979-80 Total P
Kharif crops												
Maize	203.0	268.2	117.8	89.6	320.8	357.8	203.0 (58)	336.1	144.8	102.3	347.8	438.1
Rice	53.8	65.9	.2	.1	54.0	66.1	67.2 (100)	104.7	--	--	67.2	104.7
Jowar (sorghum)	5.7	3.9	18.9	8.2	24.5	12.1	5.9 (18)	4.0	24.7	11.2	30.6	15.2
Bajra (millet)	3.0	1.4	24.8	9.1	27.8	10.6	1.7 (7)	.9	21.6	9.0	23.2	9.9
Sugar cane	78.7	3,052.1	2.1	40.2	80.8	3,092.3	85.5 (98)	3,385.0	1.6	32.0	87.1	3,417.0
Tobacco	32.8	78.8	.2	.2	33.0	79.0	31.0 (100)	50.6	--	--	31.0	50.6
Cotton	1.9	.4	.1	.01	2.1	.4	2.0 (93)	.4	.2	.03	2.2	.4
Sesamum	.04	--	1.3	.3	1.3	.3	.06	.02	.8	.2	.9	.22
Ground nuts	.6	1.0	.5	.8	1.1	1.8	.5 (18)	1.0	2.3	3.6	2.8	4.6
Kharif fruits	6.3	79.5	--	--	6.3	79.5	12.9 (100)	140.6	--	--	12.9	140.6
K. vegetables	6.8	136.1	--	--	6.8	136.1	16.1 (100)	223.1	--	--	16.1	223.1
K. pulses	--	--	29.4	11.7	29.4	11.7	--	--	--	--	19.2	12.0
Sugarbeet	--	--	--	--	--	--	--	--	--	--	13.2	29.8
Total	392.6	3,687.3	195.2	160.3	587.9	3,847.7	425.9 (65)	4,246.4	195.9	158.4	654.2	4,446.9
Rabi crops												
Wheat	230.2	181.5	359.9	149.5	590.2	330.9	298.7 (40)	441.4	446.7	369.4	745.4	810.8
Gram	4.1	1.1	74.4	16.8	78.6	17.9	6.8 (6)	.02	108.0	.2	114.9	.3
Barley	9.4	7.9	43.9	27.9	53.3	35.9	12.4 (23)	13.4	42.4	30.2	54.7	43.6
Onion	2.6	27.1	--	--	2.6	27.1	2.6 (100)	1.4	3.0	.01	2.6	31.4
Potato	4.1	42.9	--	--	4.1	42.9	7.2 (85)	70.6	1.2	8.2	8.5	78.8
Rape seed & mustard	4.3	2.0	56.2	26.9	60.4	29.0	3.8 (9)	2.1	38.8	18.3	42.6	20.5
Rabi fruits	4.2	32.5	--	--	4.2	32.5	4.7 (100)	40.7	--	--	4.7	40.7
Rabi vegetables	2.9	38.4	--	--	2.9	38.4	5.9 (100)	79.3	--	--	5.9	79.3
Rabi pulses	2.8	1.7	4.7	1.3	7.5	3.0	--	--	--	--	4.4	2.1
Total	264.6	335.2	539.1	222.4	803.7	557.6	342.1 (35)	679.1	637.1	426.3	983.7	1,105.4

Reference: A = Area in (000) ha
P = Production in (000) MT

* Numbers in parentheses are the percent irrigated is of total crop acreage.

Irrigated yields naturally run higher than rainfed yields. The following comparisons are taken from Table G.7 for 1979-80.

Crop	Irrigated kg/ha	Unirrigated kg/ha
Maize	1,656	707
Sorghum	675	453
Sugarcane	39,591	19,394
Wheat	1,478	827
Barley	1,086	712

E. Technology Growth

A few indicators are available regarding the adoption of modern agricultural technology in the NWFP. Total sales of fertilizer (Table G.8) increased from 17,230 nutrient tons in 1970-71 to 69,476 nutrient tons in 1979-80, about four-fold. The ratio of N to P_2O_5 was 5.5 to 1 in 1970-71 and 4.2 to 1 in 1979-80 reflecting a better balance in fertilizer application. Application of K_2O grew, but is relatively inconsequential. Fertilizer use is very heavily skewed toward the Peshawar Division which represents 78% of all fertilizer sales. The remaining 32% is about equally divided between Hazara, D. I. Khan, and Malakand.

The total number of tractors increased from 1,570 in 1970-71 to 4,482 in 1979-80, about three-fold. This may reflect a substitution of power for scarce farm labor, but more likely a substitution of mechanical for animal power in land preparation--a heavy power consumer. In any case, one tractor per 425 ha of cultivated land does not suggest over-mechanization. Tractor

Table G.8. Total Sale of Fertilizers in N-.W.F.P. by types.

(Nutrient Tons)

Years		Total	Type of Fertilizer		
			N	P_2 05	K
1970-71	..	17,230	14,454	2,617	159
1971-72	..	32,248	28,574	3,653	21
1972-73	..	33,053	28,915	4,107	31
1973-74	..	26,902	23,734	3,084	84
1974-75	..	24,996	22,118	2,682	196
1975-76	..	38,227	30,947	6,992	228
1976-77	..	52,309	43,973	8,150	186
1977-78	..	51,026	41,570	9,207	249
1978-79	..	58,582	45,749	11,979	854
1979-80	..	69476	55494	13180	802

Source (i) Agriculture supplies organization Ministry of Food and Agriculture Goverment of Pakistan.

(ii) Agricultural Development Authority, Government of N.W.F.P.

Table G.9. Fertilizer* Sales by Division, 1979-80

Division	N	P_2O_5	K_2O	Total
Peshawar	44,513	9,452	533	54,498
Hazara	4,309	896	114	5,319
D. I. Khan	3,173	1,416	-	4,389
Malakand	3,499	1,416	155	5,070
N.W.F.P.	55,494	13,180	802	69,476

Table G.10.Tractor Population in N.W.F.P.*

(In Nos)

Year	Government Owned	Private	Total
1970-71	90	1,480	1,570
1971-72	96	1,664	1,760
1972-73	N.A.	N.A.	1,934
1973-74	75	1,855	1,930
1974-75	52	2,368	2,420
1975-76	97	2,567	2,664
1976-77	91	2,975	3,066
1977-78	84	3,113	3,197
1978-79	87	3,258	3,345
1979-80	103	4,379	4,482

*Includes FATA

Source:—Directorate of Agriculture Government of N.W.F.P.

Table G.11.Tractor Population by Division, 1979-80

Division	No. of Tractors
Peshawar	2,119
Hazara	152
D. I. Khan	1,041
Malakand	769
N.W.F.P.	4,081
FATA	401
GRAND TOTAL	4,482

numbers are also skewed in favor of Peshawar Division but not as heavily as fertilizer sales. This Division has 52% of all tractors in NWFP. D. I. Khan has 25%, Malakand 19%, and Hazara 4%.

One further indication of technology adoption is the amount of seed treated. This has increased from almost 2,000 MT in the early 1970's to 3,400 MT in the late 1970's, an increase of about three-fourths.

A final indicator of technology application is the proportion of a particular crop to HYV seeds. Published data are available only for wheat and rice. Sixty-five percent of all wheat was planted to HYV seeds, whereas only 15 percent of the rice area was so planted. It is reported that as much as 90% of the sugarcane is planted to improved varieties.

G. Livestock

The livestock inventory from the 1976 census was as follows:

(1)	NWFP (000) (2)	Pakistan (000) (3)	(2)/(3) (%) (4)
Cattle	3,000	14,855	20
Buffalo	762	10,551	7
Sheep	3,675	18,937	19
Goats	4,686	21,693	22

Note: The addition of camels, asses, horses, and mules gives a total for NWFP of 12.7 million head and for Pakistan 29.6 million head.

NWFP has about 20 percent of the national herd of cattle, sheep, and goats, but only seven percent of the buffalo. Official livestock production data are not available. However, the

following rough estimates of the value of livestock production have been reported.[9-2]

	Rupees (Million)				
	Cattle and Buffaloes	Goats and Sheep	Poultry	Total	Percent
Meat	301.6	272.9	13.8	588.3	23
Milk	1,447.0	185.9	--	1,632.9	65
Hides & Skins	37.8	14.5	--	52.3	2
Wool & Hair	--	90.3	--	90.3	4
Eggs	--	--	71.0	71.0	3
By-products	45.3	26.7	--	72.0	3
Total	1,831.7	590.3	84.8	2,506.8	100
Percentage	73	23	4	100	---

Cattle and buffalo contribute about three-fourths of the estimated value of production and sheep and goats about one-fourth. About two-thirds of total value of livestock production is represented by milk, most of which comes from cattle and buffalo.

Present livestock production systems are very inefficient. The primary constraints to improving livestock performance are the lack, or ineffective use, of feed resources, even though ruminant livestock convert large quantities of low-quality roughage into high-protein food; debilitating diseases; poor management practices by farmers and herders; and government pricing policies that favor urban consumers.

[9-2]Atkinson, R. E. H., "Livestock Reconnaissanse Survey: NWFP," The Livestock Industry of the North-West Frontier Province, 1977.

The above data on value of livestock production combined with value of crop production from Table G.4 provides the only indication of the absolute magnitude of the crop/livestock sector of the Provincial economy. These data show a 60 (Rs. 3,840 million) 40 (Rs. 2,507 million) split between crops and livestock.