RECOMMENDATIONS FOR ESTABLISHING A SOIL SCIENCE CURRICULUM IN THE COLLEGE OF AGRICULTURE, SEOUL NATIONAL UNIVERSITY SEOUL, KOREA

by

Paul M. Burson, Adviser in Agriculture

Seoul National University Cooperative Project

(Professor of Soil Science Institute of Agriculture
University of Minnesota)

Seoul, Korea

November, 1956

MY
q5e61bu

CONTENTS

CONTENTS - 2

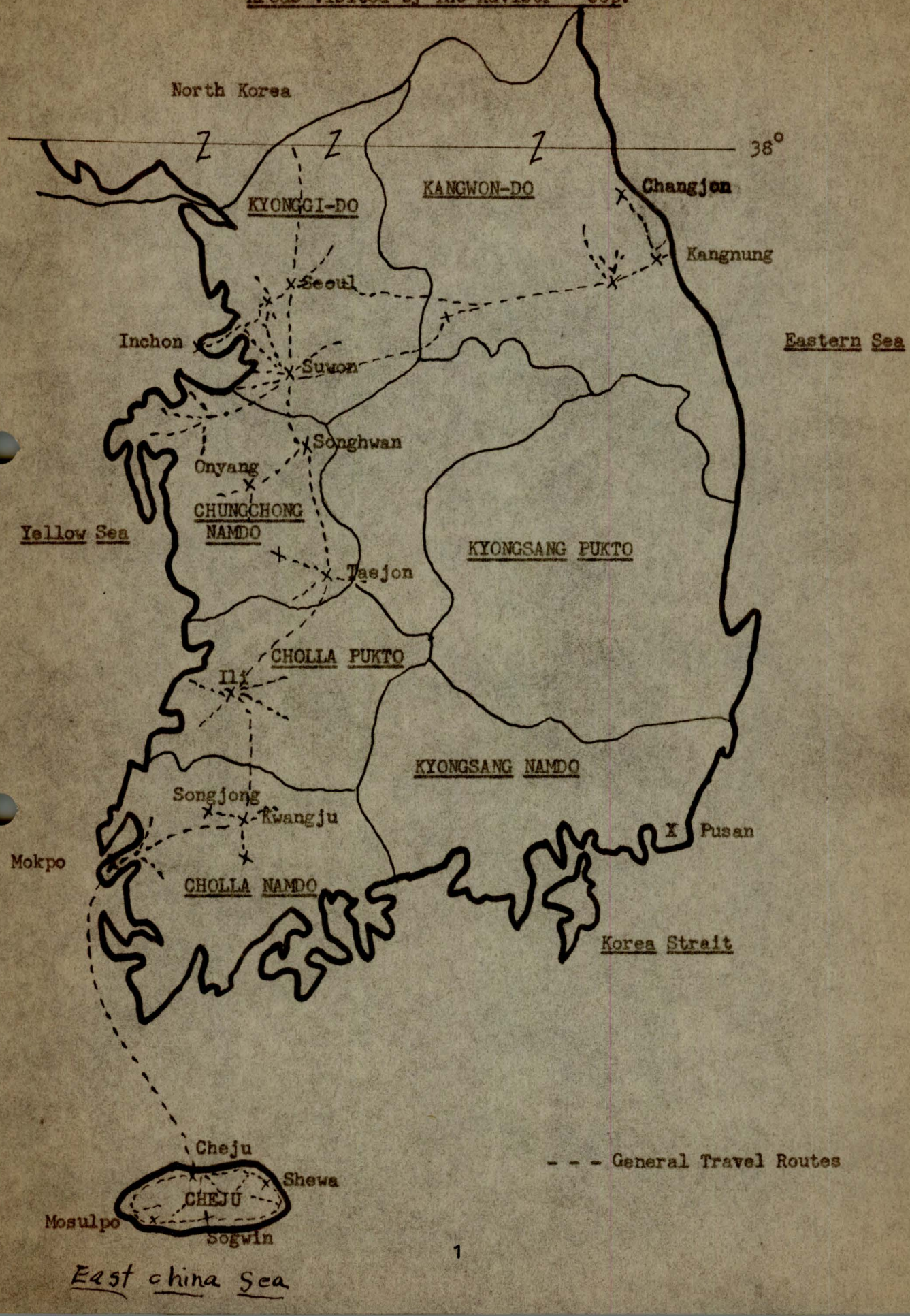
FOREWORD

The following report summarizes recommendations arrived at during the five-month period spent as adviser to the College of Agriculture, Seoul National University, June 11 - November 19, 1956. The activities included conferences with College and Experiment Station staff members, classroom visits, inspection of laboratory facilities and supplies, preparation of a list of supplies and equipment, field trips for College and Experiment Station staff members, laboratory testing demonstrations, visits to substations and staff conferences there, visits to other colleges teaching agriculture and conferences with their staffs, conferences with Ministry of Agriculture and Forestry, Provincial Government and OEC agricultural staff personnel. Based on these activities and the information thus obtained, this report was prepared with the able assistance and advice of Dean of the College of Agriculture, Cho Baik Hyun and Dr. Kim Ho Sik, Head of the Department of Agricultural Chemistry. We all concur in the principles and content of this report.

I want to take this opportunity to acknowledge that my many visits to the College of Agriculture and to staff members have undoubtedly caused considerable extra work and inconvenience. Nowhere could I have received finer cooperation and more genuine courtesies than were given me in this work. Our many fine field trips, conferences and associations will always be remembered. It is my genuine hope that as a result of this cooperative effort in working out a curriculum of Soil Science that we will have taken one more step in making Seoul National University a most effective institution of higher education for the people of Korea.

Paul M. Burson
Adviser in Agriculture
Seoul National University
Cooperative Project

Areas Visited by The Advisor - cop.



SUMMARY OF RECOMMENDATIONS

1. Establish a Soil Science curriculum in the College of Agriculture as a section in the Department of Agricultural Chemistry.

2. Name of Department to be: "Department of Agricultural Chemistry and Soil Science".

3. Develop the curriculum and subject matter on the basis of the soil and agricultural needs of Korea.

4. Develop a program of laboratory teaching including field laboratory activities.

5. Improve classroom teaching techniques by using visual aids such as photography, charts, graphs, movies and demonstrations.

6. Place major emphasis, at the beginning of the new curriculum, on the courses in Soil Fertility and Management, Soil Classification, Genesis and Soil Survey.

7. Establish the Soil Science curriculum on a major and minor basis to allow a student to select his electives as a minor in another department of the College if he so desires.

8. Make arrangements now for the young men who are in the United States studying Soil Science to study Soil Genesis and Classification, and Soil Survey in the classroom, laboratory and field so as to become trained in modern methods and techniques.

9. Every staff member in Soil Science should participate in doing some phase of research work along with his teaching activities.

10. Further develop and expand, with the Central Experiment Station, the program of staff exchange where personnel of both organizations will do both teaching and research.

11. Develop cooperative graduate student research projects with the Central Experiment Station.

12. Develop, with the Central Experiment Station, a program of in-service training during the summer to give prospective soil surveyors, and future graduate students and research workers, field experience while working for their B.S. degree.

13. Develop a student advisory system in the department, to assist students in selecting a course of study to best fit them for their future in the field of Soil Science.

14. Select the prospective outstanding students in the 2nd or 3rd year of their college training who are interested in doing research or extension work and give them special guidance in their selection of courses.

15. The Ministry of Education and the Ministry of Agriculture and Forestry establish a joint committee to study, coordinate and develop a cooperative program of teaching, research and extension.

16. This same or a similar committee to develop a coordinated national program of landuse, by outlining specific responsibilities and the contribution each bureau can make to such a program in agriculture, forestry and education as based on specific bureau data and information.

17. Develop and establish the International system of soil classification, soil survey and landuse.

18. Develop a national landuse or land policy program.

19. Set up a separate section of Soil Science in the Central Experiment Station under the direction of a trained soil scientist who will be responsible for all soil surveys, soil testing and soil research in Korea.

20. Develop a uniform program of soil research throughout all the substations of the Central Experiment Station.

21. Put into each substation three soil scientists, each trained in one of the following fields - Soil Classification and Soil Survey, Soil Fertility and Management, and Soil Testing.

22. Develop a research program in Soil Science with a balance between the practical and fundamental principles. Start this program now with major emphasis on the practical or applied to be followed by selecting the important basic or fundamental problems for more detailed study.

23. Train and develop your own college staff in Soil Science.

INTRODUCTION

The Republic of Korea is in a very critical period of war reconstruction. Many factors will have to be considered in determining what should be done first in developing her program of technical agriculture and particularly as it relates to the problems of landuse, soil fertility, and management and conservation. Economic and social factors resulting from the war and customs of the people will have a definite bearing on what must be done and what can be supported now and in future years. If the Republic of Korea is to become independently strong its agricultural education system must be closely related to its soil and natural resources and to its immediate and future economic needs.

It is well recognized that Korea is an agricultural country. At least 75 percent of its people are directly dependent upon the production, handling and processing of agricultural products for their livlihood. However, Korean agricultural resources are limited. No new major-sized soil areas are available for additional food, fuel and lumber production. Therefore, mainly by application of the most efficient methods of landuse, soil fertility, management and conservation can these soil resources be made to produce enough of the proper kinds of food, fuel and lumber to care for the nation. Many soil areas are low in productivity and are going down at a rapid rate as a result of erosion, poor management and poor landuse. At the same time there is an estimated annual population increase of 1.4 percent, even though the infant mortality rate is 20% to 25% in the first year. This situation must be recognized where there are only limited land resources to produce the food, fuel and lumber to meet needs.

Korea at the present has at least 630 persons per square mile of the total land area which is about one person per acre or about 2.5 per chongbo. Since Korea is a very mountainous country there are about 4 persons per crop acre or about 10 per chongbo. The total estimated population (the exact number

is apparently not known) of about 22,000,000 people must depend on their food coming from about 26 percent of the total land area. Sixty-one percent of these people live on farms and are directly responsible for the actual management of the soil and for the actual production of essential food and fuel crops. This farm population lived on about* 2,234,000 farms with 1,736,000 farms ranging in size from about 1.0 acre or less than 0.5 chongbo to 1 chongbo or about 2.5 acres. Another 374,000 farms range from 1 to 2 chongbos, or 2.4 to 5.0 acres, in size. This makes a total of 2,137,000 farms out of an overall total of 2,234,000 that are 5 acres or 2 chongbos or less in size. In 1949 all holdings over 3 chongbos, or about 7 acres, in size were subdivided according to law with the average-sized farm now being about 0.9 chongbo or 2.2 acres.

This raises a serious problem for the Korean farmer in his struggle of trying to make an economical producing farming unit of so small a size against high costs, high interest rates, inflation and taxes. These conditions show the extreme need for emphasizing technical agriculture as one of the major needs in the reconstruction program along with needed national policy adjustments. The advance in agricultural production must be mainly vertical based on the present limited land area. This requires land to be carefully selected for its use followed by proper fertility, management and conservation of the soil to efficiently produce the maximum amounts of all essential food, fuel and lumber crops per unit area.

It is the purpose of this report for the Adviser in Soil Science to Seoul National University to assist the staff members of the College of Agriculture to develop a curriculum in Soil Science for the purpose of training young men in the fields of landuse, soil classification, fertility, management, soil physics, soil microbiology, soil chemistry and conservation who may become leaders in teaching, research and extension and who can recognize, understand and give

*1955 Year Book of Agriculture and Forestry Statistics

technical assistance in meeting these agricultural problems. This project is made possible through the ICA/University of Minnesota contract involving technical assistance to Seoul National University. The Korea portion of the undertaking is directed by Chief Adviser Dr. Arthur E. Schneider, Seoul, Korea.

The recommendations regarding the setting up of a Soil Science curriculum in the College of Agriculture are based upon observations made by the Adviser after visits and interviews with college staff members; department heads; other agricultural college deans and staff members; experiment station, substation and branch station superintendents, agronomists and staff; Central Experiment Station director and staff members; Ministry of Agriculture and Forestry officials; OEC agricultural specialists; agricultural high school teachers; and outstanding farmers. In these interviews it was the purpose to determine general agricultural problems, educational, research and extension needs, soil problems, and general cooperative relationships between ministries, bureaus, colleges and departments.

The Agricultural Adviser, Paul M. Burson, Professor of Soil Science, Institute of Agriculture, University of Minnesota, assigned to this project by the University of Minnesota, also drew upon more than twenty-five years of experience in agricultural extension, research and teaching. The Adviser has served as a County Extension Agent and as Extension Agronomist at Iowa State College. He further served as Extension Specialist in landuse, soil fertility management, conservation, and in research, teaching and Professor in Soil Science at the University of Minnesota. This service included organization of the Soils Extension Program and the State Soil Testing Laboratory, the organization and planning of the Soils Department Rosemount Experimental Station, conducting field experiments and demonstrations,

work with substations, and teaching and advising students in undergraduate and graduate studies.

PART I

THE SOIL AND AGRICULTURAL PROBLEMS, COLLEGE OF AGRICULTURE

FACILITIES AND NEEDS

Soil Conditions and Crop Production

The geological formations of Korea are derived from materials deposited here during the various geological periods. The climatic conditions with warm temperature and high rainfall have caused the development of certain different soil characteristics as derived from the original parent rock materials. Further information on the geological formations and their analysis is available in a recent publication prepared by Mr. OH Wang Kun of the Central Experiment Station, Suwon, Korea, entitled "Geological Formations and Analysis of Korean Soils."

The soils of Korea are old and have been in production for food, fuel and lumber crops for about 4,000 years. During this long period of use severe erosion has taken place until practically all top soil is gone, many completely barren slopes and mountains exist, and severe gullies have been formed. At the same time soil nutrients were being depleted to a point where the major problem is not now one of conservation but instead is one of rehabilitation. This is the first and foremost agricultural problem if the people are to be assured of sufficient and continued supplies of food, fuel and lumber. The landscape reveals a history of various ages of different land management and landuse. Universally the areas of land observed by the Adviser show the results of severe gully erosion generations and ages ago but for some reason later there was an apparent improved change in land management and use so that these severe erosion conditions were stabalized and Nature healed the scars. Now again Korea is in an era of a repeat of these same age-old serious erosion conditions which have reached a point now where rehabilitation cannot be accomplished without a heavy financial outlay and only by close Ministry, Bureau, Agency and farmer cooperation.

Outside of the Paddy-Upland Soil Association, Korean agriculture is a subsoil agriculture. In these adjacent upland areas that could be called

foothills, as much as two to three feet on an average of the soil has been eroded away and has been deposited on the Paddy-Upland soils below. The Adviser, through his very limited observations, did find some of the foothill soils that apparently had never been disturbed except for having timber removed. Here was found what appeared to be 10 to 16 inches of top soil and as much as 24 to 30 inches of depth before reaching the now exposed subsoil which is generally being farmed in the foothill areas.

Erosion is becoming more serious each year as much of the steeper land adjoining the villages is being scraped down of all protective cover and taken to the villages for the winter fuel supply. Agricultural and forestry advisers in the Ministry estimate that as much as 80% of the annual fuel supply comes from the surface of the land. This includes such materials as grasses, weeds, desirable and undesirable brush, trees and the sweeping and scraping away of all forest litter. These exposed areas are readily observed around villages and extend back several miles or about the distance this material can be carried in by a person. This condition is most noticeable from the air. Such emergency and economic conditions as these mean that the land resources not only must produce food but the fuel and wood supply as well, and must sustain the loss of all natural vegetation that would give some protective cover to the soil.

In many areas where reforestation has been done the young trees are cut and brought in for fuel needs thus defeating the purpose of a reforestation program. The planting of a fuel producing and erosion controlling crop such as Acacia, also known as Black Locust, could be a partial answer to this most pressing and immediate fuel need and at the same time would help greatly to control erosion on these more sloping areas. This crop is a legume, it

will make satisfactory growth under most soil conditions, produces a heavy growth from year to year and develops roots that will help hold and protect the soil from erosion. The leaves provide excellent forage of high quality and nutritive value for winter feeding of poultry and rabbits. The Adviser has observed the growth of this crop on many soils and also on farms and at agricultural high schools where this feeding practice was being followed.

From this continued practice of land abuse it is estimated by Agriculture and Forestry Advisers that at least 700,000 acres of mountain timber land have been completely destroyed and are now devoid of any vegetative cover. From such areas, and from additional areas too steep for cropping or areas at present very poorly managed, it is estimated by various agricultural experts that at least 20,000 chongbos, or 50,000 acres, of Paddy-Land soils are damaged or destroyed annually by deposition from erosion occuring on these adjoining steeper upland areas. Much of the Paddy-land area, according to best information available, was peat at one time but now the peat is covered with anywhere from 5 to 6 feet to more than 50 feet of partially depleted mineral soil eroding from the adjoining steeper upland areas.

On the upland and foothill areas vegetative species of the most desirable kind have disappeared and less desirable ones have come in to take their place as soil acidity has increased and as fertility levels have been reduced. Right now much of the upland soil areas of Korea have reached the lower end of the vegetative scale where much sedge and brush now grow on areas that once were covered with good vegetation and timber. With proper soil treatments, management and conservation practices, and an effective teaching, research and extension program these soils can be brought back to more efficient production but still with certain limited use.

No soil survey or land classification work has been done in Korea in accordance with the internationally accepted methods of classification and nomenclature. Classification studies on Korean soils have been patterned after Japanese methods and no information is available on soil classification as related to landuse and soil capabilities. The work that has been done is very good, but it has not gone far enough to get the essential information needed for a good teaching, research and extension program in soil classification and landuse. This work has been limited to the Paddy-Upland Soil Association. An arbitrary landuse classification was set up following World War II, and landuse at that time now constitutes the present landuse classification. This classification is in two general groups:

1. Paddy-Upland soils
2. Forest soils.

Since the War most of the soil survey work has been discontinued because of the lack of funds and a trained personnel. However, the Paddy-Upland soils in 6 of the 8 Provinces have been surveyed. To do the job required will mean starting a completely new program of land classification which must include the training of a qualified staff of technicians and a coordinated organizational program. On the basis of the present landuse classification, the agricultural land area of South Korea constitues about 40% of the total area, or about 22,071,550 acres (8,828,622 hectares), of which 23% is in the Paddy-Upland Soil Association.

Breaking down the Paddy-Upland soil association into groups, it is estimated that this classification accounts for 2.3 million hectares (5,700,000 acres) of the total area. It is further estimated that 1.3 million hectares

(3,250,000 acres) are in Paddy soils while 1.0 million hectares (2,500,000 acres) are in Upland soils. The balance of the total land area is considered as forest with about 2% in other uses.

A further slope classification has been made by the Forest Experiment Station at Seoul showing the following estimates:

0°- 5° slope	20%	of total area
5°- 15° slope	23%	" "
15° and up	57%	" "

With this very general classification using only the single soil factor of slope and with such a limited range of groups there will be some additional land in the 5° - 15° slope range that may be brought into food and fuel crop production with proper hillculture farming practices, providing there is a cooperative and well coordinated program between Bureaus and a soil classification and landuse program set up to determine the land capabilities. A land classification program would further determine areas now being farmed which, because of serious erosion, should be put into permanent grass or forest. Certain Korean agricultural experts who have studied the country's soil conditions believe that by establishing the international method of soil survey, land classification and landuse it would be possible to bring into crop production additional land amounting up to 15 percent. This would include foothill land using proper hillculture and land management practices and the reclaiming of tideland areas adjacent to the sea coast.

The Adviser noted universal plant nutrient deficiency symptoms of nitrogen, phosphate and to a considerable extent potash. This was further supported by spot soil tests and plant tissue tests made in the field. This

condition was noted on all crops, grasses and weeds. These observations are further supported by the soil test studies carried on by the Central Experiment Station under the supervision of Mr. Oh. These soil tests show a low pH range of 4.8 to 5.5, very low available phosphate and a medium or borderline range on available potash. As soon as the phosphate level is raised potash will be essential. Phosphate deprived conditions and symptoms were indicated to some extent in livestock. The basic requirement for soil fertility improvement is the use of limestone to correct acidity, and an adequate supply of phosphate fertilizer. Nitrogen fertilizer at the present time is giving striking response but indications are now appearing that it is not the complete and correct answer for the future.

In general all crops are lacking vigor of growth with unsatisfactory yields when considering the hand labor, present treatments and cultural practices being used. For example, barley shows fairly satisfactory top growth but short heads. This may be due partly to a variety difference but most generally it is a lack of a balance of the proper nutrients to produce a head in proportion to the top growth. Where yield information is available at the sub-stations the use of a balanced fertilizer containing nitrogen, phosphate, potash and lime have increased the crop yields over 100%. In cases where compost was used the same results were obtained as resulted from the use of commercial nitrogen which indicates the need for green manure crops and to keep an adequate supply of organic matter being returned to the soil at regular intervals. No crop rotation systems are being used by the farmers. The need to produce food is too great at the present time to allow land to remain in non-food producing crops. In the southern part of Korea double cropping and the use of winter grains is a general practice.

Green manure crops are generally lacking except in the southern part of Korea where the vetches are used to a limited extent. The fall campaign

put on by the Ministry of Agriculture and Forestry to make compost is helping but is not sufficient to meet the organic matter needs of the soil. Green manure in addition to the compost not only supplies organic matter but it gives cover protection while the crop is being produced. Compost, green manure and commercial nitrogen fertilizers are going to have to be balanced with other treatments such as lime, phosphate and potash in the near future if production is to be improved.

Commercial fertilizers at the present time are used on a more or less hit or miss basis. The research work on fertilizers is not on a uniform basis. There is a definite need for a fertilizer rate study to determine the ratio of one nutrient to the other as related to different crops. Almost all fertilizers have to be imported. The small phosphate fertilizer plant at Inchon supplies about 15,000 tons per year of 0-20-0. This amount nowhere near meets the annual need. A new urea plant is being constructed at Chongju with an anticipated capacity of about 85,000 tons per year of 46-0-0. This plant, however, will not be ready for about 2 years. Night soil is one of the main sources of fertilizer. It is estimated that it supplies 25% of the total annual fertilizer needs of Korea. Its use raises a question of sanitation and disease. Information is very limited on the use of lime on various crops. This low pH condition of the soil points up a great need for practical research and a coordinated cooperative program to meet this essential need. No agricultural lime is being produced at the present time. The Adviser visited one quarry west of Yong Dung Po and found the stone to be very hard but of high neutralizing value according to Central Station tests. The hardness of the stone will increase the cost of producing agricultural materials. The supply of limestone in Korea appears to be adequate to meet the needs. Lack of roads and transportation may limit distribution from central quarries to village areas located away from main

roads. Present limited studies on liming indicate a need for using higher rates as based on soil tests to get effective results.

The mechanical type of erosion control and conservation practices on the upland soils are generally lacking. By simply placing the rows of crops on the contour or across the slope, erosion in most cases could be controlled because such areas are usually small, with no large areas at any one time being exposed and subject to erosion. The removal of excess water during the rainy season can be accomplished at the same time if the practices are properly effected on the slopes.

Considerable time has been spent on running experiments with different soil conditioners. The companies have provided more than an adequate suppy of this material. Time might be better spent on doing research on the more basic nutrient needs of the various crops with ratio studies on nitrogen, phosphate, potash, liming needs and the use of green manure crops.

Soils need to be tested to determine the liming needs and for the proper balance of nitrogen, phosphate and potash.

These problems call for a uniform program of teaching young men to do research and extension work. A uniform and systematic soils research and testing program and plan is essential throughout Korea but this cannot come about without the proper training of young men in the principles of Soil Science.

In general it would appear that there is a definite need for more effective coordination of Bureau, Section and Ministry activities in dealing with all phases of agriculture and forestry. It is highly significant that if agriculture and forestry are to contribute effectively to the Korean economy there must be certain specific, factual information and data collected and analized as to the problems in each of the fields of these various Bureaus and Sections of the Ministry and to what extent each can contribute to the

needs of Korean Agriculture and forestry. This information should then be developed into a well-defined and coordinated program setting forth the responsibilities of each Bureau and Section of the Ministry and what each can contribute to a unified program for the production of food, fuel and lumber. Each can contribute to the success of the other as well as to the whole overall agricultural and forestry program. Maybe this coordination of a unified program is underway but this approach is essential if financial, administrative and technical resources are going to be most effectively utilized.

From such a cooperative effort a national landuse or land policy program could be developed in which all phases of agriculture and forestry could be coordinated into a unified approach for producing the essential crops of food, fuel and lumber.

The Agricultural Teaching and Research Organization

The administration of all agricultural teaching, research and extension is in two separate ministries of the federal government. The research and extension work is in the Ministry of Agriculture and Forestry, where all responsibility is centered in the various bureaus of this Ministry. Responsibility for all the college teaching and training of young men in Seoul National University, including the College of Agriculture, and the other agricultural colleges of the country, rests with the Ministry of Education.

Each ministry has the responsibility to develop its own organization but at the same time to integrate it with the organization of the other ministry so as to develop a unified program of teaching, research and extension that will eventually give the people of Korea a sound agricultural foundation on which to develop their agricultural future. Educational training and leadership and the proper understanding of the agricultural problems by the people will be the

key to the eventual agricultural success of Korea. Each ministry has a mandate to carry out its intended purpose of agricultural teaching, research and extension. Here is where teamwork and cooperation of the ministries will determine the future of the agricultural programs as under the present administrative organization. The College of Agriculture of Seoul National University has the mandated responsibility of training young men in agriculture to become teachers, research workers and extension agents. No other agricultural institution, agency or bureau is in a position to supply this type of training. It is most essential that young men receive the best training possible as undergraduates and as graduate students so as to be fitted for future research work with the experiment stations or to serve as agricultural teachers or extension workers. The quality and success of the teaching, research and extension work of the future will depend entirely upon the kind and quality of training the coming young men will receive in the College of Agriculture in Soil Science or any other major agricultural field.

Research work of the future in the experiment stations will not develop or become strong without properly trained men, while extension work will not be of value without properly trained college men backed up by a sound, well-coordinated research program. Any one of these three phases of agricultural development cannot stand alone and be successful. Each must depend on the success of the other two. It is suggested, that if not already done, a joint committee of the two ministries be set up to work out a cooperative coordinated program of teaching, research and extension. As an illustration, such plans could be developed where a skilled technical man in the Central Experiment Station might divide his time between teaching in Soil Science, in the College of Agriculture, and at the same time be engaged in supervising research work in the Agricultural Experiment Station. On the other hand, a Soil Science professor in the College

of Agriculture could divide his time between his regular teaching duties and jointly assist the Experiment Station in carrying on some related research project of equal importance to both. This would contribute to an instructor's knowledge and experience in Soil Science if he were actively engaged in some current research work and at the same time keep the research work currently abreast with teaching methods and the interpretation of research data. To be effective teachers or to be effective research workers staff members of both teaching and research must be experienced in the other's field.

Soil classification and soil survey is now under the Agricultural Chemicals Section of the Central Experiment Station at Suwon. As previously stated, no soil survey work has been done in accordance with the international methods of classification. According to information given the Adviser there is now but one experienced soil surveyor in each province and only one is a college graduate. All are apprentice-trained by the Japanese. There needs to be established a sound soil survey and landuse classification program based on:

1. Installation of the internationally accepted methods of soil classification and nomenclature
2. College trained personnel.
3. Sufficient money for trained staff and equipment.

Furthermore, it would seem desirable to develop a staff of trained Soil Scientists to be placed as follows:

1. One trained Soil Scientist in soil survey and landuse classification in each Province.
2. One trained Soil Scientist to do research in soil fertility and management in each Province.
3. One trained Soil Scientist to do soil testing work, and who has some understanding of fertility problems, in each Province.

The training of this staff should start in the second year of college and be carried on jointly with College and Experiment Station staffs as a joint

College instruction and Experiment Station summer-experience program. When these Soil Science students are graduated from the College they will have both a good background of training and experience to immediately move into active soil classification work or regular research work for the Experiment Station.

It is recommended by the Adviser that a start be made as quickly as possible to establish the soil survey and research training program. To further facilitate this work it is suggested that the exchange students from Korea now majoring in Soil Science at the University of Minnesota and those going to other colleges under OEC auspices take some additional time and spend at least one summer in the field to learn the techniques of soil survey as now being used in all other countries. Furthermore, it is suggested that these men take all the courses available on soil survey and classification before returning to Korea. This will facilitate the establishing of this course in the College of Agriculture so when the students return to Korea they will have had training and experience to use in student teaching and to assist in training others when this method of soil survey and landuse classification is adopted.

To do more effective work in Soil Science research and covering such needs as soil survey and classification, soil testing, fertilizer and lime experiments, green manuring, etc., a separate section for this work should be set up in the Central Agricultural Experiment Station. The direction and coordination of the activities of this staff and their projects should be headed by a trained and experienced Soil Scientist.

The Agricultural Chemical Section, required to do the testing of all agricultural chemicals being sold in Korea, such as insecticides, pesticides, fungicides, and fertilizer, is a big program in itself, as is the research program of soil classification, soil testing and all the related phases of

soil science. This separation of responsibilities would provide for developing a uniform soil classification, soil testing, soil fertility and management and research program through all of the branch stations and substations with a coordinated and joint teaching and research program with the College of Agriculture.

There are many good students, coming mainly from farms, who are entering the College of Agriculture. These farm boys have a fine agricultural background of experience that could be used to make fine teachers, research workers and extension agents, but at the present there is little opportunity. There is no incentive whatever to return to the small farms. From data previously given on the small average size of farms there is no challenge or incentive for a college graduate to operate such a small unit. They cannot utilize their ability, have a good income or maintain a standard of living proportionate to their cultural and social training. From these students there is a great opportunity to be very selective in the type of personnel who could be guided by the College staff into the various phases of soil research, teaching and extension work.

The following table is a summary of where the College of Agriculture students come from and their parents' occupation. For the 1955-56 college year, out of 1,161 students enrolled in the College of Agriculture, 688 came from farm families:

Provincial Distribution of Birth Places of the Students

Department: / Province:	Year	Agr.	For.	Liv.	Ag.En.	Ag.Ch.	Ag.Ec.	Ag.Bi.	Seri.	Total
Seoul City	1	2	1	6	8	7	9	4	3	40
	2		3	1	1	8	1	1	1	16
	3	1	1	7	4	2	2	3		20
	4		1	5	2	3	4	2		17
		3	6	19	15	20	16	10	4	93
Kyonggi do	1	12	14	7	16	8	12	14	8	91
	2	9	2	3	16	10	8	13	7	68
	3	15	13	12	15	19	22	18	3	117
	4	25	13	20	14	17	17	10		116
		61	42	42	61	54	59	55	18	392
Chung Chong Namdo	1	7	3	8	5	2	3	2	2	32
	2	8	5	1	11	2	6	4	6	43
	3	6	2	14	18	5	15	6	7	73
	4	7	7	5	2	6	12	4		43
		28	17	28	36	15	36	16	15	191
Chung Chong Pukdo	1	1	4	1	1	3				10
	2	3	4		2	1	4	2		16
	3	4	1	2	2		4	2	2	17
	4	1	2	1	1		5	1		11
		9	11	4	6	4	13	5	2	54
Kyongsang Namdo	1	6	2	5	1	1	3	3	2	23
	2	3	7	4	2	2	6	4	4	32
	3	9	4	4	4	12	5	7	2	47
	4	6	6	3	1	3	9	4		32
		24	19	16	8	18	23	18	8	134
Kyongsang Pukdo	1	5	3	1	1	1		3	1	15
	2	4	2	4	2	1	2	2	1	18
	3	7	9		1	2	3	1	2	25
	4	2	5	1		2	3			13
		18	19	6	4	6	8	6	4	71
Cholla Namdo	1	3	1	2	2	6	7	1		22
	2	5	3	4	1		2	1		16
	3	3	2	4	2	4	4	1		20
	4	2	1	1	1	4	1	1		11
		13	7	11	6	14	14	4		69
Cholla Pukdo	1	2	1	1	2	2	1		2	11
	2		1	3	1	3	4	1		13
	3	2	2		6	2	7			19
	4		2	1	1	3	6			13
		4	6	5	10	10	18	1	2	56

Department: / Province:	Year	Agr.	For.	Liv.	Ag.En.	Ag.Ch.	Ag.Ec.	Ag.Bi.	Seri.	Total
Kangwon Do	1	1		1	1	1	1	1		6
	2	2	2				2	1		7
	3	1	5	4		6	1			17
	4	2		2	1	1	1			7
		6	7	7	2	8	5	2		37
Cheju do (Island)	1						1	1		2
	2					1				1
	3									
	4					1				1
						2	1	1		4
Hwanghai Do (North Korea)	1	1	1		1	2	1			6
	2		1	3				1	1	6
	3				1		1			2
	4				1	1				2
		1	2	3	3	3	2	1	1	16
Pyongan Namdo "	1	1		2		2				5
	2	2		2		2				6
	3			1		2	1		1	5
	4									
		3		5		6	1		1	16
Pyongan Pukdo "	1								1	1
	2	1	2			1	1			5
	3			2		2	1			5
	4				1	1				2
		1	2	2	1	4	2		1	13
Hamkyong Namdo "	1			1	1	1		1		4
	2					1				1
	3	1	1							2
	4	2		1			1			4
		3	1	2	1	2	1	1		11
Hamkyong Pukdo "	1			1						1
	2					1				1
	3			1						1
	4			1						1
				3		1				4
Total	1	41	30	36	39	36	38	30	19	269
	2	37	30	27	36	33	36	30	20	249
	3	49	42	49	53	57	66	38	17	371
	4	47	37	41	25	41	59	22		272
		174	139	153	153	167	199	120	56	1,161

Students' Family Occupation

Department:	Year:	Agr.	For.	Liv.	Ag.En.	Ag.Ch.	Ag.Ec.	Ag.Bi.	Seri.	Total
Occupation:										
Agriculture (Farming)	1	26	22	15	21	11	12	15	10	132
	2	27	22	7	26	9	24	19	16	150
	3	37	31	24	39	33	41	23	12	240
	4	28	29	18	16	26	37	12		166
		118	104	64	102	79	114	69	38	688
Engineering	1	2	1	3	2	2	2		2	14
	2	1		1		1				3
	3	1	1		1		1			4
	4		1	1						2
		4	3	5	3	3	3		2	23
Commercial Business	1	2		11	6	7	8	6	1	41
	2	5	1	6	2	10	5	8		37
	3	2	2	7	3	9	5	5	3	36
	4	4	3	7	2	4	5	4		29
		13	6	31	13	30	23	23	4	143
Mining	1	1	1							2
	2	1								1
	3		1				1			2
	4		1							1
		2	3				1			6
Military and Police	1						2			2
	2	1	1							2
	3					2	1			3
	4					1				1
		1	1			3	3			8
Public Service	1			2	4	5	4	6	3	24
	2		2	4	6	2	4	3	2	23
	3	2	2	5	5	4	5	2	1	26
	4	8	2	4	4	3	11	2		34
		10	6	15	19	14	24	13	6	107
Teacher	1	3	3	1		2	1	2	1	13
	2	2	2	1	1	1	2			9
	3	2		5		3	2	1		13
	4	1		2	1			1		5
		8	5	9	2	6	5	4	1	40
Companys' Employee	1	2	2	4	4	7	5	1	2	27
	2			1		4				5
	3		3	2	1	3		1		10
	4			3	1	2	2			8
		2	5	10	6	16	7	2	2	50
Divine	1						1			1
	2						1			1
	3									
	4							1		1
							2	1		3

Department:	Year	Agr.	For.	Liv.	Ag. En.	Ag. Ch.	Ag. Ec.	Ag. Bi.	Geri.	Total
Occupation:										
Medical Doctor	1	2	1		1					4
	2			1		3				4
	3			1			1	2		4
	4									
		2	1	2	1	3	1	2		12
Laborer	1									
	2			1						1
	3			1	1					2
	4					1				1
				2	1	1				4
Unemployed	1	3			1	2	3			9
	2		2	5	1	3			2	13
	3	5	2	4	3	3	9	4	1	31
	4	6	1	6	1	4	4	2		24
		14	5	15	6	12	16	6	3	77
Total	1	41	30	36	39	36	38	30	19	269
	2	37	30	27	36	33	36	30	20	249
	3	49	42	49	53	57	66	38	17	371
	4	47	37	41	25	41	59	22		272
		174	139	153	153	167	199	120	56	1161

At the present time there are 13 Colleges of Agriculture in Korea. The most important of these, the Seoul National University College of Agriculture, located at Suwon, had its origin before liberation from the Japanese in 1945, dating back to 1906. On September 28 and 29, 1956 the College's 50th Anniversary celebration was held at Suwon.

All the other twelve Colleges of Agriculture have been started in the last 10 years. None of these colleges offer a major in Soil Science. Only one and possibly two courses are offered in Soil Science and these deal mainly with chemistry and its relation to commercial fertilizer. No amount of research work is being done and no laboratory facilities are generally available. Practically all have staff members who are graduates of Seoul National University's College of Agriculture. The Adviser had the opportunity to visit some of these colleges, inspect their facilities, meet their staffs and with them discuss soils courses and opinions on the soils problems of Korea.

The other agricultural colleges of Korea are listed as follows:

The Agricultural Colleges in Korea

Name of College	Province	Location	Level
1. Seoul Agricultural College	Seoul City	Seoul	2 year course city college
2. Chung chon Agricultural College	Kangwon Do	Wonju	4 year course national
3. Chinju Agricultural College	Chungcheng Pukto	Chongju	4 year course provincial
4. College of Agriculture, Chung-Nam University*	Chungchong Namdo	Taejon	4 year course provincial
5. College of Agriculture, Chon-Puk University*	Cholla Pukto	Iri	4 year course national
6. College of Agriculture, Chon-Nam University	Cholla Namdo	Kwangju	4 year course national

*Colleges visited by the Adviser

+ Vet. Med.

1100

will range from 500 - 1100

The Agricultural Colleges in Korea - continued

Name of College	Province	Location	Level
7. College of Agriculture, Kyong-Pul University	Kyongsang Pukto	Taegu	4 year course national
8. Chinju Agricultural College	Kyongsang Namdo	Chinju	4 year course provincial
9. College of Agriculture, Koryo University	Seoul City	Seoul	4 year course private
10. College of Agriculture Dong-kook University	Seoul City	Seoul	4 year course private
11. Department of Agriculture College of Dong-a	Kyongsang Namdo	Pusan	4 year course private
12. Cheju College of Agriculture	Cheju Do	Cheju	4 year course provincial

Note 3rd. May reach 1100 - 1200

Situation and Problems of the College of Agriculture

No Soil Science curriculum is offered in the College of Agriculture as a major course leading to a B. S. degree in Agriculture. No facilities and equipment are available at the present for a Soil Science curriculum. The only space now available is that occupied by the Department of Agricultural Chemistry until the new main building is constructed. Until this is done, all Soil Science courses will have to be in the classrooms and laboratories now being used by Agricultural Chemistry. The 3 present laboratories are quite desirable with windows on three sides and good benches. Two of the laboratories have space for 40 students each and the third will accommodate 30, providing for a total of 110 students. Beyond this point there is little to offer. No utilities are available except electric lights. There is no running water either distilled or other, no gas and no soils equipment of any kind. The classrooms are generally not desirable with no heat, no lights, poor seating and poor blackboards. The main need here is for heat and lights with heat being the greatest need at the moment.

New Building, Classroom and Laboratory Facilities

When the new main building is completed the Department of Agricultural Chemistry and Soil Science will have additional office, classroom and laboratory space, in addition to the space now available in the present old buildings. At this time it appears there will be 5 new classrooms and possibly a similar number of new leboratories, for both undergraduate and graduate students. Considering the present facilities, plus the new facilities, the Department of Agricultural Chemistry and Soil Science will have a total of 5 undergraduate student laboratories that could accommodate a total up to 230 students at one time. This again will include students in both Agricultural Chemistry and Soil Science courses. Additional space in the new building will provide for one graduate student laboratory for 20 students plus four rooms in the old buildings which could accommodate another 12 students, making a possible estimated space for a total of 32 graduate students. In addition there will be a microscope room and 20 microscopes for 40 students and one balance room with 5 balances that should provide acommodations for at least 25 students at one time. As the plans now stand there should be adequate office, classroom and laboratory space for all undergraduate and graduate students in both the old and new facilities when the future building plans and arrangements for space are completed in the next two to three years. At the present time these are the estimates on which lecture and laboratory facilities are being planned.

College of Agriculture Curriculum, Student Teaching Program and Soil Science Staff

Up to 1950 the College of Agriculture offered only a 3-year course giving no degrees but instead a diploma at graduation time. In 1950 the course

of study was completely reorganized and put on a four-year basis giving a B.S. degree in Agriculture, with graduate work for an M.S. and Ph.D. degrees. Nine departments now constitute the College of Agriculture. The departments include: Agriculture, Forestry, Livestock (Animal Husbandry), Agricultural Engineering, Agricultural Chemistry, Agricultural Economics, Agricultural Biology, Sericulture and General Subjects. Sericulture, being the last department added to the College, will graduate its first class in 1957. In the 1955-56 school year 1,180 students (1,167 boys and 13 girls) were enrolled in the College of Agriculture. Attached to the College of Agriculture is a 2-year course in teacher training, offered at the junior college level, which includes general Agriculture, Livestock and Home Economics courses. During the 1955-56 school year 123 students were enrolled in Agriculture and Livestock and 55 in Home Economics, making a total of 178 students. When the students finish the 2-year course they receive a teacher's certificate and are qualified to teach in the agricultural high schools.

All student candidates for admission to the College of Agriculture for work leading to a B. S. degree are required to pass an entrance examination. Not over 30% of those taking the entrance examinations are accepted in an effort to keep the College attendance at about 1,000 students and at a high academic level. Requirements for graduation include the following:

1. A total of 160 semester credit hours
2. A grade-point average of about 1.0 (C average) in the major field as well as in total credits
3. A student must complete at least 80 credit hours in his major field and at least 36 credit hours from the general requisite course

A credit represents 1 hour of class work per week for one semester (15 weeks) together with the necessary preparation for that class hour. Two

hours of laboratory work are considered as the equivalent of one hour of class work. A student is permitted to carry 20 credits per semester in class and laboratory work. A student who has received a grade-point average of 2.0 (B average) or better in the preceding semester may carry as many as 24 credit hours. The following system of grades and points went into effect beginning with the 1955-56 school year:

Grade	Percentage Equivalent	Points per Credit
A - (Excellent)	90 - 100	3
B - (Good)	80 - 90	2
C - (Fair)	70 - 79	1
D - (Poor)	60 - 69	0
E - (Conditional)	50 - 59	0
F- (Failure)	Below 49	0

Passing grades range through B, C, and D, any of which enables the credit for an individual course to be counted towards a degree but an over-all C average must be maintained.

No undergraduate or graduate Soil Science major is now offered in the College of Agriculture. At the present time only three courses in Soil Science are being offered; General Soil Science (C 201) which is required for all students in the College, Soil Microbiology (C 218) and a rather general course in Fertilizers (C 204). These three courses are fundamentally good under the present teaching program but several additional courses must be added to provide for and overall balanced training in the field of Soil Science. These three courses will need to be revised and changed, to some extent, to fit with the new additional courses to be offered when Soil Science is

set up in the College as a major course of study.

The curriculum of the College of Agriculture appears to be rather highly specialized or departmentalized, especially in the 3rd and 4th years. The Adviser would not think it advisable to make too strict a requirement for a student selecting his 3rd and 4th year courses in any one of the major departments. There are many courses in each of the other departments of the College that should be included as a part of a student's program to go with his own major department if he is to have a well-balanced program of study. This is where a good student counseling and advisory system within the College and in each department can play an important part in assisting and guiding a student to select certain courses related to his major and minor fields of study.

A student, to meet the requirements for graduation, must have at least 36 additional credit hours besides the 80 credit hours in his major taken from the general requisite courses. This will mean 14 hours of credit in 3 languages, Philosophy, History of Civilization, Outlines of Natural Sciences and Physical Exercise, and at least another 6 credits from each of the following: Humanities, Social Sciences and Natural Sciences. There is no question about the importance of these courses in a broad program of college education. They are very necessary. However, as we consider a curriculum for an agricultural college it must be recognized that the Korean people are extremely interested in education and that it is not a question of the extent of education needed, but is rather a question of the type of education and where to place the greatest emphasis. Still further, we must consider the quality of the education. Korea, as the Adviser has observed through many contacts and interviews, has many colleges and universities engaged in the

field of agricultural teaching, but it appears that there is too little in the way of technical training in proportion to the emphasis now being placed on philosophy and the cultural elements of education. The whole teaching program in the College of Agriculture and the development of a Soil Science curriculum should be considered on the basis of the present and future problem and the natural and economic resources of Korea.

The objective of the College of Agriculture curriculum, in addition to giving a student the best 4-year college training possible, should be to fit him to take his place in his agricultural field to help meet the critical need for food, fuel and lumber and, as rapidly as possible, to aid in raising the standards of living of the Korean people. For such reasons, the College should place emphasis on the production phases of agriculture and to give young men the best and broadest possible training towards these objectives. Since the entire curriculum of the College of Agriculture is still in a temporary stage of development it is recommended that the teaching program as well as any new curriculum be considered in terms of the present needs and resources of the country.

The present inventory of equipment for teaching purposes is completely inadequate in most instances and especially so in Agricultural Chemistry and Soil Science. The student teaching programs are weak in terms of laboratory exercises because of the lack of equipment. It will require both additional room space and equipment to provide these needs. For all laboratory courses now offered in Agricultural Chemistry and Soil Science each student must buy a chemistry kit which he will use throughout his entire 4 years of college work. By this method the minimum essential laboratory equipment is purchased

by the student from the College where the kits are assembled. The kits consist of a wooden box to hold the equipment, which includes 2 beakers, 2 Erlenmeyer flasks; 1 funnel, 12 test tubes and 1 test tube rack and holder. The cost is 2500 Hwan or $5.00 for each kit. The present curriculum is almost entirely dependent on classroom lectures. For those courses that should have laboratory work, such as Agricultural Chemistry and the present Soil Science courses, this part of the course is eliminated except for an occasional class demonstration by the instructor. Of the classes attended by the Adviser practically none were observed where textbooks were employed and of these only a few were texts printed in English. Neither was any any American data used in the lecture material. The lack of textbooks and reference reading material has a definite effect upon the whole teaching program. When there are no textbooks available to the student it means that the instructor dictates the equivalent of a text in his lecture periods. Many times it was observed that the statement was repeated so the student could check back on the accuracy of his notes.

In some classes where no laboratory facilities and equipment were available the instructor would very carefully try to illustrate a certain method or a process on the blackboard to be copied by the students in their lecture notes. This brought out the need for supplementing the present lectures with some simple laboratory demonstrations that could be moved from place to place until laboratory facilities and equipment are available. For example, the portable soil testing kits which could easily be brought to any classroom for a lecture demonstration might be used for this purpose. These demonstrations could be further supplemented by the use of chart materials and prepared

diagrams so the students could study them after or between classes. Such material could be used from one semester to the next.

Where textbook material is limited the instructor could prepare attractive mimeographed sheets taken from the few textbooks available so students could include this as a part of lecture notes. Such a practice would lighten the load of the instructor in presenting his lecture material. This further brings out the need for using more visual aid equipment. In Soil Science courses color photography can be used effectively to illustrate nutrient deficiency symptoms of crops, differences in the growth of crops with different soil treatments, erosion conditions, soil profile differences, as well as for data, charts and disgrams. Most of the instructors have good cameras for such purposes and the College is well supplied now with projectors and such visual aid equipment.

Students should be encouraged whenever possible to purchase their own textbooks, especially those in the major field. Most students want to build a reference library for their future work. It is agreed among most of the staff that the cost of building such a library would be out of reach of most students, which is true. However, students who can afford this cost should carefully select their texts and be encouraged to make the purchases.

There is a definite need to buy and have available in the library the basic text books for student reference information and use. It might be well for the College of Agriculture to give consideration to annually setting aside funds for this purpose so current basic reference material can always be available to the student at all times.

The following is a brief outline of the three Soil Science courses with the main topics that are presented in each. All of the material is pre-

sented on a lecture basis with some laboratory demonstrations and some lecture illustrations on the blackboard.

General Soil Sciences (C 201 and C 202)

Instructor: Oh Wang Keun

1. The plant growth and their environmental condition
2. Rocks and rock-forming minerals
3. The weathering action of rocks
4. The decomposition of organic matters and humus accumulation
5. Transportation of the weathering matters
6. The principal soil types
7. The physical composition of soils
8. The physical properties of soils
9. The soil water and air
10. The chemical composition of soils, including soil chemical analysis
11. Soil colloids
12. The soil adsorption and base-exchange
13. The soil reaction
14. The soil microorganisms (briefly)

Soil Microbiology (C 217 and C 218)

Instructors: Dr. Kim Ho Sik
Dr. Lee Choon Yung

1. The microbiological population as a whole
2. Specific micro-organisms in the soil
3. Decomposition of plant and animal residues in soil
4. Humus
5. Transformation of nitrogen in soil

6. Nitrogen fixation - nonsymbiotic and symbiotic
7. Transformation of mineral substances in soil microorganisms
8. Microorganisms and soil fertility
9. Antagonistic effects of soil microorganisms

Fertilizers (C 203 and C 204)

Instructor: Lee Chai Hyun

1. Introduction
2. The compostion of plants
3. The physiological functions of plant elements
4. The absorption mechanisms of plant nutrients
5. The nutrimental stage of crops
6. The behaviour of nitrogen in the soils
7. The behaviour of phosphoric acid in the soils
8. The behaviour of potash in the soils
9. Law of the plant's production
10. The reaction of manure
11. Classification of manure
12. Effect of manure
13. Mixing of fertilizers
14. The application of fertilizers
15. The fertilizing experiments
16. The calculation of fertilizer values
17. The judgments of fertilizers
18. The standard manuring of the crops
19. Nitrogeneous manures

20. Phosphorous manures

21. Potash manures

22. Miscellaneous manures

The basic science courses of Chemistry, Physics and Mathematics are now being taught in the first and second years. These subjects are essential as a basis for a Soil Science curriculum and of course should be required for a major in Soil Science.

Practically no research is being done by the faculty of the Department of Agricultural Chemistry in any phase of Soil Science

The staff members now teaching the three courses in Soil Science are well qualified and experienced in their fields as the following training and employment records will show. The list of staff members is as follows:

Training and Experience of Staff Members now Teaching Soil Science

KIM HO SIK (52)

(1) Mar. 1924 Suwon Agricultural & Forestry College
Mar. 1929 Kyushu Imperial University, Dept. Agr. Chem.

(2) Apr.1929 - Apr.1938 Soong Chil College, Pyong-Yang
May 1938 - Sept.1945 Seoul Women's Medical College
Oct.1945 - Dec. 1947 College of Agriculture, S.N.U.
Jan.1948 - Dec. 1950 Vice.-Director, Central Agric. Experiment Station
July 1951- to date Prof. and Head, Agricultural Chemistry College of Agriculture, S.N.U.

MAING DO WON (39)

(1) Sept.1942 Hokkaido Imperial Univ., Dept. Agr. Chem.

(2) Sept.1942- Jul. 1944 Toyo Takshoku K.K.
Jul. 1944- Sept.1945 Teacher, Shin Sang Agr. School
Oct. 1945- Mar. 1947 Prof. Fishery College, Pusan
Apr. 1947- Oct. 1948 Asst. Prof., Teagu Agr. College
Nov. 1948- Sep. 1950 Central Agr. Exp. Station
Dec. 1952- Apr. 1953 Asso. Prof., Chun-Nam University
May 1953- to date Asso. Prof., College of Agr., S.N.U.

CHANG CHI HYUN(28)

(1) Sept. 1955 College of Agriculture, S.N.U.

(2) Dec. 1955- to date Assistant, College of Agr., S.N.U.

(1) Graduation; (2) Experience

OH WANG KEUN	(33)	(1)	Aug. 1948	Suwon Agr. & Forestry College, (College of Agriculture, S.N.U.)
		(2)	Jul. 1948 - to date	Central Agr. Exp. Station
			Aug. 1952 - to date	Part time lecturer on Soils, at College of Agriculture, S.N.U.
LEE CHAI HYUN	(36)	(1)	May 1951	College of Agriculture, S.N.U.
		(2)	Sep. 1952 - to date	Central Agr. Exp. Station
			Aug. 1953 - to date	Part time lecturer on Fertilizers at the College of Agriculture, S.N.Y.
CHO BAIK HYUN	(56)	(1)	Mar. 1920	Suwon Agr. and Forestry College
			Mar. 1925	Kyushu Imperial University, Dept. of Agr. Chem.
		(2)	Apr. 1925 - Aug. 1945	Prof. Suwon Agr. and Forestry College (College of Agriculture, S.N.U.)
			Aug. 1945 - to date	Dean, College of Agriculture, S.N.U.
LEE CHOON YUNG		(1)	Dec. 1941	Kyushu Imperial University, Fukuoka, Japan
		(2)	1942 - 1945	Assistant, Institute of Sericultural Chemistry, Kyushu Imperial University
			1946	Asst. Prof. Suwon Agricultural College
			1948--1954	Student, Georgetown University, Washington, D.C.
			1953	Ph. D. degree at Georgetown University
			1954 -	Professor, College of Agriculture, S.N.U.
LEE SUNG WHAN		(1)	1942	College of Pharmacy, S. N. U.
		(2)	1942 - 1945	Worked in the Mokjai Pharmaceutial Company, Seoul
			1946 - 1954	Worked in the Central Agricultural Experiment Station, in charge of agricultural drugs
			1954 -	Asst. Professor, College of Agriculture, S. N. U.

(1) Graduation
(2) Experience

Conferences, Observations and Field Trips with College of Agriculture Staff, Experiment Station Staff and Other Related Groups and Individuals

When the Adviser arrived in Korea on June 11, 1956 it was necessary to make a definite plan of procedure to follow in preparation for working out a suggested curriculum of Soil Science with the Agricultural College staff. This plan was developed on the following basis:

A. Classroom visits to observe student teaching, lecture and laboratory methods until school closed for the summer vacation about July 20. These visits included the Soil Science courses and related courses in other subjects and departments of the College of Agriculture.

B. Conferences with College administrative staff, department heads and other staff members.

C. Conferences with Central Experiment Station Director, Chai Byung Seuk, and staff, and sub-station and Branch Station Superintendents and staffs to observe and discuss the research program as related to Soil Science and what in their opinion was the place and need for a Soil Science curriculum at the College of Agriculture, Seoul National University.

D. Conferences and visits to the other colleges of agriculture in some of the Provinces to observe their work in teaching and the relationship with Seoul National University's College of Agriculture in supporting a unified Soil Science program for Korea.

E. Observations of farmer field and station experiments in different parts of the main agricultural areas.

F. Observation of general farming and agricultural operations including the proposed livestock areas on Cheju Island.

G. Observations of erosion problems and the forestry and general landuse programs.

H. Field trips and demonstrations for College staff members, department heads, Central Experiment Station, Sub-station and Branch Station staff members and staff members of other agricultural colleges to observe soil conditions, problems and needs.

I. Conferences and meetings with OEC staff specialists in the various fields of agriculture.

J. Conferences with Ministry officials, Bureau and Section Chiefs and staff members.

K. Visited agricultural high schools and met students and staff.

All conference appointments and plans for these visits were made by Dean Cho Baik Hyun, Dr. Kim Ho Sik, Head of Agricultural Chemistry, and Mr. Oh Wang Kun, Head of Soil Survey and Soil Testing in the Central Experiment Station adjacent to the College.

In these conferences the basic points for discussion had to do with the relationship of Soil Science to the other departments of the College as to the developing of major and minor courses for students between departments, its relationship to crop and livestock production, and the relationships of teaching, research and extension. The discussions were based on the following general questions:

A. Should Soil Science be a major course offered in the College of Agriculture?

B. Could Soil Science contribute to the curriculum of your department an other College departments?

C. Would it be possible to work out a joint major and minor student program between the various departments and Soil Science?

D. What are the major soil problems in Korea as you observe them from your field of agricultural subject matter and from the Experiment Station point of view in the Provinces?

E. Do you think that training of young men in college to do research and extension work in soils would contribute to the program of research and extension as now administered through the Central Experiment Station and the Ministry of Agriculture and Forestry?

F. Would it be possible to develop with the Experiment Station a program to give students in Soil Science, during their college training some experience training employment during the summer so when they graduate from college they would be ready to start working for the Experiment Station with a good background of technical training and experience? Examples would be the summer work in soil survey and classification and field experimental plot work.

G. While they are attending college, if an instructor would select and counsel capable young men who want to go into graduate and research work, would it be possible for the College teaching staff in Soil Science and the Experiment Station staff to work out a cooperative joint advisory program or project of research that would contribute to the benefit and experience of both staffs by making use of this student type of research assistance?

After these conferences it was extremely encouraging to note such a complete and sincere attitude of support and cooperation from all the College subject matter departments, from Director Chai of the Central Agricultural Experiment Station and others, in the interest of Soil Science. It is hoped that the present cooperation between the College and the Experiment Station, as manifested by these conferences and now by the teaching exchange in Soil Science with the Central Station staff, can be expanded in order that the results of research can be extended into the teaching of College students, graduate students and extension workers in the field.

The field trips and laboratory demonstrations conducted by the Adviser were designed to train and assist the various staff members, as well as the Adviser, as to the problems of soil fertility and conservation, crop production and practices that could be employed to aid in solving these problems. The group going on these tours at the various locations included the Seoul National University College of Agriculture staff of Animal Husbandry, Agricultural Engineering, General Agriculture, Agricultural Chemistry and Farm Management; the Experiment Station Soil Survey staff; the Central Station and Substation staff members; Provincial Station staffs; and some faculty members in the same subject matter fields in other agricultural colleges. The following demonstrations and observations were made on each of these trips:

A. The soil conditions and characteristics, degree and extent of erosion and the erosion problem.

B. How to use a soil auger, a soil sampling tube and shovel to take a soil sample for test.

C. Observation of plants as indicators of certain soil nutrient deficiencies.

D. Nutrient deficiency symptoms of nitrogen, phosphate and potash on the growing crop.

E. Demonstration of soil tests in the field. These demonstrations were also conducted in the laboratories at the colleges and substations.

F. Observation of phosphate deficiency symptoms of livestock as was indicated at some locations.

G. Discussions on landuse and conservation practices that could be used under various soil conditions.

H. The Adviser used colored slides, taken to Korea from Minnesota, to illustrate crop nutrient deficiency symptoms, soil testing and techniques on how visual aid equipment could be made and used for taking pictures in the field and for use in student classes and other meetings. During one of these field trips to the Rice Breeding Station at Iri in Chollo Pukto Province, the Adviser was invited by Dean Paik of the College of Agriculture to present his slides on the "Principles of Soil Fertility and Management" at the weekly student convocation at Chon Puk University.

I. How demonstrations and experiments could be planned and laid out for comparing lime and different fertilizer treatments on different kinds of crops.

The following is a list of many individuals of the various colleges, Ministries, Bureaus and organizations contacted by the Adviser and associated with him during the collection of information and the preparation of this report.

College Department Heads and Staff Members, Central Experiment Station Staff and Others

College

Dean	Cho Baik Hyun
Agriculture	Chi Young Lin - Head
Biology	Ahn Chai Jun - Head

College - continued

Chemistry	Kim Ho Sik - Head and staff
Economics	Kim Chun Po - Head
Engineering	Lee Chang Ku - Head and staff
Forestry	Hyun Sin Kyo - Head Shim Chong Supp - Associate Professor
General Studies	Cho Sung Chi - Head
Horticulture	Lee Tai Hyun - Associate Professor
Livestock	Yun Sang Won - Head Lee Young Bin - Associate Professor
Sericulture	Kim Mun Hyup - Head

Central Experiment Station

Chai Byong Suck	Director
Oh Wang Kun	Soil Survey, Soil Testing and staff
Pai Dae Han	Hydroponics
Chang Young Chul	Rice Breeder
Woo Su Jin Choi Yong Sun	With their staff of 8 Soil Survey technicians

Others

Keel Song Woon	Government of Cheju Island, President of Cheju University and Director of Experiment Station
Kim Chi Hyung	Cedju Livestock Bureau, Cheju
Lee Chong Rin	Director and Agronomist and Staff, Taejon
Kang Chin Hyung	Dean, Chungnam University, Taejon
Kim Hyun Song	Director, Kyong Ju Substation, Yong Dung Po
Young Ju Ryong	Whasan Livestock Substation, Suwon
Kang Song Hak	Director Songhwan Livestock Station and Staff

Others - continued

Kim Young Suk	Director, Ili Rice Breeding Station and Staff
Paik Nam Hyup	Dean, Chon Puk University - Agricultural College and staff
Chung Nam Ku	Chief, Agricultural Bureau, Ministry of Agriculture and Forestry
Lee Nam Sin	Chief, Livestock Bureau, Ministry of Agriculture and Forestry
Kim Yong Sup	Chief, Fertilizer Section, Ministry of Agriculture and Forestry
Kim Yong Seu	Director, Cotton Breeding Station, and staff, Mokpo
Song Chai Chul	Dean of Agriculture, Chunam Nambc University, and staff, Kwang Ju
Lee Chong Bok	Director of Substation and staff, Kwang Ju
Onyang Irrigation staff	Onyang

PART II.

RECOMMENDED PLAN OF ORGANIZATION AND DEVELOPMENT OF A

SOIL SCIENCE CURRICULUM IN THE COLLEGE OF AGRICULTURE

SEOUL NATIONAL UNIVERSITY

Name of Department and Organizational Plan

It is recommended that the Soil Science curriculum be organized and set up in the College of Agriculture as a section of the Department of Agricultural Chemistry. It seems only logical that the Soil Science section should be a part of the Department of Agricultural Chemistry because at the present time all soils courses are being taught by a staff trained and experienced in soils and chemistry. It might be desirable at some time in the future to establish a separate Soil Science Department if and when the College administration would find it necessary because of the increased work load of both Chemistry and Soils.

It is recommended that the Administrative organization be maintained under the able leadership of Dr. Kim Ho Sik, Department Head, of Agricultural Chemistry. It is further recommended that the name of the Department be known as follows:

DEPARTMENT

OF

AGRICULTURAL CHEMISTRY

AND

SOIL SCIENCE

It is also suggested that the new Department of Agricultural Chemistry and Soil Science might be broken down into sections as follows:

A. Soil Science

B. Agricultural Chemistry

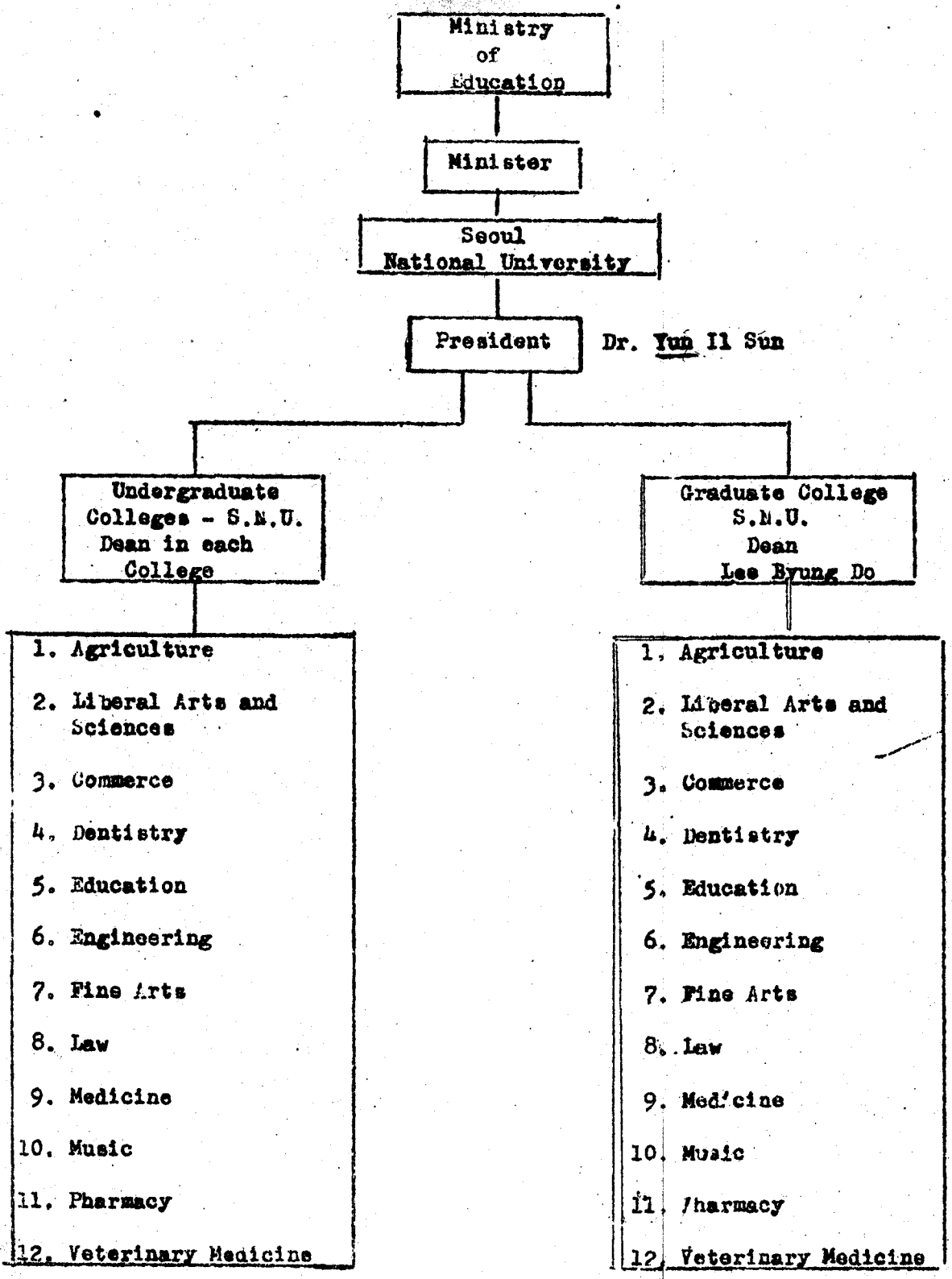
C. Biochemistry

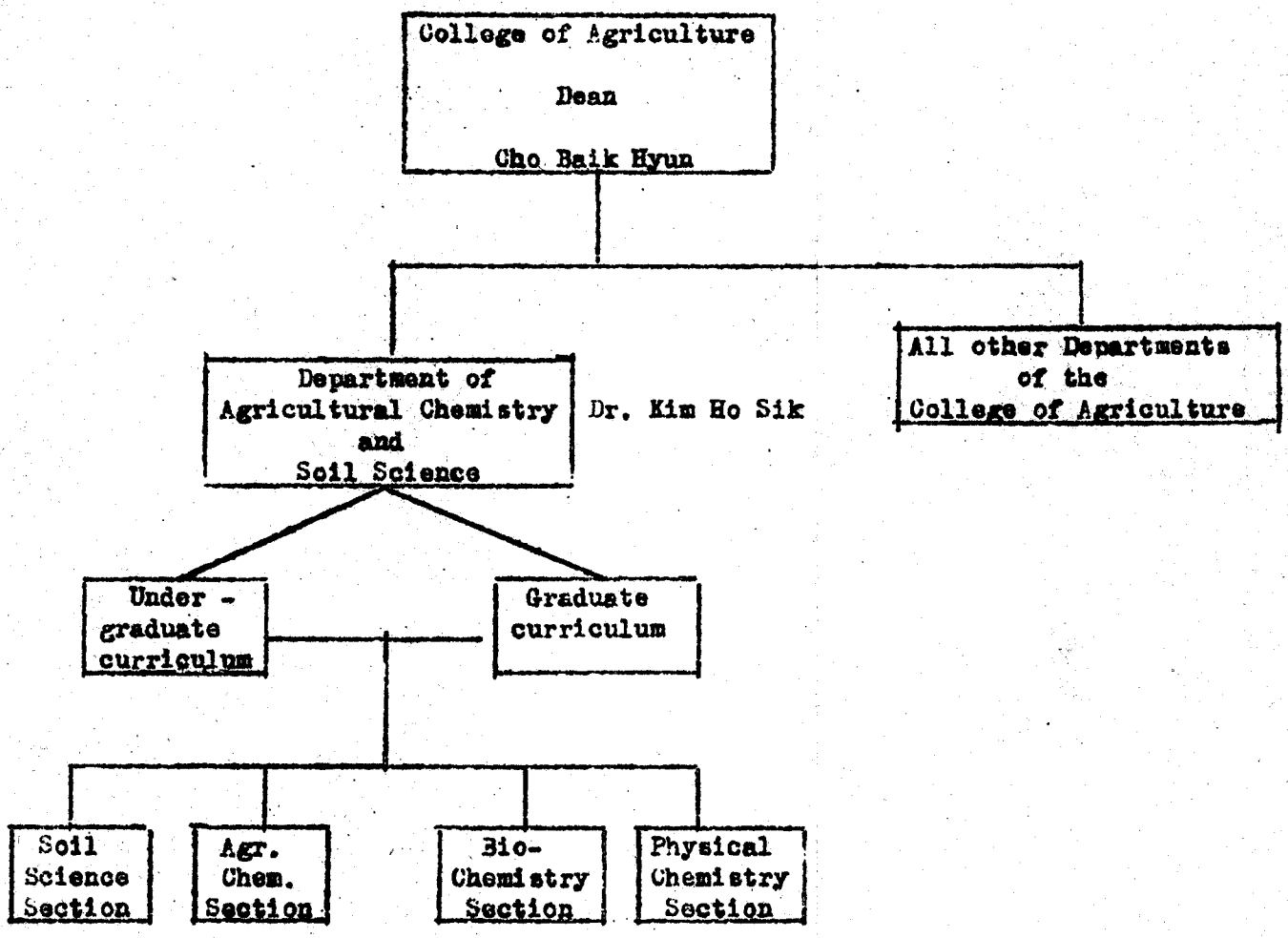
D. Physical Chemistry

These four areas are merely suggestive of how sections might be designated within the Department. There may be other more important sections than these. However, since the Soil Science curriculum will be developed from the very be-

ginning it is suggested that it might be entirely advisable for Dr. Kim, Department Head, to appoint or designate someone trained and experienced in Soil Science to set up the Soil Science section. It is further suggested that if this is done this man be vested with the responsibility to develop the Soil Science curriculum in line with the soil problems of Korea, the available funds and trained staff, to integrate the curriculum with other College departments, integrate the Soil Science courses and teaching with the Department program of student undergraduate and graduate teaching and develop and review, with each staff member, his plan and program of subject matter teaching to fit the needs of Korean soils and agriculture. It is recognized that time will be required to accomplish and develop this program and to provide trained personnel and facilities. Changes and improvements should be expected as this program develops providing it is given good, aggressive and constructive leadership in the College of Agriculture. It is hoped that this Department will develop and expand to the fullest extent and that no check will be imposed. If Soil Science and its Department has the aggressive, qualified leadership with the foresight to build a strong program of teaching and to develop research and extension leaders it should not be restricted. A chain is no stronger than its weakest link. If the College of Agriculture is going to be strong and be the leader in the colleges of agriculture in Korea then there must be aggressive leadership, effective instruction and foresight to the future. The establishment of this new curriculum in Soil Science is a challenge to the College of Agriculture in view of the present soil and land needs of Korea.

The following is a diagram suggesting the plan of organization of the Soil Science Section in the Department of Agricultural Chemistry, College of Agriculture:


Ministry of Education
Minister
Seoul National University
President
Dr. Yun Il Sun
Undergraduate Colleges - S.N.U.
Dean in each College
1. Agriculture
2. Liberal Arts and Sciences
3. Commerce
4. Dentistry
5. Education
6. Engineering
7. Fine Arts
8. Law
9. Medicine
10. Music
11. Pharmacy
12. Veterinary Medicine
Graduate College
S.N.U.
Dean
Lee Byung Do
1. Agriculture
2. Liberal Arts and Sciences
3. Commerce
4. Dentistry
5. Education
6. Engineering
7. Fine Arts
8. Law
9. Medicine
10. Music
11. Pharmacy
12. Veterinary Medicine


College of Agriculture
Dean
Cho Baik Hyun
Department of Agricultural Chemistry and Soil Science
Dr. Kim Ho Sik
All other Departments of the College of Agriculture
Under - graduate curriculum
Graduate curriculum
Soil Science Section
Agr. Chem. Section
Bio-Chemistry Section
Physical Chemistry Section

The Principles and Objectives of a Long-time Soil Science Program of Teaching, Research and Extension

A Landuse Program for Korea

1. Soil Survey and Land Classification

The Conditions and the Problems:

A. The soil and landuse inventory:

1. Determine soil type characteristics
2. Topography and classification
3. Degree and extent of erosion
4. Present fertility and production problems
5. Previous history of land management and landuse
6. Special problem soils (tide lands and others)

B. The Economic Conditions and Problems:

1. The present type of farming and agriculture
2. Size of farms and limitations
3. Markets and methods of disposal
4. Credit, taxes, interest
5. Cost of production
6. Tenure
7. Supplies of fertilizer, equipment, seeds and materials
8. Ability of the operators and farmers

II. The landuse

Determined by the Soil Survey and Land Classification incooperation with the various Bureaus of the Ministry.

Establish landuse classification standards adaptable to Korean conditions.

A. Forest, timber and fuel (develop a special program of reforestation, management and use) on soils not suitable for pasture, forages or crop land.

B. Permanent forages, pasture, hay and fuel needs on land (foothills) not suitable for grain and food crop production

C. Hillculture landuse in foothill areas not suited for regular and intensive crop production.

D. Cropland for grain and food production

1. Paddy soils

2. Upland soils

3. Tideland soils

4. Foothills with certain limitations.

III. Soil and Land Management

A. Irrigation

B. Drainage

C. Clearing brush areas

D. Systematic soil testing to determine soil treatment needs

E. Adaptable and practical erosion control practices

F. Hillculture farming.

IV. The Landuse Plan

A. Determine the soil type classification by Province and areas

B. By communities, neighborhoods and farms.

C. Develop suggested plans and recommendations for landuse and soil management.

D. Compare plans as to the soil condition needs, economic problems and to the needs of the people

E. Put the program and plan into operation through the coordinated leadership of the Ministries of Education and Agriculture and Forestry, the College of Agriculture, Seoul National University, in teaching students, doing research and through a good agricultural extension program.

This is a long-time program but any nation that will establish its future on wise landuse and consider all of the needs that must come from the land will continue to grow stronger and have a higher standard of living.

A Soil Fertility, Management and Conservation Program for Korea

A Soil Fertility, Management and Conservation Program is determined by proper soil and land classification methods which are the basis for proper use of the land. Such a program is applicable to any soil type characteristic, different crop and landuse and all types of farming conditions. The differences which come in the application of this program in the Provinces, communities and individual farms, lie in the emphasis which must be placed on one or the other of these principles, depending on the soil problems. Sometimes one principle or practice will be in control of the land needs of crop production, sometimes another and sometimes several. This provides a basic foundation on which to establish sound teaching, research and extension programs.

If this program is followed and proper treatments which it calls for are provided, the soils of Korea may be made more productive and their capacity to continue to produce the necessary food, fuel and lumber for its people will be improved and maintained.

I. Irrigation - Drainage - Land Clearing - Cultivation

A. Draining and improving tide lands and other wetland areas.

B. Expand and improve irrigation facilities

C. Clear only suitable land according to soil classification and landuse

D. Proper seedbed preparation and cultural practices.

II. Lime Acid Soils

A. Determine need by a systematic soil testing program on the individual farm. Base recommendations on research results.

B. Apply according to testing recommendations.

C. Use recommended rates.

D. Use high quality liming materials

E. Make available an adequate supply of liming materials

F. Establish research projects.

III. Use Adaptable Cropping Systems. (The Landuse Program for Cultivated Cropland)

A. Based on soil-type conditions.

B. Use adaptable and recommended crop varieties

C. Inoculate all legume crops

D. Establish research projects on different soils using different field crops.

IV. Maintain Soil Organic Matter

It is the life of the soil.

It is the store-house of fertility.

It provides good soil tilth and structure.

A. Adaptable green manure crops

B. Compost materials

C. All crop residues

D. Forage mixtures

E. Livestock manure

F. Base recommendation on a good research program.

V. Use Commercial Fertilizers

Determine the need and kind by a systematic soil testing program on the individual farm. (Develop a research program of correlation of soil tests and crop responses).

A. Nitrogen (dry, liquid and gas forms)

B. Phosphate (based on high analysis and availability tests)

C. Potash

D. Minor elements when needed

Sulphur, boron, etc.

E. Other fertilizing materials

F. Use recommended fertilizer grades and ratios.

G. Follow recommendations for rates, time and method of application

H. Establish a uniform research project to determine these recommendations and needs.

VI. Erosion Control Practices.

A. Grassed waterways (Permanent grass in all natural drainage-ways)

B. Cover crops (winter grain, later may be used as green manure)

C. Plant and cultivate all crops on the contour

D. Strip crop across all slopes

E. Construct terraces and diversion dikes. Diverted water may be used for irrigation.

F. Gully control with structures where needed.

G. Planting trees, reforestation and fuel crop varieties

H. Turf terraces

I. Hillculture farming practices

J. Other recommended practices adaptable to Korean conditions as jointly developed by the Bureaus, Experiment Stations and the College of Agriculture

In considering the needs of food, fuel and lumber, and specifically food and fuel, some attention and consideration should be given to a program called hillculture agriculture. Landuse of this kind has been developed in various parts of the world, including the United States. It is possible that the fuel needs could be brought into the agricultural food programs in the foothill areas. By using hillculture practices it is possible to grow such crops as nuts, small fruits, upland food crops, grapes, orchard crops and fuel crops such as Acacia or other suitable fast growing fuels. With such crops it is possible to utilize some of the foothill areas for additional food needs and at the same time develop a program of fuel production which could take some of the destruction pressure off the steeper upland areas so that reforestation might be more effectively protected and preserved. Here is a place where agriculture and forestry could work jointly on a program of food, fuel and lumber production. Such areas will need soil fertility, management and conservation practices in addition to hillculture practices to make such a program effectively productive. Such opportunities should be explored.

Recommended Soil Science Curriculum in the College of Agriculture

All students in the College of Agriculture are required to take the same basic courses during their first year of college before entering their major field of study, starting the second year. This appears to be a desirable approach in which a student can be given a sound but general foundation in the basic sciences so essential in the technical fields of agricultural sciences such as Soils.

A Bachelor of Science degree in Agriculture requires that a student complete 8 semesters of residence at the College of Agriculture. A student to obtain a major in Soil Science must be registered in the Department of Agricultural Chemistry and Soil Science his second, third and fourth years. The Agricultural College curriculum is still in the general process of being adjusted from year to year until the various departmental curricula are more definitely established. The semester credits required for graduation, as based on information from the Registrar's Office, are to be as follows for the next three years; 1956 - 175 credits, 1957 - 165 credits and for 1958 - 160 credits. It would seem advisable at the present time that the Soil Science curriculum be set up on the basis of 160 credits since no student will be ready for graduation for at least 4 or 5 years or until 1959 or 1960.

When specific Soil Science courses are finally developed the first consideration should be that the student will receive the best technically balanced training possible. The second consideration should be based on the soils and agricultural needs of Korea. If such a plan of teaching is followed the Soil Science curriculum can make an invaluable contribution to the agricultural needs of Korea. The following is a suggested outline of different courses with certain major topics to be included in each course.

All courses should be given a number as they are placed in the College of Agriculture curriculum.

General Soil Science

Course No. C 201 - 202

This course is now required by all students of the College of Agriculture. This is a good course as now being presented but as previously stated some of the more technical phases might be put into the new courses that will be offered later in the Soil Science curriculum. This is the key course in Soil Science. This course, depending on the material included and how well it is presented by the instructors will be instrumental in helping to determine if students have the desire to major in Soil Science. The following items are some additional suggestions that might be considered in the final outline of this course.

Lecture

1. Orientation in Soils
2. What Soil Science has to offer a student
3. Soil relationships to landuse, agricultural and forestry
4. The philosophy of Soil Science
5. Develop the students' understanding and liking for Soil Science
6. Origin, formation and classification of soils
7. The chemical and physical properties of soils
8. Elements essential for plant and crop growth
9. Soil moisture and water relationships
10. Soil reaction
11. Organic matter and decomposition
12. Soil microorganisms
13. Cropping systems

General Soil Science - continued

14. Fertilizers

15. Erosion control as related to soil conditions and characteristics

16. Diagnostic techniques

Soils of Korea

Course No. 1

Lecture (Prerequisite Geology En. 203; Soil Science C 201)

1. Characteristics and location of the major soil types and groups of Korea:

    a. Paddy soils
    b. Upland soils
    c. Foothills soils
    d. Mountain soils
    e. Other soil conditions

2. Surface geology

3. Use of the soil survey

4. Use and interpretation of soil maps

5. Productivity ratings of different soil types or groups of similar soils

6. The landuse capabilities of different soil types or groups

7. How to describe a soil profile

8. How to make a soil map

Laboratory

1. Use the field areas adjacent to the College. The instructor can select several areas of 1 or 2 chongbos ($2\frac{1}{2}$ to 5 acres) in size for students to actually determine the soil characteristics of type, slope and erosion and make a soil survey map. Students may work in teams of 2 to 4 depending on the size of the class and the number of problem soil survey areas that can be set up. The Adviser has examined the soil areas adjacent to the College and found a very good soil survey out-door laboratory can be developed. The instructor will need to lay out each area, make the soil survey maps for each area and write up the description of the soils. The students after making the soil survey maps will prepare their own reports covering soil descriptions, problems and recommendations for use and management.

Soils of Korea - continued

Laboratory

2 Take laboratory field trips to study the soil characteristics of type, slope, erosion, crop growth, etc., at various locations.

3. Use land judging as a means of studying the soil characteristics, determining use and making recommendations for management and treatments.

(Details for conducting a land judging laboratory have been given to Dr. Kim in kit)

4. Prepare soil profiles for classroom demonstration.

(Instructions and details have been given to Dr. Kim in kit)

Soil Genesis and Classification

Course No. II

This course is important to all Soil Science majors. It would be particularly important to students who are most interested in doing actual soil survey and classification work with the Central Agricultural Experiment Station and the Branch and Substations.

Lectures (Prerequisite Soils of Korea No. 1; Soil Science C 201)

1. World distribution of the major soil groups

2. Soil profile characteristics

3. Discuss the factors of soil formation

4. Detailed discussion of weathering and soil forming processes

5. Review early soil classification and progress

6. Review the International Method of Soil Classification and Nomenclature as outlined in the United States Department of Agriculture - U.S.A. publications

7. New advances now being prepared in soil classification by the United States Department of Agriculture - U.S.A.

Laboratory

See suggestions under "Soils of Korea"

Soil Management

Course No. III

Lecture (Prerequisite Soil Science C 201)

1. Principles of Soil fertility, management and conservation
2. National programs of agriculture as related to Soil Science
3. Landuse as related to soil types and classification
4. Use of soil surveys
5. Irrigation, drainage, cultivation, clearing and reclaiming tidaland soils
6. Soil reaction - pH - liming acid soils, tideland soils and problem soils
7. Crop rotation systems
8. Use of organic matter. Green manure, compost and crops residues
9. Use of fertilizer; commercial (nitrogen, phosphate, potash and minor elements), ashes, night soil and organic materials
10. Erosion control practices
11. Soil testing
12. Plant tissue testing
13. Nutrient deficiency symptoms of plants
14. Diagnostic techniques to determine crop production problems

Soil Conservation

Course No. IV

This course may need to be worked out in cooperation with the Departments of Forestry and Agricultural Engineering which are also offering a course under the same title. This course, however, should be established on the strict basis of the soil characteristics and landuse needs of Korea.

Lecture (Prerequisite Soil Science C 201; Soil Management No. III)

1. Causes and types of soil erosion
2. Relation of erosion to climate, vegetation, soil type, slope, management and landuse

Soil Conservation - continued

Lecture

3. Erosion control practices

4. Organizations dealing with soil erosion control

5. Landuse planning

Laboratory

Field trips arranged with class to study soil erosion problems

(Additional details given to Dr. Kim in kit)

Soil Physics

Course No. V.

This course may be worked out in cooperation with the Agricultural Engineering Department because of the relationships of soil characteristics to irrigation, drainage and mechanical erosion control practices.

Lecture (Prerequisite Physics En 103 - 104; Soil Science No. 1)

1. The physical characteristics of the soil
2. Mechanical composition, consistence, structure, tilth, and seedbed preparation
3. Soil and water relationships
4. Soil air and temperature relationships
5. Soil fertility and plant nutrient availability
6. Relationship to erosion and erosion control practices
7. Cultural practices and the effect on soil conditions.

Laboratory

1. Particle size analysis
2. Consistency and plasticity
3. The penetrometer
4. Aggregate analysis
5. Porosity, bulk density
6. Units used for expressing moisture tensions
   (More detailed material left with Dr. Kim)

Soil Chemistry

Course No. VI

This course may be based on the present Chemistry courses now being offered as prerequisite to this course.

Lecture (Qualitative Analysis C 213 and Quantitative Analysis 215)

1. Organization and coverage of the course
2. Inorganic soil colloids
3. Principles of mineral structure
4. Silicate minerals
5. Structural properties of class and related minerals
6. Ion exchange
7. Acid clay
8. Cation activities in clay-water systems
9. The chemical composition of Korean soils
10. Plant nutrients and the factors affecting their availability.
11. Soil organic matter
12. Other topics presented in the existing Chemistry courses relating to soils.

Soil Fertility and Fertilizers

Course No. VII

This course should be developed to include the two courses on fertilizers now being taught, C 203 - C 204 (Fertilizers), C 419 - C 420, (Fertilizer Manufacturing) and the laboratory course (C 311 - C 312).

Lecture (Prerequisite C 201)

1. Need for fertilizers, soil tests, plant deficiency symptoms, and plant tissue tests. Recommendations for fertilizer.
2. Phosphorus in soils and needs for crop and animal growth Availability and losses of Phosphorus

Soil Fertility and Fertilizers - continued

Lecture

3. Production of phosphorus fertilizers
   Sources and production of phosphorus fertilizers; phosphate lack and soluble phosphates
   Methods of manufacture

4. Use of phosphorus fertilizers

5. Potash in soils and need for crop growth

6. Production of potash fertilizers
   Sources and production of potash fertilizers
   Methods of manufacture

7. Use of potash fertilizer

8. Nitrogen in soils and needs for crop and animal growth
   Gains and losses; availability of nitrogen

9. Production of nitrogen fertilizer
   Sources and production of nitrogen fertilizer
   Methods of manufacture

10. Use of nitrogen fertilizers

11. Other nutrient elements (Ca, Mg, S) in soils and crop and animal needs
    Sources and use of elements; availability

12. Minor elements in soils and needs of crops and animals
    Sources and use of minor elements; availability

13. Mixed fertilizers
    Use and trends in manufacture

14. Forms of fertilizer-solid, solution, and liquid
    Foliar feeding

15. Methods of application - fertilizer application machinery

16. Field data interpretation and laying out demonstration and research plots

Soil Seminar

Course No. VIII

This course should be based on soil topics assigned by the instructor. The topics may be on the practical or technical information or a combination of both but dealing with points of a current nature.

1. Assigned readings

2. Reports of certain work

3. Recommendations and conclusions

4. Class discussions

A certain topic or topics may be considered for the semester such as:

1. Fertilizer

2. Organic matter

3. Soil reaction

4 Soil testing

Forest Soils

Course No. IX

This course is especially designed for students in Forestry or for those students majoring in Soil Science and wanting a minor in Forestry.

Lecture

1. Origin and classification

2. Factors of soil formation

3. Forest soil organisms

4. The forest floor

5. Physical and chemical properties

6. Soil water and erosion control

7. Use of soil maps in Forestry

8. Study and description of soil profiles

9. Texture, structure, consistence, reaction and color

10. Management of forest nursery soils

Laboratory

Field trips to study and describe soil profiles, use of soil maps and erosion problems

Suggested Laboratory Exercises in Soil Science

These laboratory exercises are in addition to the present exercises being demonstrated by the instructor or carried on by the students, depending on the available equipment at hand. These exercises may be developed with any of the newly suggested courses. Each student now buys a Chemistry kit for $1.00 for laboratory work (which is used in all Chemistry courses but can also be used in the Soil Science courses).

In the On-campus Laboratory

1. Testing soil for reaction with different methods:
    a. Comber (acidity)
    b. Truog (Wisconsin)
    c. Thornton (Purdue)
    d. Spurway (Michigan)
    e. pH meter
    f. Litmus paper (blue and red)
    g. Other methods
    h. The use of commercial field kits

2. Tests for available phosphate
    a. Purdue
    b. Bray (Illinois)
    c. Truog
    d. Spurway
    e. Other methods
    f. Field kits

3. Tests for available potash
    a. Purdue
    b. Truog
    c. Bray
    d. Spurway
    e. Field kits

4. Tests for nitrogen
    a. Truog
    b. Iowa
    c. Other
    d. Field kits

5. Minor nutrients
    a. Spurway
    b. Other

6. Limestone tests for purity and neutralizing value (Dr. Kim has information)

7. Limestone fineness (sieve studies)

8. Study soil texture and identify 8 to 10 different textures

9. Identify different kinds of fertilizers available in Korea

10. Grow crops such as corn, grains, clovers, and grasses in jars filled with river sand and fertilizer with nitrogen, phosphate and potash to bring out nutrient deficiency symptoms. This work can be carried on by the students. Use liming materials on low pH soils compared with no lime to show response on legume crops such as the clovers and alfalfa.

11. Run plant tissue tests on the plants and crops grown in pots in No. 10 item above or bring them in from the field. Run tissue tests for:

    a. Nitrogen
    b. Phosphate
    c. Potash
    d. Other

12. Have students bring in their own soil samples for the soil tests outlined under items 1, 2, 3, 4 and 8.

13. Tests for the different kinds of fertilizers to determine if the material is nitrogen, phosphate or potash as now being done with the prepared test kits in the Central Experiment Station and the substations. (All testing methods left with Dr. Kim in kit)

<u>In field laboratory</u>

The instructor will take the students on field trips to make soil, crop and plant observations.

1. Erosion problems

2. How to take a soil sample for tests

3. How to determine degree of slope:

    a. Abney level
    b. Slope indicator (Dr. Kim has construction plan)
    c. Estimation of slope (Discussed by Adviser on field trip.

4. Nutrient deficiency symptoms of plants as to growth and color:

   a. Nitrogen
   b. Phosphate
   c. Potash
   d. Acidity
   e. Other

5. How to make a soil map as given under the course in soil survey and classification.

6. Visit plots having different lime and fertilizer treatments to observe the difference in crop growth and response.

7. Demonstrate and have students run a contour line. Use the Abney level.

8. How to take a soil profile. (Dr. Kim has this information).

9. Set up different fertilizer treatment plots as a top dressing on the campus areas adjacent to the buildings for use as class demonstration.

10. Conduct land judging demonstrations for all Soil Science students.

Other Recommended Courses of Undergraduate Study for Students Majoring in Soil Science

The following topics should be developed into separate courses for students who are planning to go into extension education or the general applied type of research.(May be selected as electives).

1. Public speaking

2. Production and presentation of radio and television programs

3. Journalism writing for newspaper consumption

4. Writing the interpretation of research data for general public consumption

5. Preparation of visual aids such as data, chart material, photography and slide preparation in laboratory and field work

6. Course Ec. 425 - Ec 426 (Agricultural Extension)

7. Difference between an experiment and a demonstration

8. How to lay out field experiments

9. How to lay out field demonstrations

10. How to present a field demonstration and the results to visiting groups

First Year (Soil Science)

The courses listed below are required of all students registered in the College of Agriculture. These also are the recommended subjects all Soil Science students should take before going into their specific Soils courses:

Course No.	Subject	Semester credits 1st	Semester credits 2nd
101 - 102	Korean	2	2
105 - 106	English	3	3
En.101 - 102	Mathematics	2	2
C 101 - 102	General Chemistry	2	2
En 103 - 104	General Physics	2	2
B 101 - 102	General Botany	2	2
B 103 - 104	General Zoology	2	2
Ec 201 - 202	Principles of Economics	3	3
A 101 - 102	Outline of Agriculture	2	2
113 - 114	Physical Training	1	1
	Total	20	20

The above 20 credits are obtained by attending 30 hours of lecture per week.

Second Year (Soil Science)

Course No.	Subject	Semester credits 1st	Semester credits 2nd
C 201	Soil Science	3	3
C 207 - C 208	Organic Chemistry	3	3
En 203	Geology	2	--
A 201 - A 202	Plant Cultivation I and II	2	2
L 201	Principles of Livestock	2	--
B 201	Plant Physiology	2	--
	Crops V	--	3
C 213	Qualitative Chemical Analysis	3	--
C 215	Quantitative Chemical Analysis	--	3
110	History of Civilization	--	2

Second Year (Soil Science) - continued

Course No.	Subject	Semester Credits 1st	2nd
108	Outline of Philosophy	--	1
B 302	Genetics I	--	3
B 311	Plant Pathology	3	--
	Total	20	20

All students in the College of Agriculture are required to take Soil Science C 201 - 202

Third Year (Soil Science)

Course No.	Subject	Semester Credits 1st	2nd
En 204	Geology	--	2
No number given	Forestry	2	--
I	Soils of Korea	3	--
III	Soil Management	--	3
C 217	Soil Microbiology (Will be given both semesters)	3	--
VII	Fertilizers and Soil Fertility	3	3
VI	Soil Chemistry	--	3
VIII	Soil Seminar	2	2
En 308	Farm Machinery	2	--
S 202	Outline of Sericulture	--	2
	Elective Courses	5	5
	Total	20	20

Fourth Year (Soil Science)

Course No.	Subject	Semester Credits 1st	2nd
II	Soil Genesis and Classification	3	--
IV	Soil Conservation	--	3
V	Soil Physics	3	--
VIII	Soil Seminar	2	2

Fourth Year (Soil Science) - continued

Course No.	Subject	Semester Credits 1st	2nd
Ec 205	Farm Management	2	--
Ec 309	Agricultural Policy	3	--
Ec 416	Korean Economics	--	2
Ec 426	Agricultural Extension	--	2
En 405	Tide Land Reclamation	--	2
	Elective Courses	7	9
	Total	20	20

Elective Subjects (Soil Science)

Course No.	Subject	Semester Credits 1st	2nd
107 - 108	German (4th yr)	1	1
En 205	Statistics (4th yr)	2	--
En 202	Meterology	--	2
En 215 - 216	Surveying	2	2
C 409	Agricultural Chemicals	2	--
Ec 207	Agricultural Geography	2	--
Ec 17	Korean Agricultural History	2	--
Ec 407	Agricultural Bookkeeping	2	--
Ec 320	Rural Sociology	--	2

The above represent a few suggested courses but others should be recommended to the student as the counselor would plan the course of study with each student majoring in Soil Science.

In addition to the general elective subjects, students who may want to minor in another department of the College should take at least 20 semester credits from the department in his selected minor field. The student advisor in the major and minor departments should guide the student in selecting his elective courses. A Soil Science student should be permitted to select his minor in any other dppartment of the College. Such student courses will develop

graduates of stronger and broader training and better fit them for their specific fields as well as giving them a better understanding of how other subject matter fields can strengthen and contribute to their specific work.

Graduate Training and Research in Soil Science

One of the important educational means of rebuilding Korea for the future is to further develop a strong program of training the outstanding young men for research. Research is an investment in and insurance for the future. A strong research program must be given strong support and strong leadership by the administrative bodies. The Ministry of Education and the Ministry of Agriculture and Forestry must pool their resources of leadership and finances to develop a joint and cooperative program. The solution calls for able young men that are well trained. Bringing trained men from other countries to Korea or the sending of Korean young men to other countries is not the final answer to the teaching and research needs of Korea. The only final answer is the development and training in Korea of its own teaching and research workers. Here is one field of education where the College of Agriculture, Seoul National University, can become the leader and be looked upon as the outstanding institution of higher education where students may come to do graduate study in Soil Science and related agricultural fields of subject matter.

Coupled with the selection of outstanding students to guide into research work, there will be need for good laboratory facilities, equipment and an adequately trained and experienced teaching staff. One staff member cannot carry the whole load of teaching of undergraduate students, do research work and train graduate students. With sufficient staff personnel this load can be spread, while at the same time a staff member can be given the opportunity to work in all three phases of instruction.

The next important point for good research is to have good student advisory leadership. This is probably the most important point of all. A good adviser should be a person who is or has been a teacher and also a person who is carrying on some research work with his teaching. Here is where the exchange of College and Station staff in Soil Science could develop this kind of advisory technique. Teaching and research go hand in hand. One is dependent on the other if both are to be successful and contribute to the needs of Korean Agriculture.

Here is where the College of Agriculture and the Central Experiment Station and the two Ministries can cooperate and coordinate a unified research program.

In developing a research program in Soil Science consideration must be given to two types of research, the practical or applied and the fundamental or basic. In the end, for a sound research program there must be a balance between the two if research is to give the maximum contribution. A good research worker is a man who has the imagination, vision and experience to see and understand the importance of these two very necessary and essential elements of a sound research program.

One important consideration facing the College of Agriculture and the Central Experiment Station is where such a research program should begin. This question might well be answered by evaluating the essential needs and reconstruction problems now facing Korea. The root of this problem is one of soil fertility, management, landuse, crop production, essential food, fuel and lumber needs. In view of this situation the research program might well be started on the applied or practical basis to get some of the most pressing questions or problems answered as quickly as possible. However, at the same time the good researchworker is studying his practical results,

he will also be planning and developing the fundamental or basic research work that will and must follow as the overall program develops. If such a plan pertinent to the soils problem is carried out, research can be made almost an immediate benefit, while at the same time the basic research program can be developing on certain specific problems as found in the practical or applied research results. These research findings can then be interpreted and extended to the farmers and related agricultural groups and organizations through an Agricultural Extension program.

At the present time only a limited number of graduates are taking graduate training at the College of Agriculture. Fourteen Master's degrees were conferred in all fields of Agriculture at the commencement exercises in March, 1956. In the College now there are a total of 26, including two in Chemistry, doing graduate work leading to the Master's degree. At the present time there are no candidates for a Doctor's degree but such a degree can be conferred with the completion of a well-defined program of graduate study. This field of education should be strengthened.

Requirements for Master's Degree

A candidate for a Master's degree in Soil Science must meet the following requirements:

1. Must complete at least 24 to 30 semester credits of graduate study as approved by the faculty.
2. The graduate student must be a resident of the College of Agriculture for a minimum of 3 semesters.
3. Must present a certificate of proficiency in the foreign language of English.
4. Must prepare a thesis that is approved by the Department of Agricultural Chemistry and Soil Science.
5. Must pass an oral examination.

Requirements for Doctor's Degree

A candidate for a Doctor's degree in Soil Science must meet the following requirements:

1. Must complete at least 60 to 80 semester credits of graduate study as approved by the faculty.

2. The graduate student must be a resident of the College of Agriculture for a minimum of 3 academic years.

3. Must meet the language requirements in two foreign languages.

4. Must prepare a thesis that is approved by the Department of Agricultural Chemistry and Soil Science and display high research ability.

5. Must pass an oral examination which covers the subject matter of the thesis and in the major field of study.

Courses for Graduate Study in Soil Science

The following are suggested courses for students taking graduate work in Soil Science:

1. Soil Conditions and Crop Growth

2. Soil Chemistry

3. Advanced Soil Management and Conservation

4. Advanced Soil Fertility

5. Advanced Soil Genesis and Classification

6. Advanced Soil Physics

7. Advanced Soil Bacteriology

8. Thesis Research problems

   a. Soil Bacteriology
   b. Soil Fertility
   c. Soil Physics
   d. Soil Management and Conservation
   e. Soil Morphology and Genesis

   (There are many phases of research that can be selected from each of the above that are related to Korean soils)

9. Soil Mapping

10. Principles of Soil Erosion

11. Field and Laboratory Studies

a. Soil texture, structure and color
b. Soil reaction
c. Nutrient deficiencies (soil and plants)
d. Lime and fertilizer experiments
e. Organic matter, microbiology, decomposition
f. Plot layout, techniques and design
g. Interpretation of research data
h. Soil maps, their use and interpretation

12. Seminar

Reports and discussions on current investigations in Soil Science

Suggested Additional Preparation Courses for Graduate Students

1. Public speaking

2. Principles and ethics of research

3. Experimental plot design and layout

4. Harvesting plot yields and collecting data

5. Making field notes and observations

6. Interpretation and writing of research data

Some Suggested Research Problems

The following are a few suggested research problems that should be considered when starting a research program. There are many others to be included but these appeared to the Adviser to be the ones of most importance and were the ones most generally referred to by different agricultural leaders throughout the country.

1. The effects from the use of different forms of nitrogen fertilizer (dry, liquid, gas) on rice and all upland crops

2. The placement in the soil of the different forms of nitrogen fertilizer on rice and all upland crops

3. The comparison of green manure crops with different forms of nitrogen fertilizer

4. The comparison of different rates of liming ranging from 2 to 16 tons per acre as based on soil test

5. Different methods of applying agricultural limestone - 1/2 plowed under (deep) and 1/2 applied after plowing (shallow) and all deep and all shallow

6. The comparison of the fineness of grinding and quality of agricultural limestone, as to time and rate of application and the changes in pH of the soil

7. The effect, if any, of different fertilizer rates and ratios on rice blast (rice sickness)

8. The comparison of different kinds of phosphate fertilizers on all crops

9. The comparison of different rates of fertilizer application on crop response such as using 0 - 20 - 0 at rates of 200 - 300 - 400 - 500 - 600 - 800 - 1000 lbs. per acre

10. The time of application of different kinds of fertilizers on different soil type conditions and on different crops

11. Use of N fertilizer on present pasture areas as to rates and time of year of application

12. Use of lime and fertilizer (N-P-K) on newly established pastures and forage crops

13. Effect of lime and fertilizer (N-P-K) on the composition of pasture and forage mixture of legumes and grasses

14. Effect of lime and fertilizer treatments on nodulation and nitrogen fixation of different legumes such as beans and forage crop legumes

15. Soil compaction conditions and oxygen relationships of the various soil types and management in the rice paddy fields

16. The study of the needs for minor nutrients for crop growth such as boron, sulphur and others

17. Several fertilizer and lime responses as related to specific soil types

18. The correlation of soil tests with field response on all soil types and different crops

Suggested Qualifications of Staff in Soil Science

1. A graduate of an agricultural college with a major in the field of Soil Science

2. A Ph.D. or equivalent degree with a major in some specific field of Soil Science to meet the needs of the Department as certain special fields of subject matter are gradually developed

3. A background of practical agricultural experience whenever possible

4. Experience in teaching, research, and extension if such a combination might be found

5. Have a liking for working with young college men

6. Have a desire to be a good counselor for guiding young men into their fields of interest and ability

7. Have a personality that demands confidence and will win the respect of students and others

8. Possess and show the qualities of leadership

New Staff Members

As the new Soil Science curriculum is started and eventually developed, plans should be projected now as to anticipated staff needs with definite arrangements for budgeting sufficient funds for employment. Furthermore, there may be some able young men now in prospect who could be developed and trained to meet the needs of additional staff. This study of prospective staff members should begin immediately. These young men could be trained and developed by the young men now doing graduate study in Minnesota and other States. In this way the College of Agriculture can start its own training program of prospective staff which should be the eventual result of the Seoul National University cooperative project. Top academic training is basic, but its true value will never be realized until there is adequate experience gained to give it the added support. To get experience takes time which means staff development may come slowly depending on the kind of young men that will be selected to be the future staff members and the kind of training leadership they are given. For that reason every opportunity should be taken to properly use prospective staff members now studying in the United States, and present staff members and the development of the staff exchange

program between the College Soil Science staff and the Experiment Station staff. If the Soil Science staff is to become strong and effective, then it must come by way of an objectively planned and executed training program within the College.

The staff members representing the following fields of subject matter should eventually be added to the staff of the Department of Agricultural Chemistry and Soil Science. It is further suggested that if at all possible the additions be made in the order listed below:

1. Soil fertility, management and conservation
2. Soil genesis and classification
3. Soil physics
4. Soil Chemistry

Opportunities for Students Who Graduate in Soil Science

There are many opportunities for students who graduate in Soil Science. A few are outlined below. The Department of Agricultural Chemistry and Soil Science should discuss the development of the new curriculum of Soil Science and point out to the student body the opportunities available to young men trained in Soils. As time goes on and as more students are graduated in Soil Science consideration should be given as to when and how these students can be brought into the Korean agricultural economy. In some fields of agriculture and forestry there seems to be some concern as to what can be done with large numbers of students now graduating in these fields from the various Agriculture and Forestry Colleges throughout the country. For the next several years this situation should be of no particular problem in Soils but eventually it could become important. Now, it is most important to get young men trained in Soil Science to meet the present needs. Since there is such an apparent demand for a college education and

and there are twelve other agricultural colleges with each teaching Soil Science a similar problem could develop in this field.

Work Opportunities for Soil Science Graduates

1. Do research work leading to a graduate degree in soil classification, landuse, fertility, management and conservation and other specific fields of Soil Science.

2. Become an extension specialist in landuse, soil fertility, management and conservation. This program of education will shortly develop into one of the three major fields of education in Korea. It is a program of extending research findings to the farm and to all agricultural people.

3. Become extension agents in counties or communities to organize and direct agricultural extension work into a coordinated program of agriculture for the farmers.

4. Do soil survey and land classification work in the Agricultural Experiment Station. This program must be developed if the soil resources of Korea are to be effectively preserved and efficiently used. No college trained personnel are now available. College trained men should be the first requirement of qualification.

5. Become a soil conservation and landuse specialist to work in the provinces and in soil erosion control districts and areas.

6. Become a college teacher of Soil Science in the various agricultural colleges throughout Korea.

7. Teach Soil Science in the agricultural high schools.

8. Work in the commercial fertilizer and lime industry. Commercial fertilizer is new in Korea and to date very little is being manufactured within the country. In 5 to 10 years there will be a need for trained soils scientists in the various fields of this industry. This field of opportunity is only now getting started.

9. Develop a private business in agricultural supplies. This provides opportunities for young Soil Science graduates to start their own private business of selling all grades of fertilizers, limestone, all kinds of improved seeds, inoculation for legumes, agricultural chemicals, a soil testing service and other agricultural supplies and services.

10. Farming to those graduates who have the land and opportunity to develop the program of general or specialized farming.

Selected Text Books on Soil Science that Will be in the College of Agriculture Library, Seoul National University

In recommending this list of Soil Science text books, journals and other books relating to the field of Soil Science it should be remembered that there are other publications of equal value and importance as far as reference materials are concerned:

1. Geochemistry. V. M. Goldschmidt. Oxford at London Press, London. 1954
2. Irrigated Soils, Their Fertility and Management. D. W. Thorne and H. B. Peterson. 2nd Ed. 1954.
3. Bibliography of the Literature on Minor Elements. 4th Ed., Vol. 1, Chilean Nitrate Educational Branch, Inc. Supplemented by Vol. II-1951 and Vol. III - 1953.
4. Diagnosis and Improvement of Saline and Alkali Soils. U. S. Salinity Laboratory Staff, Agr. Handbook 60. U.S. Government Printing Office. 1953.
5. Fertilizer Technology and Resources in the United States. Ed. by K. D. Jacob. Academic Press. 1953.
6. Soils and Fertilizers. F. E. Bear. John Wiley & Sons. 1953.
7. Method of Statistical Analysis. C. H. Goulden. John Wiley & Sons. 1952.
8. Our Garden Soils. C. E. Kellogg. Macmillan. 1952
9. Soil Microbiology. S. A. Waksman. John Wiley & Sons. 1952.
10. Soil Physical Conditions and Plant Growth. Ed. by B. T. Shaw. Academic Press. 1952.
11. Soils and Soil Fertility. L. M. Thompson. McGraw-Hill Book Co. 1952
12. The Nature and Properties of Soils; A College Text of Edaphology. T. L. Lyon, H. O. Buckman and N. C. Brady. Macmillan. 1952.
13. Fundamentals of Soil Science. C. E. Millar and L. M. Turk. John Wiley & Sons. 1951.
14. Soil Survey Manual. Soil Survey Staff, U. S. Govt. Printing Office. 1951. Washington, D.C.
15. Soils, Their Origin, Constitution and Classification. G. W. Robinson. John Wiley & Sons. 1951.
16. Commercial Fertilizers. G. H. Collings. Blakiston Co. 1950
17. Irrigation Principles and Practices. O. W. Israelson. 2nd Ed. 1950

18. Methods of Analysis. Association of Official Agricultural Chemists, Washington, D.C. 1950.

19. Practical Report on Writing. S. S. Santmyers. International Textbook Company. 1950.

20. Soil Conditions and Plant Growth. Revised by E. W. Russell. 8th ed. Longmans. 1950.

21. Hunger Signs in Crops. American Society of Agronomy, and the National Fertilizer Assoc. Judd and Detweiler, Washington, D. C. 1949.

22. Pedology. J. S. Joffe. Somerset Press. 1949.

23. Diagnostic Technique for Soils and Crops. The American Potash Institute. 1948.

24. Farm Soils - Their Management and Fertilization. E. L. Worthen. 5th Ed. John Wiley & Sons. 1956.

25. Grass. U. S. Department of Agriculture Yearbook. U. S. Government Printing Office. 1948.

26. Soil Physics. L. D. Baver. John Wiley & Sons. 1948

27. Farm Management. J. D. Black and Associates. Macmillan. 1947.

28. Soilless Growth of Plants. C. Ellis and M. W. Swaney. 2nd Ed., Revised by T. E. Reinbold. 1947.

29. Forest Soils. H. J. Lutz and R. F. Chandler. John Wiley & Sons. 1946.

30. Forest Soils and Forest Growth. S. A. Wilde. Chronica Botanica. 1946.

31. Soil and Plant Analysis. C. S. Piper. Interscience Publishers. 1944.

32. Geomorphology. O. D. Von Engeln. 1942.

33. Climate and Man. U. S. Department of Agriculture Yearbook. U. S. Government Printing Office. 1941.

34. Factors of Soil Formation. H. Jenny. McGraw-Hill. 1941.

35. Legumes for Erosion Control and Wildlife. E. H.Graham. M. P. 414. U. S. Government Printing Office. 1941

36. On Agriculture. L. J. M. Columella. Wrttten A. D. 70. Translated by H. H. Ash. Harvard University Press. 1941.

37. Outlines of Physical Geology. C. R. Longwell and Associates. 2nd Ed. 1941.

38. The Soils That Support Us. C. E. Kellogg. MacMillan Co. 1941.

39. Humus. S. A. Wakeman. Williams and Wilkins Company. 1938.

40. Soils andMen. U. S. Department of Agriculture Yearbook. U.S. Government Printing Office. 1938.

41. Fertilizers and Crop Production. L. L. Van Slyke. Orange Judd Publishing Company. 1937.

42. Soil Science. W. W. Weir. Lippincott Company. 1936.

43. Atlas of American Agriculture. C. F. Marbut. Part III, Soils of the United States. U. S. Government Printing Office. 1935

44. Soils. E. W. Hilgard. MacMillan Company. 1930.

45. Color Classification of Soils. Soil Survey Staff. U. S. Government Printing Office, Washington, D.C. (Order).

46. Plant Nutrient Deficiencies, Diagnosed by Plant Symptoms, Tissue Tests and Soil Tests, Special Bulletin 353. R. L. Cook & C. E. Millar, Michigan State University, East Lansing, Michigan (Order).

47. Soil Testing - A Practical System of Soil Fertility Diagnosis. Technical Bulletin 132 (4th Revision). C. H. Spurway and K. Lawton, Michigan State University, East Lansing, Michigan (Order).

48. The Purdue Soil and Plant Tissue Tests. Station Bulletin 584. A. J. Ohlrogge Purdue Station, Agricultural Experiment Station, Lafayette, Indiana (Order).

Selected Text Books on Fertilizer Technology

1. Andrews, W. B.
The Response of Crops and Soils to Fertilizers and Manures, 459 pages W. B. Andrews, State College, Mississippi, 1947.

2. Bear, Firman E.
Soils and Fertilizers, 374 pages. John Wiley and Sons, 1947.

3. Collings, Gilboart H.
Commercial Fertilizers, Edition 2, 522 pages. Blakiston Co., 1947.

4. Curtis, Harry A.
Fixed Nitrogen, 517 pages. Chemical Catalogue Co., 1932.
(Out of print but may be consulted in many libraries)

5. Jacob, K. G., Editor
Fertilizer Technology and Resources in the United States. 454 pages Vol. III of Agronomy Monograph Series. Academic Press Inc. 1953.

6. McVickar, Malcolm H.
Using Commercial Fertilizers and Crop Production, 208 pages National Fertilizer Association, Washington 5, 1952.

7. Pierre, W. H., Editor
Soil and Fertilizer Phosphorus in Crop Nutrition, Vol. IV. Agronomy Monograph Series. Academic Press 1953.

8. Soucholli, Vincent
Manual on Fertilizer Manufacture, 126 pages
Davidson Chemical Corporation, Baltimore, 1946.

9. Turrentine, J. W.
Potash in North America, 186 pages. Reinhold Publishing Corporation, 1943

10. Van Slyke, Lucius L.
Fertilizers and Crop Production, 493 pages. Orange Judd Publishing Co., 1937

11. Waggaman, William H.
Phosphoric acid, Phosphates and Phosphatic Fertilizers, 683 pages
Reinhold Publishing Corporation 1952.

Soil Science Journals Recommended for the College of Agriculture Library

1. Advances in Agronomy
2. Agronomy Journal
3. Commercial Fertilizers
4. Journal of Soil Science
5. Soil Science
6. Soils and Fertilizers
7. Proceedings of Soil Science Society of America
8. Journal of Soil and Water Conservation
9. Whats New in Crops and Soils
10. Journal of Agriculture and Food Chemistry
11. Journal of Land Economics
12. Field Crop Abstracts

For any specific information relative to addresses, places of publication, etc., write to Mr. L. G. Monthey, Executive Sectretary, American Society of Agronomy, 2702 Monroe Street, Madison 5, Wisconsin, U.S.A.

Other Text Books in the College of Agriculture Library Assigned to Other Departments That may be Used for Additional Reference Material for Soil Science

1. Plant and Soil Water Relationships. P. J. Kramer
2. Elements of Soil Conservation. H. H. Bennett
3. Moisture Requirements in Agriculture. H. B. Roe
4. Handbook on Fertilizer. A. F. Gustafson
5. Chemistry of the Soil. F. E. Bear
6. National Phosphate Research Work Group. Summary of Phosphate Research in the United States. National Soil and Fertilizer Research Committee, United States Department of Agriculture
7. Mineral Nutrition of Plants. University of Wisconsin
8. Mineral Nutrition of Plants and Animals. Frank A. Gilbert
9. Soils, Their Physics and Chemistry. Amar N. Puri
10. Soil Fertility. Chas. E. Millar
11. Soil Chemistry. M. Y. Shawarbi
12. Growing Plants in Nutrient Solutions. W. I. Turner
13. Plant Growth Substances. University of Wisconsin
14. Plant Growth Regulation in Agriculture. H. B. Tukey
15. Ground Water. E. W. Bennison
16. Ground Water. C. F. Talman
17. Rainfall and Runoff. E. E. Foster
18. Soils of Europe. Walter L. Kubiena
19. Soil. V. Y. Jacks
20. Soil Restoration. Ed. H. Faulkner
21. The Soil. Alfred D. Hall
22. International Congress of Soil Science, 4th Amsterdam Transaction, 1950
23. Introduction to Climate and Weather. G. T. Terwartha
24. Sprinkler Irrigation. McCulloch & Schunk

25. Soil and Water Conservation Engineering. Richard F. Freuert

26. Land Judging. Ed. Roberts

27. Farm Appraisal. W. G. Murray

28. Field Crop Production. H. K. Wilson and Wm. M. Myers

29. The Production of Field Crops. Thomas B. Hutchinson

30. The Production of Field Crops. T. K. Wolf & Kipps

31. Field Crops. C. H. Rother & Harrison

32. Grassland Farming. Geo. H. Serviss

33. Forage and Pasture Crops. Wm. A. Wheeler

34. Forage Plants and Their Culture. C. V. Piper

35. Forages, the Science of Grassland Farming. H. D. Hughes

36. Forage Crop Production. Hughes & Heath

37. Crop Production. H. D. Hughes

38. Pasture Production and Management. R. E. Lush

39. Grasses and Grassland Farming. H. W. Staten

40. Land Economics. Rolland R. Brom-Renve

41. The Worlds Food. Merrill K. Bennett

42. Future Food and Agricultural Policy. J. D. Black

43. Asia's Lands and People. Geo. Babcock Cressey

44. Land Problems and Policies. V. W. Johnson

45. Conservation of Natural Resources. G. H. Smith

46. Field Crop Insects. Fred [illegible]. Fenton

47. A Review of Literature on Soil Insecticides. H. C. Gough

48. Weeds. Walter C. L. Menscher

Supplies and Equipment

Since no Soil Science major is offered in the College of Agriculture, no laboratory or teaching demonstration equipment is in use or is now available. The Adviser has worked with Dean Cho and Dr. Kim of the College of Agriculture to prepare a list of essential equipment and supplies to be used for undergraduate and graduate teaching. Every effort was made to eliminate duplication with the Central Experiment Station. Where there is any minor duplication it only occurred as it was necessary to have such minor equipment as would be necessary to carry on as nearly as possible an adequate teaching program. This list of equipment and supplies has been approved by Dean Cho and Dr. Kim and is on file in their offices.

Additional Equipment That Can Be Constructed by the Department of Agricultural Chemistry and Soil Science

This equipment can be made at the College of Agriculture for preparation of subject matter material to be used in all student teaching, research and extension:

1. Make square-meter crop samples for harvesting different crops. (See Dr. Kim for illustration given in kit)

2. Painted plywood boards for photographing differences in crop response from different soil treatments. The boards may be 2 ft. x 3 ft. in size with yellow background and black 1/2-inch lines and 2-inch numbers. Vertical length black lines 12 inches apart. Horizontal length black lines 6 inches apart. To be used with the black flannel bulletin board and white plastic letters. The flannel boards were ordered in the list of equipment and supplies. (Illustration of construction and use was presented by the Adviser to the staff on colored slides).

3. Measuring markers, same colors (black on yellow), 2 inches wide x 1 meter long with two 4-inch nails extending from the bottom end to hold the marker erect when nails are forced into the soil. (Illustrated on slides at staff meetings).

4. Prepare a slope finder as shown by the illustration. (See Dr. Kim for information in the kit.) Each student could prepare his own slope finder to be used for his own purpose.

5. To improve the laboratory equipment each student could prepare his own test tube holder by boring holes at proper spacing for the desired number of test tubes in a piece of 2-inch x 2-inch lumber. The same can be done for constructing a test tube drying rack by placing 1/4-inch pegs 2 inches long at proper intervals in a 2-inch x 2-inch piece of lumber. In construction of each rack the length will be determined by the number of tubes to be accommodated. (Discussed in staff meetings).

Reference Kit of Materials

The Adviser has prepared a kit containing a list of additional references and materials including information too detailed to include in the report. This kit was turned over to Dr. Kim Ho Sik, Head, Department of Agricultural Chemistry and Soil Science. The kit includes some of the following materials:

1. Different types of soil survey publications
2. Equipment lists
3. Price lists
4. Special bulletins and publications
5. Soil testing kits
6. Plant tissue testing kits
7. Methods for preparation of all types of soil and plant testing solutions
8. Soil testing information and general instructions
9. Visual aids catalogs
10. Class teaching outlines.

Some Suggested Experimental Plots

From observations made in the field, discussions with many agricultural leaders and observing the research work now being conducted, the following general experimental plots, covering some of the main needs at this time, are here suggested as a guide to the planning of future experimental work. All treatments should be randomized in each replication with at least four replications. The size of each treatment plot should be determined by the plot supervisor on the basis of area and need. The size can vary according to situations. Similar designs and arrangements can be used as extension demonstrations. All treatments are set up on a per acre rate basis and can be converted to any Korean unit area. The treatments are all on an N, P_2O_5 and K_2O basis with lime on a ton (2000 pounds) per acre rate basis. Every plot should be permanently marked and staked. Prior to liming and fertilization, carefully selected soil samples should be taken from each plot area for soil testing to study correlation of soil test results with the crop responses. This soil test study should be carried on with every experiment whenever possible to obtain additional soil test information.

General Limestone and Fertilizer Study

1. Check - no treatment
2. Limestone or equivalent - according to test
3. Limestone + 60 lbs. P_2O_5
4. Limestone + 60 lbs. P_2O_5 + 60 lbs. K_2O
5. Limestone + 50 lbs. N. + 60 lbs. P_2O_5 + 60 lbs. K_2O
6. Check - no treatment

This experiment can be run on all crops including hay and pasture forage legumes and grasses.

Liming Rate Study

1. Check
2. Limestone - 500 lbs. per acre
3. Limestone - 1000 lbs. per acre
4. Limestone - 2000 lbs. per acre (1 ton)
5. Limestone - 2 tons (4,000 lbs.) per acre
6. Limestone - 4 tons (8,000 lbs.) per acre
7. Limestone - 6 tons (12,000 lbs.) per acre
8. Check
9. Limestone - 8 tons (16,000 lbs.) per acre
10. Limestone - 10 tons (20,000 lbs.) per acre
11. Limestone - 12 tons (24,000 lbs.) per acre
12. Limestone - 14 tons (28,000 lbs.) per acre
13. Limestone - 16 tons (32,000 lbs.) per acre
14. Check

Make a basic fertilizer treatment over all of the plot area of 60 lbs. of P_2O_5 + 60 lbs. of K_2O.

Such a study is best used on forage legumes of alfalfa, sweet clover, medium red clover, alsike clover, ladino clover, and mixtures of the same with grasses like timothy and orchard.

Limestone Placement Study

1. Check
2. 100% applied on surface after plowing
3. 100% applied on surface and plowed under
4. 50% applied on surface and plowed under and 50% applied on surface after plowing
5. Check

Apply the limestone on the basis of soil test.

Make a basic fertilizer treatment of 60 lbs. of P_2O_5 and 60 lbs. of K_2O.

Phosphate Fertilizer Rate Study

1. Check
2. 40 lbs. P_2O_5
3. 60 " "
4. 80 " "
5. 100 " "
6. 120 " "
7. Check
8. 140 lbs. P_2O_5
9. 160 " "
10. 180 " "
11. 200 " "
12. Check

Make a basic fertilizer treatment of 50 lbs. of N + 60 lbs. of K_2O over all of the plot area.

Note: This same study can be run for potash using a basic treatment of 50 lbs. N. + 60 lbs. of P_2O_5 over all of the plot area.

Source of Phosphate Fertilizer Study

1. Check
2. 0 - 20 - 0 (60 lbs. P_2O_5)
3. 0 - 45 - 0 (" ")
4. 0 - 63 - 0 (" ")
5. Check

Make a basic fertilizer treatment of 50 lbs. N. + 60 lbs. K_2O over the entire plot area.

Nitrogen Fertilizer Rate Study

1. Check
2. 20 lbs. N.
3. 40 " "
4. 60 " "
5. 80 " "
6. 100 " "
7. 120 " "
8. Check

This study may be run on all small grain grains such as rice, barley, wheat and other grain crops and on the native permanent grass pasture and hay areas.

Make a basic fertilizer treatment of 60 lbs. P_2O_5 + 60 lbs. K_2O.

Source of Nitrogen Fertilizer Study

1. Check
2. Ammonium sulphate - 60 lbs. N.
3. Ammonium nitrate - 60 lbs. N.
4. Urea - 60 lbs. N.
5. Any other forms of N. applied at the rate of 60 lbs. of N.
6. Check

Make a basic fertilizer treatment of 60 lbs. P_2O_5 + 60 lbs. of K_2O.

Fertilizer Placement Study

1. Check
2. 60 lbs. P_2O_5 on surface plowed under
3. 60 lbs. P_2O_5 on surface after plowing
4. 60 lbs. P_2O_5 + 60 lbs. K_2O - same as 2.
5. 60 lbs. P_2O_5 + 60 lbs. K_2O - same as 3.

6. 50 lbs. N + 60 lbs. P_2O_5 + 60 lbs. K_2O - same as 2.

7. 50 lbs. N + 60 lbs. P_2O_5 + 60 lbs. K_2O - same as 3.

8. Check

Lime the entire area at the recommended rate according to soil test.

Fertilizer on Corn at Songhwan Livestock Station

1. Check

2. Along corn row at planting time as a starter fertilizer

   15 lbs. N.

   30 lbs. P_2O_5

   30 lbs. K_2O

3. Plow under before planting time

   50 lbs. N.

   60 lbs. P_2O_5

   60 lbs. K_2O

4. Combination of 2 and 3

5. Sidedress with 60 lbs of N between the corn rows when the corn is 12 inches tall on one-half of each of the plots 1, 2, 3, 4, and 6.

6. Check

This study is more of a demonstration than an experiment. Under this particular set up it would be difficult to replicate.

The above examples of a few experiments that may be established are only suggestions. Variations in rates of application may be desirable to make but if this is done all treatments must be kept on an equivalent basis as they are now set up. Always have at least two check plots in each replication which have had no soil treatments of any kind. This is necessary if the proper comparisons of different treatments are to be obtained.

PART III

SPECIAL REPORT ON SOIL

FERTILITY - GRASSLAND - LIVESTOCK PROGRAM

1. Cheju Pasture areas

2. Kangwon-Do Pasture, Livestock and Forage Experimeltal Farm

3. Hwason Livestock Substation Pasture area

There is considerable interest in the Ministry of Agriculture and Forestry and in the College of Agriculture in the development of a livestock program in Korea. At the present time the Central Livestock Experiment Station at Songhwan Station has developed the foundation for a good livestock program. The main interest is in the fertilization, seeding, management and development of the foothills areas into pasture, hay and forage. Very little information is available on this subject. These areas should be selected and determined on the basis of soil surveys, landuse classifications and the soil capabilities of producing the various kinds of crops of food, fuel, forages and lumber. Various estimates have been given as to the extent of the grassland areas that might be considered for a Livestock - Grassland production program. General estimates seem to indicate there may be as much as 665,000 acres that would possibly be available in Korea and around 115,000 acres on Cheju Island. These are areas of foothills not now covered with forest. The Livestock Bureau has made a classification of the vegetative species of these grassland areas as follows:

1. Native legumes - 52 species
2. Native grasses - 97 species
3. Other desirable species that may be used for hay, pasture and forage - 277 species

The Adviser was asked to visit the three major and proposed areas to observe conditions and make program recommendations. The two areas are located on Cheju Island and the newly proposed Livestock Substation in Kangwon-Do Province. The special reports on each area are as follows:

RECOMMENDATION FOR A GRASSLAND - LIVESTOCK PROGRAM

for

CHEJU ISLAND

The trip to Cheju Island was made September 12 to 22, with Dean Cho of the College of Agriculture and Mr. Oh Wang Kun of the Central Experiment Station at Suwon. The purpose of this trip was to look over the grassland area and make recommendations for the soil fertility needs and how a Grassland - Livestock program could be established. President Rhee has proclaimed that Cheju shall be reestablished as the livestock industry center for the Republic of Korea. Cheju Island is located just north of the 33rd parallel and about 100 miles, by boat, off the southern tip of Korea. It requires about 8 to 10 hours by boat to make the trip from Mokpo on the mainland. The total area of the Island is about 325,000 acres of which about 115,000 acres is in pasture, most of which is generally open except for a few scattered trees. The soils are all of volcanic origin, very rocky and stony and of very mountainous terrain. The entire island is a cone-shaped peak, sloping down in all directions to the sea from Mt. Halla, an old volcano about 1950 meters high. Below this high peak are about 240 other old volcanic peaks of various altitudes that constitute the main topographic area of the Island. East to west the Island is about 42 miles long and 18 miles wide from north to south. Roads are very poor, generally limited to the seashore with travel only by bus, truck or jeep. It takes about 2 days to make the trip around the Island, a distance of about 100 miles. Because of its subtropical location and the high altitude areas there is a great variation in type of vegetation and adaptability of crops. Conifers are found at 500-700 meters, pasture and

broadleaf trees at 700 - 1000 meters, pastures and birch at 1000 to 1400 meters and a northern type of conifers above 1400 meters. Along the seashore subtropical timber and grasses are found including some palm while on the south shore citrus fruits are common. The timber on Cheju is generally different than what is found on the mainland. The main crops on the Island are sweet potatoes, wheat, Italian millet, barley and some rice.

The population, of about 250,000, is concentrated along the seashore and extending up to an altitude of about 500 meters. The capital is Cheju, located on the north side having a population of 60,000 to 80,000 people. The Governor of Cheju is Keel Song Woon, who is President of Cheju Agricultural College and also Dean and Experiment Station Director. A new livestock substation of the Central Livestock Station at Songhwan is being established and will be completed by the fall of 1957. The present livestock population is down following the war out there are still about 30,000 head of native cattle and 10,000 native/Cheju horses. There are only a few of actual beef and dairy cattle and they are only for experimental purposes. One of the apparently unanswered problems that is causing serious trouble is the control of the cattle tick. According to Governor Keel and his Chief of the Livestock Bureau this is becoming a serious problem.

The pasture areas are already established, with each village having its own pasture area protected and enclosed by a stone fence. All the livestock for each village are controlled or managed by a cattle boy who herds the cattle during the day then brings them back to the village at night. Many of the pasture areas are terraced. From the best information obtainable these terraces were hand constructed some 40 to 50 years ago to prevent erosion and to allow grazing and some limited tillage operations. These terraces are now all well grassed and erosion is no serious problem if the present pasture and forage cover is maintained

and properly managed when grazed.

Practically all of the village pasture areas have their own water supply from springs or in made ponds that catch and hold a supply of rain water. In some cases water is still a problem. Where Government pasture areas are grazed by the farmers there is no rental charge.

Because of the typhoon weather conditions of wind and rain during the Adviser's visit to the Island it was not possible to give a very thorough inspection of the pasture areas. From the limited inspection and soil tests made there appears to be good opportunities to develop and expand the livestock and grassland program because the pasture areas are not covered with timber and the fact that the areas are all fenced and identified with the villages. From the limited observations by the Adviser the following are suggestions that may be applied to the existing conditions.

1. Appoint a technical committee of Soils, Agronomy and Livestock specialists and others if necessary to plan, develop, coordinate and apply a Grassland - Livestock program for Cheju Island. This program should include research studies with extension application of practices on the grassland areas.

2. Develop a soil testing program with each village to determine the lime and fertilizer needs. The few tests run on these soils show they have a low of around 5.5. Although not as acid as the mainland the soils are still in need of lime for a most successful pasture, forage and soil fertility program.

   The phosphate tests are low the same as on the mainland soils. Phosphate will have to be supplied in commercial form to grow good pasture that will be high in phosphorus composition. Cattle could become phosphorus deficient grazing soils so low in phosphate. The potash tests show the soil supply is adequate. However, soil tests should be made on all pastures before treatments are actually made or recommended.

   Because of the low pH, low phosphate and low nitrogen supply a considerable amount of sedge and small brush has come in in place of the more desirable pasture and forage species. Wherever animal dropping spots were found, supplying sufficient nitrogen, there was a big response and growth of pasture grasses indicating a

definite need for a nitrogen fertilizer along with the lime and phosphate.

3. Each pasture area should be cleared of small brush, rosebushes, and sedge to reduce the competition for the desirable pasture and forage species. This material can be cut and removed as compost or fuel material.

4. In pasture areas where water shortages may be a problem it is possible to construct some pond reservoirs to maintain a reserve supply of water when needed.

5. Since the soils are rocky and steep and many of the pasture areas are terraced, no cultivation practices should be used. The other limitation to any cultivation practices is the lack of power and proper tillage equipment that could properly renovate such grass sods.

6. Apply all limestone and fertilizer treatments as a top-dressing. The limestone should be applied according to the soil test. If this is done it may not be necessary to again apply lime for 8 to 12 years or even longer. The fertilizer should be mainly a nitrogen and phosphate unless the soil tests show a need for potash. A good fertilizer program to follow is to make a basic (initial treatment) treatment followed by an annual lower rate of application per acre. The annual application can be made in the fall or very early spring.

   Suggested rates per acre:

Basic	-	60 pounds	N
		80 "	P_2O_5
		80 "	K_2O (if needed)
Annual	-	60 pounds	N
		40 "	P_2O_5
		40 "	K_2O (if needed)

7. Research work on liming, fertilization, pasture and forage mixtures, and grazing management should be started at the new Livestock Experiment Station as one of the first projects. This is the only means of knowing if the above recommendations are correct.

8. Conduct simple liming and fertilizer demonstrations with some of the farmers in the various villages on their regular pasture areas and in different areas of the Island. Use the same treatments as suggested under item 5 above.

RECOMMENDATIONS FOR A GRASSLAND-LIVESTOCK PROGRAM

KANGWON PROVINCE

Kangnung, Korea

Part I.

The trip to Kangnung in Kangwon Province on the east coast of Korea was made October 19 through October 22 with Dean Cho, Dr. Kim Ho Sik, Head of Agricultural Chemistry and Soil Science, College of Agriculture, Mr. Oh Wang Kun of the Central Experiment Station at Suwon and Mr. Choi Dong Gok, Agronomist of the Livestock Section of the Ministry of Agriculture and Forestry from the Gongwan, Central Livestock Experimental Farm. The purpose of this trip was to look over a pasture area being developed as a Grassland-Livestock Experimental farm in the Pyong Chang Gun near the village of Haeng Ge. The total area amounts to about 650 acres, much of which is very steep. These steep areas should remain in timber or be reforested, with the less steep areas or foothills developed into pasture and grazing lands.

Barns and buildings are now being constructed in a protected valley. This area is located in the higher altitudes of this mountain range area where climatic conditions are not as mild as near the coast or at the lower elevations to the west. The main grazing areas are to the back side of the farm a considerable distance from the buildings. To get directly to the main grazing area there is considerable steep land covered with heavy brush. Some arrangement should be made to clear out much of this brush to provide for reforestation and at the same time provide lanes from the buildings to the pasture areas. At present there is no apparent water supply on these higher elevation pasture areas. Some of the lower

elevation areas can supply spring-fed water. However, on the lower elevation areas there is considerable low-growing brush and some scattered broadleaf trees. If these areas are cleaned up of brush and old trees very good pasture could be produced. At present these areas are almost worthless. It might be possible that people in the area would be willing to remove this brushy material for use as fuel. It was in these lower foothill areas where the Adviser found soils that had 10 to 16 inches of top soil and apparently had never been disturbed except for the removal of timber. In the higher open pasture areas there was as much as 8-10 inches of dark-colored top soil. In these open areas there was a growth of sedge and a type of wheat grass although the Adviser was not certain of this grass species. This so-called wheat grass resembled the wheat grasses of the states. There also was a grass similar to the U.S. big and little blue stem. According to Mr. Sim Sang Lach, Gun Chief, the livestock relish these two grasses. These pasture areas could extend down about one-third of the distance from the summit and provide good pasture production before the areas become too steep. On these steeper areas reforestation should be practiced. On this farm a grazing and reforestation program could be developed, demonstrating different uses of land as related to soil and slope conditions. One of the main problems is to get the necessary soil treatments such as limestone and fertilizer to these higher altitudes.

A more direct route should be worked out so these materials can be brought in and applied on the land. The fertilizer can be carried in and spread by hand.

The following suggestions will be necessary on these areas to make productive pasture and forage crops:

1. Clear off brush, dead timber and clean up the area so soil treatments can be applied.

2. Apply limestone according to the soil test. If the necessary amount is applied no additional will need to be applied for at least 8 to 12 year or longer. All may be applied as a top dressing anytime during the year.

3. Apply commercial fertilizer on the basis of the soil test. Nitrogen and phosphate are the main nutrients generally needed. Potash should be applied if the soil tests indicate a need. Apply these treatments on the basis of an initial or basic treatment followed by an annual application as follows, in the fall or early spring:

Suggested rates per acre:

Basic treatment -	60	pounds of N.
	80	" of P_2O_5
	80	" of K_2O (if needed)
Annual treatment -	60	pounds of N.
	40	" of P_2O_5
	40	" of K_2O (if needed)

4. Construct fences to protect the forested areas from grazing and to arrange for a grazing program in the pasture area.

Part II.

In addition to the main pasture area there is an additional area of about 90 acres adjoining the village of Haeng Ge which is being considered for doing specific studies on different legumes, grasses, forage mixtures, liming, and fertilization. All of this area has been used as agricultural farm land and will make very good experimental land. The area is large enough to provide for livestock grazing experiments. It is recommended by the Adviser to plan ahead for the setting up of small plot experiments and then larger areas to study soil fertility levels as related to methods of grazing and the actual production of beef under different fertilization and grazing management. In the spring of 1956 the Central Livestock Experimental farm at Songwan put out row plots of sweet clover, alsike clover, red clover, ladino clover, alfalfa, orchard grass and meadow fescue. All the stands look good but for pasture and hay purposes the experimental seedings alone or in mixture combinations should be put in as solid or broadcast seedings. Production will be too low when planted in row seedings. There is no reason why very good solid seedings cannot be obtained if proper lime and fertilizer treatments are made. Row seedings are satisfactory for seed production but are not recommended for pasture and forage production.

Erosion is not a serious problem on this area except on a few small, steeper areas that should be seeded down to permanent pasture and hay. The general slopes are quite uniform and will lend themselves to a fairly uniform layout of experimental plots. If plans are properly worked out ahead of time with a good soil survey, land carefully selected for uniformity for small plots and then the necessary conservation practices put in at the beginning, this area could develop into an excellent experimental

farm. The Adviser recommends that this farm be developed by a committee made up of the following people representing the different fields of agricultural science:

1. A Soil Scientist to assist on the soil survey, soil tests, fertilizer and lime needs and the selection of suitable land areas for different experiments.

2. An Agronomist who can assist on proper legumes and grasses and mixtures, rates of seeding and forage crop management.

3. A Livestock Specialist who can guide the feeding and utilization of the forages and who understands the management of livestock.

These three men could develop an excellent team of specialists who could build an outstanding program of Grassland-Livestock farming and research.

The following are a few suggested steps that should be followed in setting up the operation of this farm in addition to the team of specialists recommended above.

1. Make a detailed soil survey of this farm showing the soil types, percent of slope and the degree or extent of the seriousness of erosion.

2. Seed to permanent grass all of the small steep areas that are now beginning to gully. The Adviser pointed out these areas as the group visited and inspected the farm.

3. From the soil survey select the most uniform soil areas as to soil type, slope and extent of erosion that would be the most desirable for doing small plot work on lime, fertilizer, legumes, grasses and mixtures.

4. Determine where conservation practices should be placed. The Adviser pointed out where terraces should be placed to protect land from further gully erosion and where terraces should be placed to protect areas selected for small plot work.

5. Measure out the small plot areas to determine how they will fit into the slopes so they can be of sufficient size and provide for at least four replications.

6. The Technical Committee of specialists should work out all

the plans for the various experimental projects and determine how they will fit into the selected soil areas so if adjustments are necessary they can be made before the farm layout is started.

7. Where grazing studies are to be conducted, determine where fences will be placed so that each pasture area will have similar soil type conditions and that all pastures will be of the same size.

8. Make soil tests at the time of the soil survey to determine the need for lime and fertilizer.

9. Plan to develop the farm one step at a time, each year adding to the program as fast as money and equipment becomes available.

10. The first place to start after the preliminary plans are complete is with the small plots which could be a guide as to what might be done later on the main grazing areas.

MASON LIVESTOCK SUBSTATION FARM

This farm has great possibilities for developing an excellent Soil Fertility-Grassland-Livestock program. The substation is well equipped with sufficient machinery and power to do the necessary job of grassland renovation. Practically all of the grassland area is open except for a few scattered trees. Erosion is not a serious problem because the present sod is dense enough to give sufficient protection. There are a few scattered bushes but they can be removed by hand or would be destroyed if a renovation program was started. The main need on this farm is for lime and fertilizer. In the pilot plot area near the office buildings where lime phosphate fertilizer and compost was used on the many common legumes and grasses excellent stands and growth were obtained in 1956 following seeding in the spring. This work shows what can be done with these desirable pasture and forage legumes and grasses if proper liming and fertilization practices are adopted. The same results can be expected on the general pasture areas.

The forage and pasture improvement and management program should be established on the basis of the topography of the grassland area.

1. On areas too steep to operate renovation machinery or would be subject to erosion if cultivation was used all of the soil treatments should then be applied on the surface as a top-dressing and no new seedings established.

2. On areas less rolling, where machinery can be operated and where erosion would not become a serious factor the sod should then be renovated and seeded with an adaptable grass and legume mixture along with proper liming and fertilization. Under both conditions systematic soil tests should be done on all areas to determine the lime and fertilizer needs. Apply the lime according to test and at least 6 months before renovation and reseeding with a legume-grain mixture. In the case of the top-dressed areas the lime can be applied anytime during the year.

The following are the recommended steps to follow to renovate an old grassland sod:

1. Test soil to determine lime and fertilizer needs.

2. Apply lime 6 months before renovation and seeding.

3. Renovate or cultivate the old sod with the heavy disk now available on the farm. Work with this disk enough times to thoroughly tear up the old sod and provide a loose seedbed.

4. Follow with a harrow to level the seedbed before seeding the legume-grain mixture.

5. Renovation may be done at two different times of the year.

   a. If done in very early spring, at the time of seeding the legume-grass mixture, the present old grass sod will not be killed out. This may be desirable because it will be possible to preserve the present adaptable grasses and native legumes.

   b. If renovation is done in late August and the area worked from time to time during autumn until freeze-up time, all of the old vegetation will be killed and the new pasture will be established with only the seeded legume-grass mixture.

6. Whichever method and time of year is used, apply the recommended lime and fertilizer as found by test, at the time the area is seeded with the legume-grass mixture. All fertilizer should be broadcast. Rates of application of fertilizer, if test shows need, should be about as follows:

   60 pounds/ acre of N
   80 " " " P_2O_5
   80 " " " K_2O

7. The above rates of fertilizer should be used as the initial rate on the top-dressed areas too steep for renovation.

8. The legume-grain mixture should be seeded in very early spring using orchard grass and timothy and ladiono clover, alsike clover and alfalfa. Only as a suggestion the mixture might be 5 lbs. of orchard grass, 3 lbs. of timothy, 1 lb. of ladiono clover, 2 lbs. alsike clover and 5 lbs. of alfalfa. These rates are on the basis of lbs. per acre.

9. Use a light seeding of a grain such as wheat, barley or oats at the rate of 1 bushel per acre. Remove this grain crop by grazing or for hay or silage when the head is just forming. If grazing is practical start when the grain growth is about 12 inches tall.

10. Success of this program will be determined by good grazing management. Never over-graze.

During each year following the above initial fertilization on the two pasture improvement methods make an annual top-dressing fertilization application in early spring. A suggested rate would be as follows:

60 lbs/ acre of N

40 " / " of P_2O_5

40 " / " of K_2O - if needed.

according to test.