

臺灣之農業工程教育

Education of Agricultural Engineering in Taiwan

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English Summary

Taiwan is located in sub-tropic area, agriculture is very important there, farm machanization, adjust water use, reclamate tidal and sloping land for agricultural and industry use are government policys in the field of Agricultural Engineering in Taiwan. So, to do research work and training for agricultural engineers are very important program now.

There are three education classes of agricultural engineering in Taiwan such as university or college, academy and vocational school, the field includes Irrigation and Drainage, Hydrology and Fluid Machanics, Water Pollution, Soil and Water Conservation and Agricultural Machinery. Credit teaching system is adopted in university, college and academy, but hour system is used in vocational school. Professors in university or college do research works and training agricultural engineers, but teachers in vocational schools are only training for farming workers.

中文摘要

臺灣地處亞熱帶，對農業開發甚為重視，因此農業機械化，水資源有效利用，海埔地，河川地、山坡地、砂丘地開發等項目，目前為政府在農工工程方面之政策。故對農業工程師之培育與研究工作之加強，為政府之重點政策之一。

本文討論之農業工程教育分大學院校，專科及農職等三部分。訓練及研究範圍包括水文流力、灌溉排水，水質污染、水土保持與農業機械等項。大學院校與專科教育制度均為學分制，而職業學校則為小時制。大學院校之教師除教學外尚從事研究工作，但職業學校教師僅以教學為主。全國 24 所大學校中，設置有農業工程科系與有關課程者有四所，五專及二專者有二所。26 所高級農業職業學校中，同時設置農業機械與農業土木科者有三所，僅設置農業機械科者有 14 所、僅有農業土木科者僅一所。

Introduction

The author had written a paper which was "Education of Agricultural Engineering during Twenty Years in Taiwan" in 1974. It was discussed Curriculum, Equipments and Students of Agricultural Engineering in university or college, technological academy and vocational school, at last, to discuss the development of education in

agricultural engineering in the future, it was not discussed so much about research work in the field of agricultural engineering.

The government has emphasized the agricultural engineering for helping the production of agriculture very much, so, the education of agricultural engineering is progressed very much during the recent years. This paper discusses present conditions of agricultural engineering in Taiwan, it includes school training, teacher and student, curriculum and laboratory, research work, fund and equipment, advance study and employment in the field of Agricultural Engineering. It is started from individual school then discuss each element as a whole, at last to discuss some government policies which are related to agricultural engineering such as farm mechanization, reclamation of tidal and mountain land, water resources and increase unit production of crops.

School training of Agricultural Engineering

The definition of Agricultural Engineering is included Agricultural Machinery and Irrigation and Drainage, some of the universities and colleges set the two parts in one department, but some are separated. This paper so called "Education of Agricultural Engineering in Taiwan" is included three grades, such as university or college, technological academy and vocational school. The education system is four and two years in university or college and academy respectively after graduation from high school, vocational school is equivalent to high school. The school names in the field of Agricultural Engineering are listed in Table 1. It shows that five universities or colleges have Department of Agricultural Engineering, but only one university complete the whole field in Agricultural Engineering in the National Taiwan University (NTU): Two Departments separate two divisions in National Chung Hsin University (NCHU), such as division of Agricultural Machinery in the Department of Agricultural Education and the Department of Soil and Water Conservation. The Department of Agricultural Engineering NTU and Department of Soil and Water Conservation NCHU are Provided graduate school to offer Master Degree. There are two divisions in the Department of Hydraulic Engineering under Engineering College in Tamkang College of Arts and Science (TKC). Other College of Chung Yuan (CYC) and Feng Chia (FCC) are only one course of irrigation engineering design in the Department of Hydraulic Engineering. There are only Chia Yi and Pingtung two Agricultural Technology Schools (CYT & PTT) in Taiwan, two divisions in the Department of Agricultural Engineering, CYT and four Department in Pingtung Agricultural Technology such as Agricultural Machinery, Agricultural Civil Engineering, Soil and Water Conservation and Mechanical Reclamation. Talking about Agricultural Vocational School, seventeen schools have the Department of Agricultural Machinery and four Department of Agricultural Civil Engineering vocational 26 schools.

Table 1. The name of school in the field of Agricultural Engineering in Taiwan

Grade	Name of school	Department	Content
University or College	National Taiwan University (NTU) National Chung Hsin University (NCHU)	Agricultural Engineering (under graduate & graduate) 1. Agricultural Education (under graduate only) 2. Soil and Water Conservation (under graduate and graduate)	1. Division of irrigation and drainage 2. Division of agricultural machinery Division of agricultural machinery 1. Division of agricultural land 2. Division of water shed management
	Tamkang College of Arts & Science(TKC)	Hydraulic Engineering	1. Division of irrigation engineering 2. Division of soil and water conservation
	Chung Yuan Christian College of Science and Engineering (CYC)	Hydraulic Engineering	Irrigation engineering design course only
	Feng Chia College of Engineering & Business (FCC)	Hydraulic Engineering	Irrigation engineering design course only
Technological Academy	Taiwan Provincial Pingtung Agricul. Technology (PTT)	1. Agricul. Machinery 2. Agricul. Civil Engr. 3. Soil & Water Conservation 4. Mechanical Reclamation	
	Taiwan Provincial Chia Yi Agricul. Technology (CYT)	Agricultural Engineering	1. Division of irrigation and drainage 2. Division of agricultural machinery
Provincial Vocational School	Ilan	Agricultural Machinery	
	Taoyang	Agricultural Machinery	
	Taichung	Agricultural Machinery Civil Engineering	
	Miaoli	Agricultural Machinery	
	Yuanling	Agricultural Machinery	
	Hsi lo	Agricultural Machinery	
	Hu wei	Agricultural Machinery	
	Pei Kang	Agricultural Machinery	
	Tung Shih	Agricultural Machinery	
	Ming Hsiung	Agricultural Machinery	
	Pei Men	Agricultural Civil Eng.	
	Tainan	Agricultural Civil Eng. Agricultural Machinery	
	Chi Shan	Agricultural Machinery	
	Kang Shan	Agricultural Machinery	
	Chai Tung	Agricultural Machinery	
Nei Pu	Agricultural Machinery		
Tai Tung	Agricultural Machinery		
Hualian	Agricultural Civil Eng. Agricultural Machinery		

Teacher and Student in the field of Agricultural Engineering

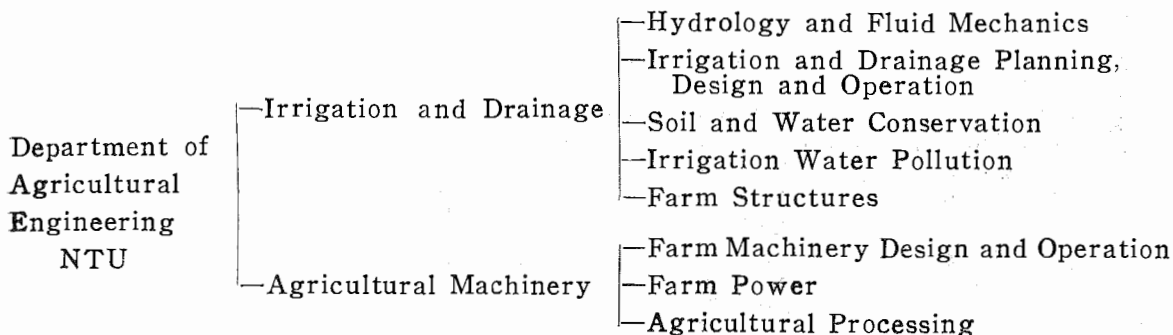
There is a teaching hours regulation which was instituted by the Ministry of Education in Taiwan, the minimum teaching hours per week is shown in the table below, it means that whose teaching hour is more than regulation, he may get an extra payment, the rate depends on his class, it ranges from US\$ 5.5 to 3.3 per hour, but the extra hour could not be exceeded four hours per week. Some universities and colleges, the professors have a lot of works except teaching, their teaching hours may be decreased to three hours per week or less.

minimum teaching hours in different teacher class

teacher class	teaching hours per week
professor	8
associate professor	9
instructor	10
teacher in high school	12

Number of teachers and students in the field of Agricultural Engineering are shown on table 2, the grade of teacher is divided into four classes, such as Teaching Assistant, Instructor, Associate Professor and Professor, when he graduated from university or college, he may be qualified teaching assistant, if he has a valuable research paper and good teaching credit, he may be promoted to instructor after four years; the same. if who has three years teaching experience and a valuable research paper in the rank of instructor or associate professor, he may be promoted to higher class until to full professor. So called part time staff on table 2 includes instructor, associate professor and professor, teaching hours is limited to four hours per week. There are one hundred and forty nine teachers in universities, colleges and technological academies in the field of Agricultural Engineering, among them, about 11 % is provided Ph. D., 17% Master Degree and 72 % Bachelor science, part time teacher is about 26% of total staff.

National Taiwan University is the largest university in Taiwan, she has 69 Departments and Graduate Schools, all Departments are much better than which in other universities and colleges in Taiwan. The Department of Agricultural Engineering, NTU has Irrigation and Drainage Division and Agricultural Machinery Division, each division includes more than three subdivision as below:



The Department was established in 1945 which is the longest history of agricultural engineering in Taiwan, students graduated from this Department were about 32% of total under graduate student in Taiwan until 1978. Talking about graduate student, it is also longest history and largest number of students in Taiwan, about 87% of all graduate student was graduated from this Department until 1978, but the Department has not offered Doctor Degree yet. Total students have been graduated in field of Agricultural Engineering in Taiwan is about 3,128 up to 1978, among them, about 500 students went abroad and worked there, especially in the United States.

Table 2. Number of teachers and students in the field of agricultural engineering in universities, colleges and technological academies in Taiwan up to Summer of 1978

School name		NTU		NCHU		TKC		PTT			CYT		Total
		ID	AM	AM	SWC	IE	SWC	AM	ACE	SWC	AM	ID	
Department & division		ID	AM	AM	SWC	IE	SWC	AM	ACE	SWC	AM	ID	
teacher	Professor	7	2	2	3	2	2	4	1	2	3	0	28
	Associate professor	5	4	2	3	2	2	3	3	0	0	4	28
	Instructor	0	4	2	2	3	3	3	2	3	3	2	27
	Part time	3	4	5	5	5	5	0	2	3	4	3	39
	Assistant	1	0	2	4	6	6	1	2	2	2	1	27
	Sub total	16	14	13	17	18	18	11	10	10	12	10	149
student	Graduate	28	6	—	5	—	—	—	—	—	—	—	39
	Under graduate	623	351	65	257	371	330	381	182	162	260	107	3089
	Sub total	651	357	65	262	371	330	381	182	162	260	107	3128
established year	Graduate	1966	1975	—	1974	—	—	—	—	—	—	—	
	Under graduate	1945	1945	1972	1974	1970	1970	1960	1960	1965	1967	1970	

Note: ID Irrigation and Drainage
 AM Agricultural Machinery
 SWC Soil and Water Conservation
 IE Irrigation Engineering
 ACE Agricultural Civil Engineering

NTU National Taiwan University
 NCHU National Chung Hsin University
 TKC Tamkang College of Arts & Science
 PTT Taiwan Provincial Pingtung Agricultural Technology
 CYT Taiwan Provincial Chia Yi Agricultural Technology

Curriculum and Laboratory

According to the regulation of the government, under graduate must finished one hundred and twenty eight credits before graduation, these credits include three parts such as common course, basic course and technical course, the first part is 31 credits, about 21% of total, which any students in university or college have to be taken, most of the courses are taken by freshman, the courses are shown on table 3.

Basic course means the basic knowledge in the field of Agricultural Engineering, which is 37 credits about 29% of the total in first and second year, the courses are listed on table 3.

Table 3. Common and Basic courses in the field of Agricultural Engineering in university or college

Course	Credits	Grade	Remarks
The thoughts of Dr. Sun Yet sen	4	freshman	
Chinese	8	"	
English	8	"	
General History of China	4	"	
Contemporary History of China	2	"	
Logic or International Relationship	3	"	
Sub total for common course	31 (21% of the total)		
General Mathematics	8	freshman	
General Physics	8	"	three hours per week lab
Graphic Science	2	"	two hours per week practice
Engineering Drawing	2	sophomore	two hours per week practice
Engineering Mechanics	7	"	
Engineering Mathematics	6	"	
Introduction of Agriculture	6	"	
Sub total for basic course	37 (29% of the total)		

Technical course is more than 60 credits about 40% of total, it is divided into two parts such as required and selective course, but common and basic courses are required. Technical course is a little different from each division, which are shown on table 4. Because of many courses have been taken by students in this field both in agriculture and engineering, therefore, every student was taking credits to exceed the standard 128.

There are only two universities have graduate school to offer Master Degree in the field of Agricultural Engineering, such as the Department of Agricultural Engineering NTU and the Department of Soil and Water Conservation NCHU. According to the regulation of the government, graduate student has to take minimum 24 credits and 6 credits thesis within two years after graduation from university or college. The courses of graduate school in the field of Agricultural Engineering is shown on table 5.

The course of Agricultural Technology is almost the same with the required course in university or college, because of limitation of the paper words, no more discussion here.

Many laboratories and practices are provided in the field of Agricultural Engineering. There are fifteen, seven and twelve laboratories and practices in the Division of Irrigation and Drainage, Agricultural Machinery and Soil and Water Conservation respectively, each laboratory is provided enough equipments and space for students to do work. The name of laboratories are listed on table 4 & 5.

Table 4. Technical course in each field of Agricultural Engineering
in university or college

Field	Required or selective	Name of courses	Credits	Grade	Remark
Irrigation and Drainage	Required course	Surveying and practice	6	Sophomore	3 hr. per week practice
		Fluid Mechanics	4	"	
		Hydrology and practice	3	Junior	3 hr. per week lab.
		Structural Theory	3-6	"	3 hr. selective course
		Reinforced Concrete and Design	3-6	"	3 hr. selective course
		Fluid Mechanics Test	1	"	3 hr. lab.
		Engineering Material and lab.	4	"	3 hr. per week lab.
		Principle & Practices of Irrigation and Drainage	3	"	3 hr. per week lab.
		Drainage Engineering	3	Senior	
		Irrigation Engineering	3-6	"	3 hr. selective course
		Irrigation & Drainage Engr. Design	2	"	3 hr. per week practice
		Soil Mechanics and Test	3	"	3 hr. per week lab.
		Soil and Water Conservation	3	"	
		Sub total for Irrigation & Drain.	41-50		9 hr. selective course
	Selective courses	Geology Engineering	3	Sophomore	3 hr. per week lab.
		Irrigation Management	3	Senior	
		River Engineering	3	"	
		Construction Method	6	Junior	
		Intermediate Fluid Mechanics	3	"	
		Farm Structures	4	"	
Open Channel Hydraulics		3	"		
Rural Sanitary Engineering		3	"		
Hydraulic Model		3	Senior	3 hr. per week lab.	
Water Conservancy Law		2	"		
Subtotal for Irrigation & Drain.	33				
Agricultural Machinery	Required courses	Engineering Materials	4	Sophomore	3 hr. per week lab.
		Farm Shop Practices	2	"	3 hr. per week practice
		Electric Engineering	3	Junior	
		Farm Power and Lab.	6	"	3 hr. per week lab.
		Farm Machinery and Lab.	6	"	3 hr. per week lab.
		Thermal Engineering	4	Sophomore	
		Mechanism	4	"	
		Farm Machinery Design	4	Senior	
		Testing Farm Machinery	2	Junior	
		Fluid Mechanics	4	Sophomore	
		Agricultural Processing Engr.	2-4	Senior	2 hr. selective course
		Subtal for Agric. Machinery	41-43		2 hr. selective course

Field	Required or selective	Name of course	Credits	Grade	Remark
Agricultural Machinery	Selective course	Heat Transmission Engineering	6	Senior	
		Perservation and Handling of Agricultural Products	3	Junior	
		Hydraulic Machinery	3	Junior	
		Rural Electrification	3	Senior	
		Manufacture of farm Machinery	3	"	
		Subtotal for Agric. Machinery	18		
Soil and Water Conservation	Required course	Geology Engineering	2	Freshman	
		Soils	3	"	3 hr. per week lab.
		Introduction of Soil & Water Conservation	2	Sophomore	
		Applied Statistics	5	"	
		Surveying	6	"	3 hr. per week practice
		Fluid Mechanics	4	"	3 hr. per week lab.
		Soil Physics (1)	3	"	3 hr. per week lab.
		Hydrology	3	"	
		Plant in Soil & Water Conservation	3	"	3 hr. per week lab.
		Principle of Erosion	3	"	3 hr. per week lab.
		Applied Meteorology	3	"	3 hr. per week lab.
		General work of Soil & Water Conservation	3	"	
		Research Method of Soil and Water Conservation	1	Senior	
		Subtotal for Soil & Water Conservation	41		
		Required course in Agricul. Land	Required course in Agricul. Land	Agronomy Method for Soil and Water Conesevation	3
Soil Physics (2)	2			"	3 hr. per week lab.
Planning of Sloping Farm	2			Senior	
Terrace Engineering	3			"	
Subtotal Agricultural Land in Division of Soil and Water Conservation	10				
Required course in Watershed Management	Required course in Watershed Management	Water Management	6	Senior	
		Engineering of Sand Prevention	4	Junior	3 hr. per week lab.
		Subtotal for Watershed Management in Division of Soil & Water Conservation	10		
Selective course	Selective course	Extension of Soil & Water Conservation	2	Junior	
		Land Utilization of Soil & Water Conservation	2	"	
		Irrigation and Drainage	3	"	
		Crop on Sloping Land	3	"	
		Design of Terrace	3	"	
		Analysis of Hydrology	2	"	

Field	Required or selective	Name of course	Credits	Grade	Remark
		Protection of Road	2	Senior	
		Planning of Sloping Land	3	"	
	Selective course	Economics of Soil & Water Conservation	3	"	
		Planning of River	3	"	
		Flood Engineering	3	"	
		Plants, Moisture and Soil	2	"	
		Subtotal for Soil & Water Conservation	31		

Table 5. Graduate course in the field of Agricultural Engineering

Field	Name of course	Credits	Year	Remark
Irrigation and Drainage	Seminar	4	1st-2nd	required course
	Ground Water	3	first	
	Water Pollution	3	second	lab.
	Sprinkler Irrigation	3	first	lab.
	Planning of Agricultural Water Resources	3	second	
	Sedimentation	3	first	
	*Instrumentation	3	second	
	Irrigated Soil	3	first	
	Land Improvement	3	first	
	Advanced Hydrology	3	second	
	Surface Irrigation	3	second	
	Advanced Open Channel Hydraulics	3	first	
	Numerical Analysis Applied to Hydraulic Engin.	3	first	
	*Advanced Fluid Mechanics	3	first	
	*System Analysis	3	second	
	Estuarine Hydrodynamics	6	second	
	Water Quality Management	3	second	
Subtotal selected course in Irrigation and Drainage	54			
Agricultural Machinery	Seminar	4	1st-2nd	required course
	Mechanical Vihration	3	first	
	Soft Soil Mechanics	4	first	
	Special Topics in Farm Machinery	4	second	
	Machinery of Animal Products	6	first	
	Advanced Agricultural Processing Engineering	3	first	
	Solar Energy Utilization in Agriculture	3	second	
	Environmental Engineering	3	second	
	Physical Properties of Agricultural Products	3	second	
	Subtotal selected course in Agricultural Machinery	29		

Field	Name of course	Credits	Year	Remark
Soil and Water Conservation	Seminar	4	1st-2nd	required course
	Advanced Applied Statistics	3	first	
	Advanced Mathematics	3	first	
	Advanced Sand Prevention Engineering	3	first	
	Research on Plant Root Pattern	2	first	
	Advanced Fluid Mechanics	3	first	
	Applied Ground Water	2	second	
	Planning of Water Resources	2	second	
	Special Topic on Watershed Management	2	second	
	Special Topic on Water Pollution	2	first	
	Sloping Land Utilization	3	first	
	Special Topic on Sloping Land Management	3	second	
	Advanced Soil Phasics	3	first	lab.
Subtotal selected course in Soil & Water Conservation	31			

Note: * selective course both in Irrigation and Drainage and Agricultural Machinery

The required courses of Agricultural Vocational School in the field of Agricultural Engineering are listed on table 6. It is "hour system" different from university and college-credit system, it is 37 hours a week, the total hours is 222 during three years before students graduation. It contents common course 66 hr. about 30%, basic course 20 hr. 9%, and practice course 90 hr. 40% of the total, most courses are required except 12 hr. selective courses. It shows that practice is the main part in Vocation School, it means that the students in Agricultural Vocational School is trained for worker in the field of Agricultural Engineering.

Table 6. Required course and teaching hour in the field of Agricultural Engineering in Agriculral Vocational School

Field	Course type	Name of course	Year			Total	Remark
			First	Second	Third		
Agricultural Engineering	common course	The thoughts of Dr. Sun Yet-sen			4		
		Citizen	4	4	—		include morality of professional service include basic Chinese culture & education of nationalism spirit
		Chinese	8	8	8		
		English	4	4	4		
		Physical Culture	2	2	2		
		Military Training	4	4	4		
		Sub-total	22	22	22	66	
	basic course	Mathematics	8	8	—		
		Physics	4	—	—		
		Sub-total	12	8	—	20	

Field	Course type	Name of course	Year			Total	Remark
			First	Second	Third		
Agricultural Civil Engineering	Teoheanical course	Introduction of Agric. Civil Engr.	4	—	—		
		Materials of Civil Engr.	2	—	—		
		Introduction of Agric. Engr.	4	—	—		
		Soil and Water Conservation	—	2	—		
		Engineering Mechanics	—	6	—		
		Structural Theory	—	—	6		
		Reinforced Concrete	—	—	3		
		Irrigation and Drainage	—	2	4		
	Sub-total	10	10	14	34		
	Practice course	Soil Practice	6	—	—		
		Farm Practice	6	—	—		
		Drawing Practice	6	6	6		
		Hydrology, Surveying	—	6	—		
		Irrigation & Drainage Practice	—	6	6		
Reinforced Concrete Practice		—	—	12			
Sub-total		30	30	30	90		
	Selective Course	—	4	8			
	Total hours	74	74	74	222		
Agricultural Machinery	Technics course	Introduction of Agriculture	4	—	—		
		Introduction of Mechanics	6	—	—		
		Engineering Drawing	2	—	—		
		Agricultral Machinery	—	12	—		
		Maintenance of Agric. Machine	—	—	8		
		Sub-total	12	12	8	32	
	Practice course	Farm Practice	4	—	—		
		Drawing	4	—	—		
		Basic Working Method	16	—	—		
		Practice of Agric. Machinery	—	34	—		
		Practice of Maintenance	—	—	36		
		Physics Laboratory	4	—	—		
		Sub-total	28	34	36	98	
		Selective Course	—	6	8	14	
	Total hours	74	74	74	222	include common & basic course	

Research work in the field of Agricultural Engineering

Research work in the field of Agricultural Engineering about 80% of total was done by university staffs. The application system of research project includes two phases, such as assigned by government and applied by individual. The most fund is supported by Joint Commission on Rural Reconstruction (JCRR) now change to Council of Agricultural Development and Planning (CADP) and National Science

Council (NSC). One who applies for project, the government asks some authorities to examine the project before approval, most of the projects must be finished within one year, but a few can be extend longer, any way, the researchers have to submit an intermediat and final report before finish the project, then evalute the project again, if it is successful, take it for extension. The name of the projects in the field of Agricultural Engineering in universities and colleges from 1975 to 1978 are listed on table 7.

Table 7. Research Project in the field of Agricultural Engineering from 1975 to 1978

Field	Subject of Research Project	Year	Fund US\$	
Irrigation and Drainage, National Taiwan University	Study on Planning of Paddy Plot Related to Irrigation Factors	1975	7,950	
	Project of Machine Plowing Related to Surface Irrigatigation Method on Upland Crops in Chianan Area	1975	5,560	
	Water Pollution Influence to Irrigation Water	1975	22,220	
	Corn Irrigation Experiment under Automatic Rainfall Shelter	1975	13,890	
	Final Report of Upland Crop Irrigation Experiment at Hsueh Chia Sta.	1975	7,780	
	Long Duration Drought Frequency Analysis	1975	1,450	
	Feasility Study on Water Distribution Rrogram with Application of computer for Cho Main Canal System	1975	11,110	
	Study on Runoff Coefficients in Taipei City	1975	1,3020	
	Study on Land Subsidence from the Investigation of Observation in Taipei	1975	2,780	
	Roughness and Inundation Experiment on Grass Lining Canal	1975	8,610	
	Sub total 10	1975	94,370	
		Drainage Study on a) Water Inundation on Paddy Field, b) Regulation Effect of Paddy Field on Over Land Flow, c) Computer Program for Optimum Drainage Capacity	1976	11,110
		Experiment on Wind Mill Pump for Irrigation	1976	8,330
		Study on Optimum Utilization at Min-teh Reservoir	1976	2,640
		Experiment on Grass lining Canal	1976	6,950
		Long Duration Drought Frequency Analysis	1976	2,500
		Investigation on Quality of Irrigation Water	1976	16,670
		Computerized Dynamic Eatuary Simulation-The Contributions of Hydraulic Transport Phenomena to Water Quality Control	1976	4,030
		Pollution Problem Inflnence to Quality of Irrigation Water	1976	22,220
		Compilation of Final Report of Upland Crop Irrigation Experiments at Hsueh Chia Station	1976	7,780
	Theoratic Study on the Movement of Moisture in Irrigation Water	1976	3,470	
	Remote Control Project for Tou-liu Irrigation Canal	1976	33,330	
	Analysis of Reasonable Operation and Maintenance of Ta-pu Reservoir Irrigation System	1976	3,050	
	Feasibility Study on Semi-permanent Diversion Structures	1976	25,000	
	Study on Mechanical Removal of Sediments in Cho Main Canal	1976	27,780	
	Experiment on Consumptive Use of Upland Crops under Rainfall Shelter	1976	8,330	
	Sub total 15	1976	177,630	

Field	Subject of Resedrch Project	Year	Fund US\$	
Irrigation and Drainage, National Taiwan University	Experiment on Water Requirement of Paddy Land Preparation for Transplanting with Mechanized Operation	1977	6,170	
	Experiment on the Loss of Paddy Rice Production Due to Water Inundation	1977	7,780	
	Study on Water Management and Available Utilize Irrigation Water in Tao-yung Area	1977	11,110	
	Investigation on the Quality of Irrigation Water Effects by Industrial Waste	1977	8,330	
	Study on the Land Subsidence from Investigation of Observation Well in Taipei	1977	2,780	
	Study on the Modeling and Application of Reginal Drainage System	1977	11,250	
	Study on Rational Synthesis for Design Flood Hydrograph of River in Taiwan	1977	22,360	
	Study on Periodicity of Drought of Watersheds in Taiwan	1977	4,450	
	Study on Sedimentation in Tseng Wen Reservoir	1977	11,110	
	Study on the Extreme Discharge Estimation by Determination of Regional Parameters from Recording Data	1977	2,610	
	Sut total 10	1977	87,950	
		Study on the Storm and Flood Models in Tsengwen Reservoir	1978	8,650
		Study on the Drought Models in Taiwan	1978	5,000
		Study on the Properties of Black Colour Solids in Eastern Taiwan	1978	2,780
		Ground Water Table Influence to production of Paddy Rice	1978	3,610
		Study on the Chemical Quality of Water in Teh-chi Reservoir	1978	4,390
		Hydraulic Study on Grass Lining for Drainage Canal	1978	9,720
		Expriment on Drainage System in Watershed of Sloping Land	1978	1,780
		Study on Land Subsidence from the Investigation of Observation Well in Taipei	1978	2,780
		Compile on Hand Book of Upland Crop Irrigation	1978	16,670
		Study Computer program on Irrigation and Drainage Structures Design	1978	7,500
		Study on the Extreme Discharge Estimation by Determination of Regional Parameters from Recording Data in Kao-ping Region	1978	2,690
		Investigation on the Quality of Irrigation Water	1978	5,920
		A Mathematical Model Study of Water Pollution in Irriga. & Draindge Canal	1978	6,670
		The Influence of Rainstorm on the pollutants of Chung-kan Shui	1978	4,180
		Hydraulic Study on Grass Lining for Drainage Ditch	1978	10,000
		Experiment on possible Losses of paddy and Upland Crops Crops Causes by Poor Drainage	1978	8,660
		Study on Storm and Flood Forecast Model in Tsengwen Reservoir	1978	7,220
		Investigation on Water Quality in Teh-ge Reservoir	1978	8,330
		Sub total 18	1978	116,550
		Study on the Improvement of Paddy Warehouse	1975	54,720
		Designing and Building a New Storage System in Lotung	1975	8,470
	A Pilot Project for a Movable Floating Drier	1975	19,440	
	Study on Construction of Greenhouse System for Grain Drying & Nursling	1975	41,670	
	Study on Farm Cableway	1975	6,570	
	Sub total 5	1975	130,860	

Field	Subject of Research Project	Year	Fund US\$	
Agricultural Machinery, National Taiwan University	Windmill Study for Pumping Irrigation Water	1976	8,330	
	Study on Loading and Unloading Machines for Paddy Warehouse	1976	14,440	
	Study on the Improvement of the Present Tower Driers	1976	44,440	
		Sub total 3	1976	67,210
	Study on the Paddy Silo Storage System	1977	12,500	
	Remodelling of the Traditional Tobacco Drying Houses and Studies on Drying Rice Grain	1977	30,400	
	Pilot Survey and Improvement of Existing Farm Rice Warehouses	1977	50,830	
	Analysis on the Experimental Storage of _____ in Low-temp Ware-house at Lotung	1977	56,390	
	Test on Rice Hull Furnaces	1977	13,720	
	Study on the Improvement of the Present Large Driers	1977	56,390	
	Design of Wet Paddy Separator	1977	12,690	
	Study on Grain dry by Solar Energy	1977	4,610	
		Sub total 8	1977	237,530
	Development of small Type Sorting Machine for Citrus Fruits	1978	7,680	
	The Development of Paddy Cultivator and Weeder	1978	7,590	
	Testing of New Farm Machinery and Implements	1978	17,220	
	Study on Milling Yield of Extra-long Rice and Improvement of Rice Husker	1978	7,120	
	Study of Tree Shaker on the Sloping Land	1978	7,610	
	Improvement of Drum Type Greenhouse Drying Grain System	1978	10,640	
	Study on the Turning and Aeration System of Paddy Warehouse	1978	14,420	
	Study on the Cold Storage System of Modern Convenience Store	1978	5,350	
	The Improvement of the Cutting Mechanism of rice Combine	1978	3,470	
	Improvement of Greenhouse Solar Drying System	1978	12,140	
	Improvement on the Present Small-sized Driers in Taiwan	1978	11,890	
	Study on the Storage Losses and Processing Characteristics of Paddy Warehouse in Taiwan	1978	37,690	
	Study on the Paddy Silo Storage System	1978	8,890	
	Study on Rice Hull Furnaces and Grinding Machines	1978	17,150	
	Study on the Solar Energy Utilization in a Greenhouse Solar Drying System	1978	11,940	
	Improvement of the Cutting Mechanism of Rice Combine	1978	2,500	
	Testing and New Farm Machinery and Implements	1978	10,030	
	Investigation of the Existing Large Rice Drying and Floating Driers in Taiwan	1978	4,920	
	Investigation of the Small-sized Rice-driers in Taiwan	1978	2,500	
	Improvement on the Rice-separating Machine	1978	7,280	
Remodelling of the Traditional Tobacco-drying Houses and Study on Their Drying Characteristics	1978	9,610		
	Sub total 21	1978	217,640	
Study on Small Type of Peanut Combine Harvest Machine	1975	5,970		
Utilization of Small Type of Peanut Combine Harvest Machine	1976	20,550		
Extension and Training on Agricultural Mechanization NCHU	1977	27,730		

Field	Subject of Research Project	Year	Fund US\$	
Agricultural Machinery NCHU	Improvement and Demonstration on Peanut Combine Harvest Machine	1978	16,060	
	Improvement and Manufactory on Peanut Combine Harvest Machine	1978	20,500	
	Manufactory on Grass Wrapping Machine	1978	10,190	
	Investigation on Operation Labor of Cheese Farmer	1978	3,700	
	Study on Equipment of Spray Medicine in Orcharn Garden in Sloping Land	1978	9,440	
	Sub total 5	1978	59,890	
Soil and Water Conservation NCHU	Experiment on the Effect of Soil Conservation Treatment on Tea Plantation	1975	1,220	
	Study on the Effect of Soil Conservation Treatment on Tea Plant	1976	2,610	
	Study on the Effect of Soil Conservation Treatment of Mulberry Plantation	1976	3,180	
	Collection and Analysis of Soil and Water Losses Data Obtained from the Soil Conservation Experiments in the Past Years	1976	10,420	
	Study on Correlation of the Quality of Runoff and Percolated Water to Washing Away of Soil Nutrients	1976	1,670	
	Observation of Frotion on forest Land and Soil and Water Losses on Orchard in the Watershed of Techí Reservoir	1976	4,720	
	Study on Mathematical Model for the Total Sediment Estimation Tsengwen-chí Watershed	1976	3,900	
	Study on Design of Drainage Holes in Check Dam	1976	1,890	
	Sub total 7	1976	28,390	
	Soil and Water Conservation NCHU	Study on Soil and Water Conservation Methods for Banana, Lichee and Taiwan Giant Bamboo	1977	1,400
		Study on the Effect of Soil Conservation on Mulberry Plantation	1977	1,890
		Study on the Effect of Soil Conservation on Tea plantation	1977	2,470
		Study on the Effect of Cover Crops and Mulching on Soil Conservation	1977	2,940
		Sub total 4	1977	8,810
Soil and Water Conservation NCHU	Study on Soil Conservation Methods for Farm Lands	1978	23,470	
	Analysis on Gully Control and Drainage Methods in Taiwan	1978	4,110	
	Sub total 2	1978	27,580	
Soil & Water Con. PTT	Observation of Planting Grasses on Farm Road	1975	1,220	
	Observation of Planting Grasses on Farm Roads for Road Protection	1976	2,750	
	Experiuent on Maintenance of grass Farm Road	1976	2,440	
	Sub total 2	1976	5,190	
	Study on Characteristics of Tropical Rain drops in Taiwan	1977	4,300	
	Study on the Characteristics of Tropical Rain drops of Taiwan	1978	5,440	
	Total	117	1,326,080	

117 projects have been done in the field of Agricultural Engineering and spent about US\$1,326,000 from 1975 to 1978, project field and fund in each year is summarized as below:

Table 8. Research papers were published in the field of Agricultural Engineering during 1975 to 1978

	Number of project	funb (U. S. \$)	Field	year
	10	94,370	Irrigation & Deainage NTU	1975
	15	177,630	"	1976
	10	87,950	"	1977
	18	116,550	"	1978
Sub total	53	476,500	"	4
	5	130,860	Agric. Machinery NTU	1975
	3	67,210	"	1976
	8	237,530	"	1977
	21	217,640	"	1978
Sub total	37	653,240	"	4
	1	5,970	Agric. Machinery NCHU	1975
	1	20,550	"	1976
	1	27,780	"	1977
	5	59,890	"	1978
Sub total	8	114,190	"	4
	1	1,220	Soil Conserva. NCHU	1975
	7	28,390	"	1976
	4	8,810	"	1977
	2	27,580	"	1978
Sub total	14	66,000	"	4
	1	1,220	Soil Conservation PTT	1975
	2	5,190	"	1976
	1	4,300	"	1977
	1	5,440	"	1978
Sub total	5	16,150	"	4
Total	117	1,326,080		4

From table above, there are 90 projects about 78% of total which were done by the Department of Agricultural Engineering, NTU, among them 53 projects in the field of Irrigation and Drainage, Hydrology and Fluid Mechanics and Water Pollution; 45 projects in the field of Agricultural Machinery, 37 projects of them in the Agricultural Processing in NTU and 8 projects in Mechine Design in NCHU. There are 19 projects in the field of Soil and Water Conservation, 14 and 5 in NCHU and PTT respectively.

There are 106 research papers in Universities and Colleges from 1975 to 1978, the name of the papers are listed on table 8. Among them, about 68 papers (64% of the total) were done by NTU, 42 and 26 papers in the Division of Irrigation and Drainage and Agricultural Machinery respectively. 18 and 17 papers in the field of Agricultural Machinery and Soil and Water Conservation respectively in NCHU.

3 papers in the field of Agricultural Machinery in CYT. In another word, 42 papers in the field of Irrigation and Drainage, Fluid Mechanics and Water Pollution, 47 in Agricultural Machinery and 17 papers in Soil and Water Conservation were done in universities in Taiwan during 1978. to 1978.

Table 8. Research papers were published in the field of Agricultural Engineering from 1975 to 1978

Field	Subject of Research Paper	Author	Date of publish
Irrigation and Drainage NTU	I1 Comparison on Irrigation Efficiencies in Animal and Machine plowing field	Charles Shih	Nov. 1975
	I2 Report on Irrigation water management in East Jawa Indonesia	"	March 1976
	I3 Comparison on surface Irrigation in Animal plowing and Machine plowing field	"	March 1976
	I4 Study on the Simulation for Regional Drainage Planning	"	July 1977
	I16 Primarily study on Damage to paddy Rice by water inundation	"	Nov. 1977
	I17 Rating Discharge Coefficient of Drainage Notch in paddy field	"	Nov. 1977
	I5 Experiment and study on water requirement of paddy land preparation with mechanized operation	"	June 1978
	I6 Study on Damage to paddy rice by clean water inundation	"	Sep. 1978
	H1 Study on Stable Channels	S. P. Mao	May 1977
	I7 The probability using computer program to distribute Irrigation water in Cho Main canal irrigation system	C. E. Kan	Apr. 1976
	I8 Study on optimum utilization of Min-Teh Reservoir	"	Dec. 1976
	H2 Report on land subsidence from observation of well in Taipei area	R. Y. Wang	Aug. 1975
	H3 Study on optimum Model Hydrologic system in watershed	"	Nov. 1975
	H4 Analysis of land subsidence in Taipei Basin	"	June 1976
	H5 Report on land subsidence from observation of well in Taipei area	"	July 1976
	H6 Report on land subsidence from observation of well in Taipei area	"	July 1977
	H7 Report on land subsidence from observation of well in Taipei area	"	July 1978
	H8 Study on Modeling and application of Regional Drainage Planning	"	May 1978
	H9 Study on the Rational Synthesis of Design Flood Hydrographs of River Basins in Taiwan	"	Sep. 1978
	H10 Study on Roughness Coefficient for Grassed Channels	M. T. Wu	Apr. 1976
	I9 Final Report of Upland Crop Irrigation Experiment at Hsioh-Chia Station	"	Apr. 1976
	H11 Experiment on grass lining in Irrigation and Drainage canal.	M. T. Wu T. S. Chen	June 1976
	P1 Pilot survey and Improvement of Existing Rice Warehouses In Taichung	"	March 1977
	H12 The Development of Hydrology and Application of Stochastic	Victor J. Yih	June 1975
	H13 Long Duration Drought Frequency Analysis	"	May 1975
	H14 Primarily study on Extreme Discharge Estimation by Determination of Regional	"	May 1975

Field	Subject of Research Paper	Author	Date of publish	
Irrigation and Drainage NTU	H15 Analysis on long Duration Drought Frequency in Techí, Shihmen and Tsengwen Reservoirs	Victor J. Yih	May 1976	
	I10 Study on Telemeter and Remote control in the Cho Main canal Irriga. System	Y. S. Tsao	Apr. 1976	
	I11 Study on Irrigation Slide Rule	"	July 1976	
	I12 Study on Remote Control and Simulation of its optimum in Tao-yuan Main Canal	"	June 1977	
	I13 Soil Moisture Available to Plant	Y. P. Hsu	Sep. 1975	
	W1 Effects of Industrial waste water to Irrigation water Quality	"	Sep. 1975	
	I14 Soil Improvement and Irrigation to Increament of Agricultural production	"	Feb. 1976	
	W2 Storm Runoff water Influence to water quality	"	July 1977	
	W3 Quality Changes of Irrigation Water in Taiwan	"	Nov. 1977	
	W4 The effects of Lead and Zine on rice growing Stage in Nutrient Solution	"	June 1977	
	W5 Study of some potential pollutants in Irrigation & Drainage water in southern Taiwan	"	Apr. 1978	
	W6 Irrigation water quality in Taiwan	"	May 1978	
	H16 A Linear Reservoir planning Model and Its Simplification	C. M. Liu	March 1978	
	I15 Net flow model to supply irrigation water in ponds	"	Dec. 1978	
	H17 Ralation between flood capacity and out let quantity of water in reservoir	"	Aug. 1977	
	H18 Storage Requirement and Consecultive Sums of Net Inflow	"	June 1977	
	Agricultural Machinery NTU	P2 Grain Storage and Drying	K. W. Shen	June 1975
		O1 Study on Ductile Iron Production	"	June 1977
P3 Improvement of Machines for Making Rice husk Charcoal		C. S. Su K. K. Muh C. C. Yang	Sep. 1976	
P4 Solar Energy Utilization in A Bulk Curing and Drying System		H. S. Chang	June 1977	
P5 Solar Energy Utilization in a Greenhouse Drying system		"	Winter 1978	
P6 Predicting the air Temperature Inside of the green house Solar Drying System		"	Dec. 1978	
P7 Design and Tests of Rice Hull Furnaces		K. W. Lee	June 1978	
P8 Temperature and Moisture Effects on Mechanical		"	June 1977	
P9 Properties of Rice		"	Sep. 1977	
P10 Study on Rice Milling Inducry		"	Nov. 1977	
P11 Study on Rice Hull Crashing		"	Nov. 1978	
P12 A Tentative Drying for Rice During Rainy Season		Y. L. Chen D. S. Fon	Mar. 1975	
P13 Dry Theory aud Intermittent Dryeration of Rice with High Temperature		"	June 1975	
R14 Comparison on characteristics of air-tight and Aeration in storage system		D. S. Fon Y. L. Chen	Nov. 1975	
P15 The performance test and Analysis on the present Tower Rice Driers in Taiwan		"	June 1976	
P16 Experiment on low Temperature rice Storage Warehouse at Lotung		"	Mar. 1977	
P17 Theory and Practçe on Tobacco Curring and Drying		"	July 1977	

Field	Subject of Research Paper	Other	Date of publish
Agricultural Machinery NTU	P18 Drying characteristics study of Remodeling of Traditional Tobacco Drying Houses	D. S. Fon Y. L. Chen	Feb. 1978
	P1 Study on Corn Planter in power Tiller Driving Type	K. Y. Liu	Mar. 1976
	P19 Study on Design of Greenhouse System	"	June 1978
	D2 Study on the efficiency of Combined Lister and Rotary Tiller for Soil Scattering	F. M. Lu	Nov. 1975
	P20 Study on Paddy Silo Storage System	"	Nov. 1977
	P21 Investigation of the Efficiency of Local Rice Mills	"	Mar. 1977
	P22 Improvement of Mechanical Handling System at Conventional Paddy Warehouses	"	Mar. 1978
	P23 Study on the Storage Losses and Processing Characteristics of paddy Warehouse in Taiwan	"	July 1978
	P24 Study on Simple Drying Equipment with Solar Energy for Paddy Rice	K. K. Muh	Nov. 1977
Agricultural Machinery NCHU	D16 Development of a small Peanut Combine	H. T. Chen	
	D3 Shopwork on the form in Taiwan	C. K. Lin	
	S4 Study of Mechanization of livestock production in Taiwan Mountain area	C. L. Pen	
	D15 Manufacture and Demonstration of proto-type four-row peanut Combine	Y. R. Hwang	
	O2 Fundamental Researches on Traveling Characteristics of Pneumatic Rubber tires	"	
	O3 The Compressive Wafening of Grass Hay	K. N. Wang	
	O4 Two-Dimensional Cutting Theory of Soils	"	
	D5 Study on the Development of Bower Tiller with Drill Planter for Food Crops and Testing for its Performance on Field Operation	J. M. Chen	
	D6 Development of Rice Nursery Seeder and Its Performance Tests	"	
	O5 Study of Forage Harvester	J. M. Luam	
	D7 Safety Indicator on Tractor	"	
	O6 Study on the Paddy Dryer	W. C. Lin	
	D8 Study on the Improvement of Mower	"	
	O7 Study on Land Leveler of the Paddy Field for Tractor	W. T. Liu	
	D9 Study on the Rice Combine	J. M. Shvu	
	D10 Estimation of Potatoes Harvest with Machine	K. R. Hwang	Dec. 1976
	D11 Parts Method Applied to Research and Design in Agricul. Engr.	C. L. Pen	Sep. 1976
	D12 Harvest Machine of Grass	C. L. Pen	Nov. 1977
D13 Design of Land Leveling Machine with Tractor in Paddy Field	W. T. Liu	Aug. 1976	
D14 Research on Grass Cutting Machine in Paddy Field	"	June 1977	
O8 Investigation on Operation with Machine in Sloping land Orchard	"	Mar. 1968	
	S1 Design and Application of Slide Rule for Cable	S. C. Lin	Dec. 1975
	S2 Design and Application of Slide Rule for Water Content of New Timber	"	Oct. 1975
	S3 Design and Application to Calculate Timber Volume, High and Diameter	"	Mar. 1976

Field	Subject of Research Paper	Author	Date of Publish
Soil and Water Conservation HCHU	S5 Design of Density for Rain Measurement Station in Cho-Shui	Y. C. Chiang	July 1975
	S4 Experiment on Erosion of Travers Road in Sloping Land	"	Dec. 1975
	S5 Discussion on Sedimentation Load in Rivers of Taiwan	C. W. Ho	May 1975
	O9 Mechanics Analysis on Blood Circulation Based on the Idea of Relative Balance and Relative Exercise	"	Nov. 1975
	S5 Mathematic Model for Estimating Sedimentation in Ta-Chia River	"	Dec. 1975
	S7 Investigation of Root System of Mandioca in Li-shan	C. P. Yen	July 1975
	S8 Measurement of Evapotranspiration of Plant in Water in Teh-Chi Reservoir slope protection	"	Dec. 1975
	S9 Experiment on Sprout of Pamboo Pile for Slope Protection on Different Treatment	C, J. Lee	July 1975
	S10 Spray Different Stik Natter to Plant Grass for Stable Slops	"	Dec. 1975
	S11 System Analysis on Management of Sand Catch Dam in Watershed	C. H. Tuan	Dec. 1975
	S12 Relationship Between Water Holding Capacity and Intake Rate in Teh-Chi Water Shed	C. I. Hwang	Dec. 1975
	S13 Investigation on Land Sliding in Chenghua Area	F. C. Yu	Dec. 1975
	S14 Investigation on plant of Soil and Water Conservation in Lin-hua Pond	H. H. Lin	Dec. 1975
	S15 Description of Discharge Measurement of River	W. F. Chen	Dec. 1975

Note: I The research paper in the field of Irrigation and Drainage
H The research paper in the field of Hydrology and Fluid Mechanics
W The research paper in the field of water pollution
P The research paper in the field of Agricultural Processing
D The research paper in the field of Machine Design
S The research paper in the field of Soil and Water Conservation
O The research paper in the other field except above
I10, H9, etc. is shown the number of research paper in each field

Fund and Equipment in the field of Agricultural Engineering

Fund in public schools and universities are supported by government, but in private schools TKC, CYC and and FCC on table 1 the fund are from tuition fee from students. The fund in scientific department of public universities and colleges is about US\$14,000 per year for buying equipment and to replenish laboratory materials, if some department needs some special equipments who has to make a special application to the school or government, sometimes who may use project equipments for practice in laboratory.

Another fund for buying reference books in department is also supported by government, it is about US\$3,300 per year. In general, there is enough equipments and books for teaching use in universities and colleges but it is not enough equipment for practice in Agricultural Vocational schools.

Advance study and employment in the field of Agricultural Engineering

The ambition of students in Taiwan is advance study to universities and go

abroad. The students in Agricultural Vocational and Technology Schools, they try effort to study in university or college after their graduation; The students in universities and colleges they like to go abroad for advance study, but they do not like so much advance study in their own country in graduate school. The government has the different education policies between high school and vocational school, if he can enter to university or college who must read another books himself which are the same in high school, if he loss his effort that he can not get into university or college, therefore he does not have enough technical knowledge for working in his future, because he lost the technical courses in Vocational School. Sometimes some one misunderstand to evaluate the Vocational Schools at the "ratio of advance study to university" the higher is the better.

If the students will apply a job after their graduation from university or vocational school, they must pass some examinations before go to public office, but they may get a job in some private agency without examination. Usually one who graduates from university or college he may get a job either public or private agencies, but the vocational students are little hard to get a job. Now, the government has a farm mechanization policy, so, they may easily get the job of tractor driver, repair farm machine and run their own farm.

An estimation of student employment has been made in the Department of Agricultural Engineering NTU and Department of Soil and Water Conservation NOHU as shown below for your reference:

Estimation of employment in Dept. of Agricultural Engineering, National Taiwan University

Go abroad for advance study	20%
*Oversea students go back to their countries	18%
Work in the field of Agricultural Engineering public and private agencies	42%
Work in company and factory	11%
Education agencies	9%

Estimation of employment in the Department of Soil and Water Conservation NCHU

Engage in soil and water conservation work	35%
Go abroad for advance study	17%
Teacher in junior middle schools	19%
*Oversea students go back to their countries	5%
Others	24%

*Most of the public schools have oversea students who are Chinese and come from another countries, they will go back to their countries after their graduation.

Discussion and conclusion

There are 24 universities and colleges in Taiwan, only three universities or colleges have the field of Agricultural Engineering and two Agricultural Technology Schools are provided the Department of Agricultural Engineering. Nineteen

vocational schools have the Department of Agricultural Machinery out of twenty six, but only four Departments of Agricultural Engineering in Agricultural Vocational Schools.

In order to solve some modern problems in Taiwan, some government policies are related to Agricultural Engineering such as below:

1) Industry is developing in Taiwan, part of agricultural labors are transferred to factories, do not enough labors for agriculture use in the future, so, farm mechanization is carrying out in the recent years.

2) Because of population pressure and limitation of agriculture land in Taiwan, the government devotes to develop tidal and mountain land for agriculture and industry use.

3) Because of increase domestic and industry water in the future, we have to study economic use of irrigation water under constant water resources in Taiwan.

4) In order to increase unit area production of crops, to promote irrigation and drainage conditions in the farms becomes very important.

Based on the government policies above, the work must be done by Agricultural Engineers, so, research work in the field of Agricultural Engineering and training Agricultural Engineers are very important in the future in Taiwan.

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* The references above were written in Chinese except 1, 13, 14 in English.