

# 琉球大学学術リポジトリ

## 沖縄における農地保全対策とその普及事業

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## Soil conservation measure and extension in Okinawa, Japan\*

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**Key Words** : soil conservation, extension work, ISIDRE, soil conservation day, land improvement project, erosion control measure

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### Summary

Soil erosion problems in Okinawa began to be recognized after pineapple cultivation was introduced in late 1950s. It was only during the 1970s that soil erosion was seen as a serious problem. At that time, farming had started to expand to sloping areas with little regard for soil conservation. Okinawa had no previous experience in controlling soil erosion, and little knowledge accumulated on this subject, so it had to be applied the planning standards for land improvement projects. Reclamation of large-scale farm areas was implemented with subsidies from government agencies, and soil conservation extension was limited to farm and crop management.

Currently, erosion problems affect farmers and the non-farm population. A solution to soil loss is sought with the cooperation of administration, industries and research bodies. Soil conservation extension in Okinawa has not been satisfactory because of the lack of efficient erosion control techniques.

The paper presents soil erosion problems and suggests how the methods of soil erosion control may be extended to the farmers and officials. Some suggestions for solving soil erosion problems are as follows:

- (a) Discuss present problem in an Annual Soil Conservation Day's in order to promote awareness of soil preservation.
- (b) Demonstrate the state of soil erosion.
- (c) Promote land use planning and cover cropping on sloping land.
- (d) Extend soil erosion control methods through television, radio and other media.

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## I. Introduction

In Japan, rice farming is traditionally the main agriculture enterprise, but, dry land farming is carried out mainly on sloping areas not suitable for cultivation. Under such a system of farming, and with heavy annual rainfalls in Japan, it is quite conceivable that some degree of soil erosion did always occur.

But some farmers were totally indifferent to the erosion problem, while other took some measures to prevent the loss of surface soil. Those in the former category were indifferent, it was said, because the subsoil of the Ando soil areas, for example, was soft and could be cultivated easily even after its topsoil had been eroded away<sup>6)</sup>. Those in the latter category minimized effects of erosion by using such protective measures as terracing the field, piling stones along the sides and contour listing. In any case, compared with the present-day situation, effects of soil erosion must have been almost negligible, as clearing land for cultivation depended only on human power and that of domesticated animals.

Yahata<sup>5)</sup> pointed out that it was not until after the second world war that Nogyo-Doboku (Irrigation, Drainage and Reclamation Engineering) engineers began to realize that the problem of soil conservation was within the area of their responsibility. Before that time they apparently considered it as a problem of individual farmers. This may be the main reason why no serious research was done on soil conservation.

## II. Agricultural extension work

In Japan real cooperative agricultural extension work started in 1948 under the guidance of the Nature Resource Service of the U.S.A<sup>1)</sup>. The work has some notable features as described below.

Firstly, system and structures to encourage farmers are so arranged that they can improve their farming or living conditions by themselves, for more is made of human resources than is material aid.

Secondly, since family farming is the special characteristic of Japanese agriculture, the improvement of farmers' living is essential to improve farming itself, which accordingly, is incorporated in these project.

Thirdly, to foster farmers, above all youths, leading agricultural production or rural communities is one of the main objects. In short, these methods are educational, for their importance is attached rather to bringing up progressive farmers than to diffusing technical knowledge.

These extension activities were implemented by agriculture officers and home demonstration advisors all over the country. However extension work concerning soil conservation did not play an active role as described later.

As mentioned before, Japan had little problem of soil erosion until right after the second world war, and soil conservation was not taken in regard to social and political problem at the time the extension work had started. This is the reason why soil conservation extension work did not become a matter of concern.

Land improvement law was enforced in 1949, and improvement projects were carried out under this law. In accordance with the projects, the thought of soil conservation was raised, and studies and techniques about soil conservation had been advanced.

Therefore as mentioned later educational activities and exchange of research and technique are active among the persons related to the project, although the soil conservation work is not enough yet.

### III. Soil conservation measures

#### Administrative Measures

The first administrative action taken in regard to farmland conservation was the issuing of the Planning Standards for Land Improvement projects in 1956. This provided for general rules relevant to the formulation of plans for farmland conservation in accordance with the Land Improvement Act. However, Japan had to rely mainly on data from the United States in formulating standards, because at that time the government had no local knowledge based on soil erosion<sup>4)</sup>. A revised version of the standards was issued more than 20 years later (in 1979), with guidelines established on the basis of research conducted in Japan.

Since planning and design standards for land improvement projects should be established for the rational and economic execution of those projects, the standards must reflect the changing needs, regional characteristics and the status of research. This is the reason why the government revised those standards at certain intervals as conditions required it.

#### Activities of the JSIDRE

The Japanese Society of Irrigation, Drainage and Reclamation Engineering (JSIDRE) published its journal monthly, its transactions bimonthly, and Irrigation Engineering and Rural Planning (English) semi-annually, making its contribution towards the advancement of basic research and applied sciences and technology in the field of *Nogyo-Doboku* (IDRE). In the past 12 years from 1980 through 1991, with respect to farmland conservation, the Journal carried more than 50 papers in the field of basic and applied research, in addition to more than 20 technical reports. The Transactions published more than 20 papers during the same period. The society has 11 subsidiary research organizations which promote academic exchange among them through meetings and symposiums. One such organization is the Farmland Conservation Research Group established in 1970 with 172 members. The group, which held its first academic meeting in 1980, has since met annually in various places throughout Japan. These meetings have served as a forum for academic discussion and exchange of information among researchers and engineers endeavoring to find solutions to problems of soil erosion in many areas of Japan.

### Governmental measures

Deforestation as a result of rapid development, construction of golf courses and resort facilities, and extensive farmland development, have caused widespread problems related to soil erosion. Government agencies and municipal offices concerned are giving developers technical guidance to deal with these problems. Universities are conducting research on the conservation of farmland and environmental protection on commission from governmental agencies municipal offices or foundations, or using Scientific Research Grants from the Ministry of Education, Science, Sports and Culture.

National or local government agencies in charge of environmental administration are employing such methods as environmental assessment surveys to determine possible of proposed projects, but this approach has not yielded satisfactory results to date.

## IV. A case study-Okinawa

Soil erosion became a matter of concern in Okinawa in the latter half of 1950s when farmland was extensively reclaimed for pineapple growing. For farmers of Okinawa who had had no major source of income, the introduction of pineapple was an epoch-making event.

Consequently, extensive farmland development of a scale and speed never known in the agricultural history of Okinawa was launched in steep mountain areas with the aid of heavy equipment. Development at such a high pace inevitably altered surface conditions of the soil and the soil structure, increasing potential danger of erosion by rainfall. But soil erosion was not perceived as a problem at the time. This was perhaps because farmland reclamation at that time was carried out by individual farmers who were too preoccupied with pineapple growing to pay any attention to erosion preventive measures. It is also undeniable that there were some social as well as agricultural factors that made the society as a whole tolerant toward the erosion problem. For example, agriculturally speaking, even when the top soil was washed away, a possible drop in pineapple productivity could have been made up for by use of chemical fertilizers<sup>3)</sup>. On the other hand, Okinawa society had never known any erosion problems that would have polluted drainage basins, and therefore it did not take seriously the possible adverse influence that soil erosion could have made on the environment of drainage basins.

Furthermore, it can be pointed out that the conversion of rice paddies into dry farms as a result of reduction in rice production has deteriorated the mechanics of soil conservation of the environment.

After the administrative reversion of Okinawa to mainland Japan, the government-subsidized Agricultural Foundation Consolidation Project was implemented and under the project, farms were reclaimed or rearranged in such manners as would raise labor productivity. But the project was not necessarily erosion-preventive, and as a consequence, erosion problems surfaced later. The main reason behind this was that there was no accumulated knowledge or information regarding soil erosion and conservation in Okinawa and therefore the project had to be carried out in accordance with preventive standards set for mainland Japan. Red clay runoff from rain-eroded areas in the red-

yellow soil regions in northern Okinawa and Ishigaki Island still occurs today.

V. Extension work under U.S administrative period

The Okinawa region, located at the southernmost and westernmost end of Japan, is comprised of many islands, collectively know as the Ryukyu Archipelago, spread over a vast ocean area of 350,000 square kilometres with its central point at 26° N and 127° E (Fig.1). Its total land area is 224,587 square kilometres, or 0.6 per cent of the total land area of Japan.

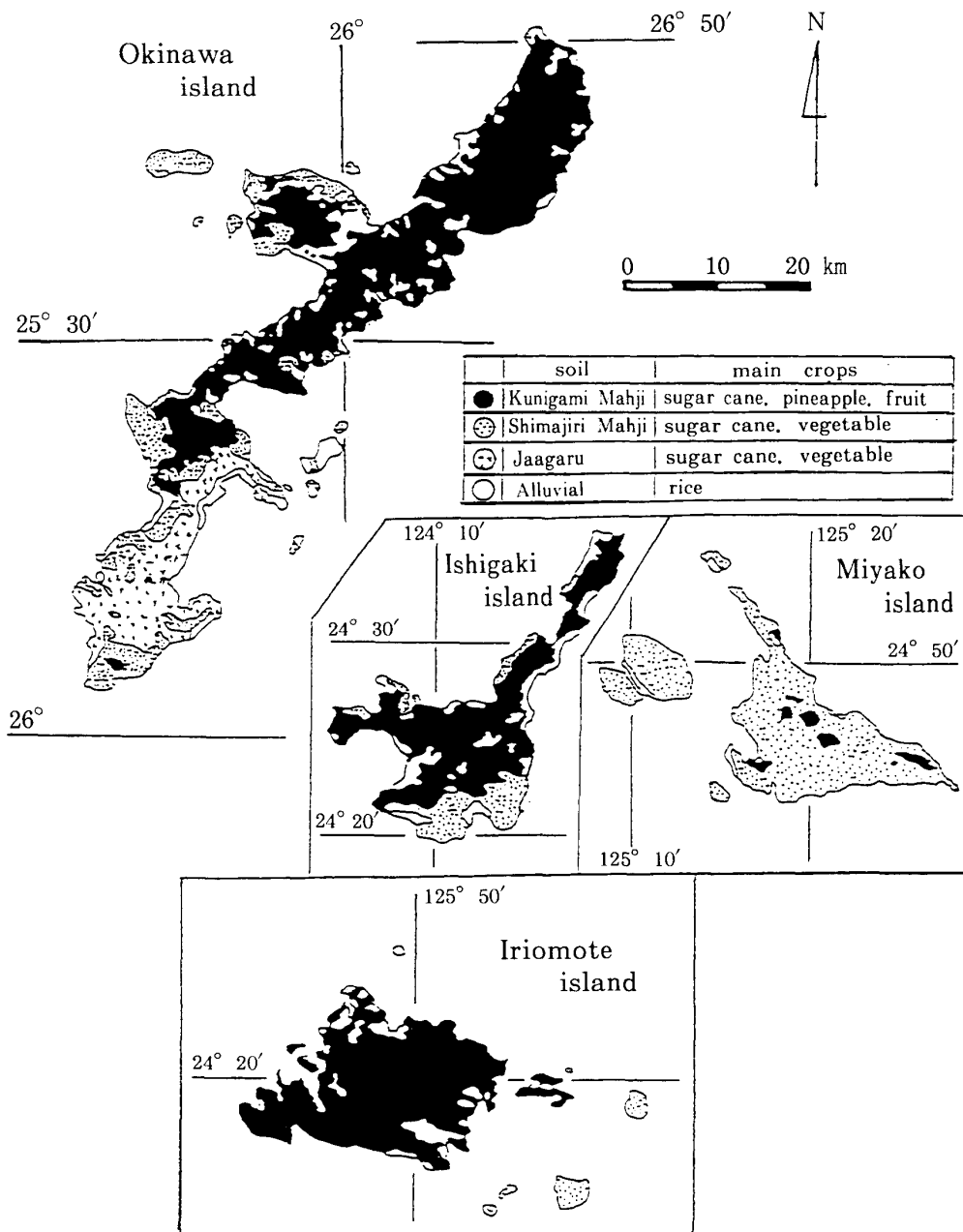


Fig 1. Location and soil map of Ryukyu Is'lands

Okinawa prefecture was occupied by US military at the second world war and after that the sovereignty of Okinawa was under the US military administration. Accordingly the agricultural policy was affected by US policy and system cooperative extension work was introduced as the up-to-date method.

General extension was directed by the Department of Economics in 1950. Their pamphlet series "Farmer's Friend" was published until 1967 (107 issues) as a media for agricultural extension work.

In 1955 the University of the Ryukyus took over the agricultural extension. In accordance with the United States Land Grant College System, the University had three main functions, namely teaching, research and extension, but the system was not practiced on mainland Japan<sup>2)</sup>. The University of the Ryukyus contributed to the extension work through a monthly magazine "Farm and Home News" which was published until 1972 (197 issues).

However, during its entire existence only two articles were published about soil erosion and conservation, which shows how little attention to soil conservation problem political, educational and of research at the time. Insufficient activity of soil conservation extension work was the main reason why people were indifferent of soil erosion.

## VI. The present state of extension work

Okinawa prefecture is one of the municipalities of Japan which consists of 47 municipalities. Therefore cooperative agricultural extension work and soil conservation measure was made to conform with that practiced in mainland Japan. But Okinawa has its own peculiarity of soil erosion causes by rainfall from the view point of natural conditions.

Okinawa is located in the monsoon region of Asia and has a humid subtropical climate, with its annual rainfall ranging from 2000mm to 2500mm. The erosivity of rainfall is high compared to those of mainland Japan which has the same annual rainfall, and erosive soil, originating from noncalcareous material, is distributed widely in Okinawa. Therefore, soil erosion is severe. Most of the eroded soil is red-yellow soil and its runoff washes into the ocean which causing disturbance to ecosystems and scenery of the seashore. Although extensive effort has been invested in extension and soil conservation measures have been carried out, a lot still remains to be done.

Described bellow are the countermeasures and the extension work of soil conservation which have been implemented up to the present in Okinawa.

## VII. Soil conservation measure

Two stages, planning stage and operation stage, are set up in the land improvement project to control soil erosion. The matters to be considered at the planning stage are as follows.

- 1) Leave out the sites where severe soil erosion has been predicted.
- 2) Select the sites where non erodible soil exists.

- 3) The area should not be developed if precious plants and animals are living.
- 4) Do not set up an unreasonable plan.
- 5) Establish reasonable land utilization.

In the operation stage, the subjects described below are to be considered basically.

- 1) Runoff from the inside and outside of cultivated land should be drained separately.
- 2) Construct soil catch dams, sedimentation ponds to retard runoff and to precipitate soil fraction (Fig.2).
- 3) Protect surfaces with bare soil by mulching (Fig.3).
- 4) Decrease by 3% the field surface slope or terrace the field like paddy (Fig.4).

#### VIII. Soil conservation extension work

Okinawa was reversed to mainland Japan in 1972 and after that the mainland Japan extension work system was established.

But no real soil conservation extension system was established until 1980. Knowledge and techniques were advanced after that administrative measure by publishing the manual on soil erosion control.

Recently, the Okinawa Government has introduced the "soil conservation day" to promote awareness of soil saving for farmers and the persons concerned soil erosion problem.

The outline of program of soil conservation day are as follows.

##### 1. Purpose

To protect soil loss from farmland, and to promote the thought of soil saving in the annual soil conservation day.

##### 2. Promoter

Agriculture, Forestry and Fisheries Department of Okinawa Prefectural Government (OPG), and municipal governments.



Fig.2 Soil catch Pond



Fig.3 Mulching by miscanthus sinensis



### 3. Date

The first Wednesday of June, annually.

### 4. Main events

- (1) Demonstrate the state of soil erosion.
- (2) Symposium, lecture meeting and field study concerning of soil conservation.
- (3) Delivery of pamphlets and posters pertaining to soil conservation.
- (4) Extend the objectives of soil conservation day through newspapers, T.V and radio.
- (5) Promote planning on slope surface of farmlands.
- (6) Participate to the events of soil conservation day for farmers.

Table 1 shows the example of program on soil conservation day.



Fig.4 Terraced field



Fig.5 Planting for soil conservation(Photograph by agriculture, forestry and fisheries Dept. of OPG)



Fig.6 Seeding of cover cropping(Photograph by agriculture, forestry and fisheries Dept. of OPG)

Table 1. Example of program on soil conservation day (June,1994)

District *	Number of participants	program
Northern part	200	Planting for soil conservation (Fig.5)
Central part	90	Take away sediment of drainage ditch
Southern part	100	Seeding of cover cropping (Fig.6)
Miyako	100	Lecture meeting: countermeasure of soil erosion control
Yaeyama	60	Lecture meeting: Effects of soil conservation by cover crop

## IX. Conclusion

Farmland are shrinking and soil is continually deteriorating everywhere in the world. The threat to farming has been reported by the media and researchers are sounding signal by publishing the results of their studies in books. This is due to over exploitation of soil and negligence to protect soil loss.

In Japan farmland is reclaimed in large scale with gentle slope to meet rationality and economy of land improvement project. Therefore, great quantity of soil is moved and soil structure is broken, so severe erosion occurred in high erosivity area like Okinawa.

The soil of farmland reclaimed in this manner include few top soil and regarded as artificial soil. This is the reason why farmers pay little attention to soil and neglect its protections from erosion.

But recently it is pointed out that the soil loss from farmland causes not only decline productivity of farmland but also disturbance of adjacent coastal ecosystem. So, farmers seriously pay attention to soil erosion problem. Soil loss protective regulation was enforced in October 1995 by Okinawan government. This states the obligation of associate agency, constructors and farmers about protecting soil loss.

The obligation is to observe presentation of documents of construction design to the prefectural governor when they develop or change the land more than 1000m<sup>2</sup> and construction facilities should restrain the mudiness of flow to less than 200ppm.

But this regulation is very strict for constructors and farmers today. As mentioned before the lack of extension work led to the establishment of necessities. Extension work of soil conservation must be enforced in future. The extension work is necessary for farmers identity and our cooperation with them.

It is desirable that extension work of soil conservation contribute to the harmony between environmental protection, land development and soil loss protective regulation.

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## 沖縄における農地保全対策とその普及事業\*

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### 要 約

沖縄における土壌侵食問題はパイナップル栽培が導入された1950年代の後期に端を発している。しかしながら土砂流出問題が深刻に受け止められたのは1970年代からである。当時は、農地の拡大は傾斜地に展開されたが、土壌保全にはほとんど注意を払われていなかった。

沖縄は従来から土壌侵食の経験が少なく、その抑止策についての知識の蓄積が殆どないので、土地改良事業は日本本土の計画基準をそのまま適用せざるを得なかった。

大規模な農地造成などは政府の援助の下に実施されたが、土壌保全の普及事業は個々の農地や作物の栽培管理に限定されていた。

土壌流出問題は産官学が一致協力して解決できるものである。

沖縄における土壌保全の普及事業は十分な侵食抑制技術の不備のため、まだ満足すべきものではない。

本論文は土壌侵食の問題を提起し、農民や関係機関に対し土壌侵食、抑止方法について示唆を与えるもので、以下はその方法である。

- (a) 土壌保全の思想を啓蒙するために、年1回の土壌保全の日に、土壌侵食の現状について検討会をもつ。
- (b) 土砂流出が流出源の土壌の退廃を招き、少なからぬ影響を及ぼすことを演示してみせる。
- (c) 合理的土地利用計画と傾斜地の被覆作物栽植の促進。
- (d) 土壌侵食抑止方法についてテレビ、ラジオ、その他のメディアを通して普及する。

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