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Studies on the Improvement of Jaagaru (Calcareous Heavy Clay Soil) in Okinawa Island 1 Introduction

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Studies on the Improvement of Jaagaru (Calcareous Heavy Clay Soil) in Okinawa Island

I Introduction

by

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(Okinawa Pref. Agr. Exp. St.)

1 Purpose of the Study

Most of the middle and southern parts of Okinawa Island is occupied by Jaagaru, an Okinawan word refers to soils derived from marl parent material as seen in Fig. 1. The soil in general, is fertile and used mainly as sugar-cane and partly as vegetable fields.

The prominent physical properties of Jaagaru are in hardness, shrinkage, and formation of wide and deep cracks when dry; in softness, swelling, plasticity, and stickiness when wet; and in poor permeability of subsoil. Therefore, it can be said that workability of this soil is greatly influenced by the water content, and furthermore, the kind of crops grown in this soil is also limited because of its physical characteristics.

Agricultural system of Okinawa will be mechanized in the near future. In this case, tillage must become a problem as an important soil characteristics. From the standpoint of soil management, the problems of Jaagaru can be said in poor tillage of surface soil and poor internal drainage.

Therefore, the improvement of Jaagaru is aimed to establish preferable physical conditions of surface soil as well as establishing effective drainage system for draining of the excess water from subsoil.

This study was done to find the method of improving Jaagaru by Niibi (Okinawan word refers to sand stone of upper Miocene) as the soil conditioner of the surface soil and by installation of the mole drainage to have better drainage from the subsoil.

Description of the typical profile of Inamine series described by Matsusaka et al. (1963) is as follows.

Typical profile of Inamine series.

Area: Sakamoto, Inamine, Ozato-son, Okinawa Is.

Use: Upland farming planted to sugar cane.

Topography: Gentle slope (5°) on a plateau.

Parent material and Physiography: Marly clay, residual.

Horizon 1: 0 to 20 cm, low organic matter (<2%), black brown (2.5Y3/3) (moist), LiC; no gravels: fine granular (<2mm) and fine blocky (<2cm) structure with fine (<0.5mm) pores (<5%); no mottlings; hardness 10; very sticky, very plastic; moist; pH 8.0; smooth clear boundary.

Horizon 2: Below 20 cm, low organic matter (<2%), black yellow (3.75Y3/4) (moist), SiC; no gravels; weakly angular (>2mm) blocky with fine (<0.5mm) to small

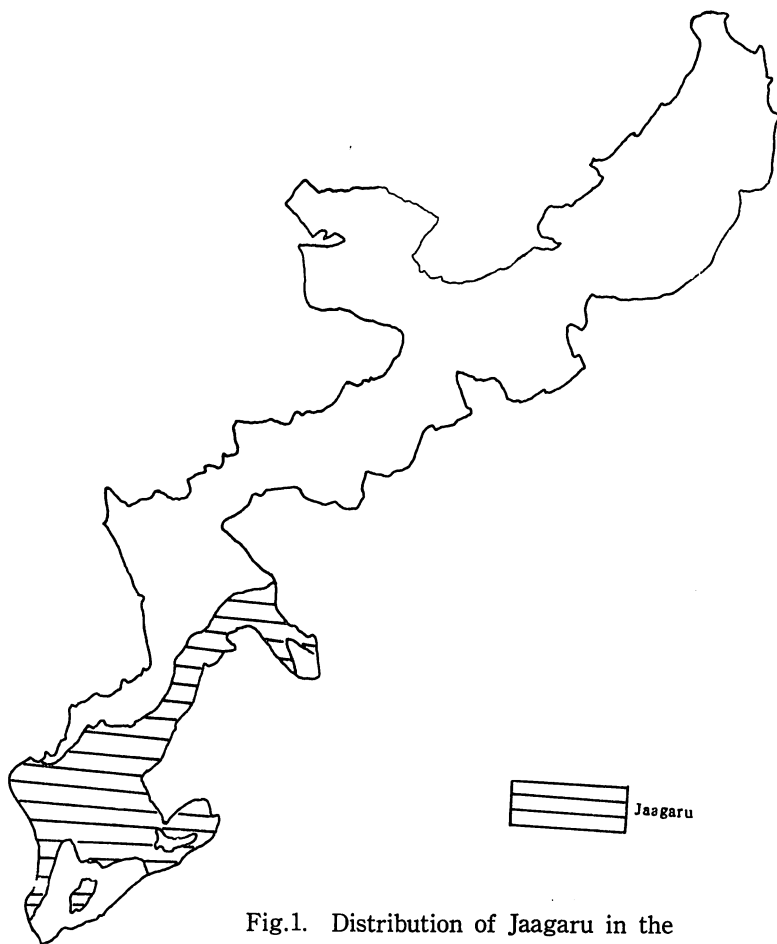


Fig.1. Distribution of Jaagaru in the Okinawa Island Jaagaru

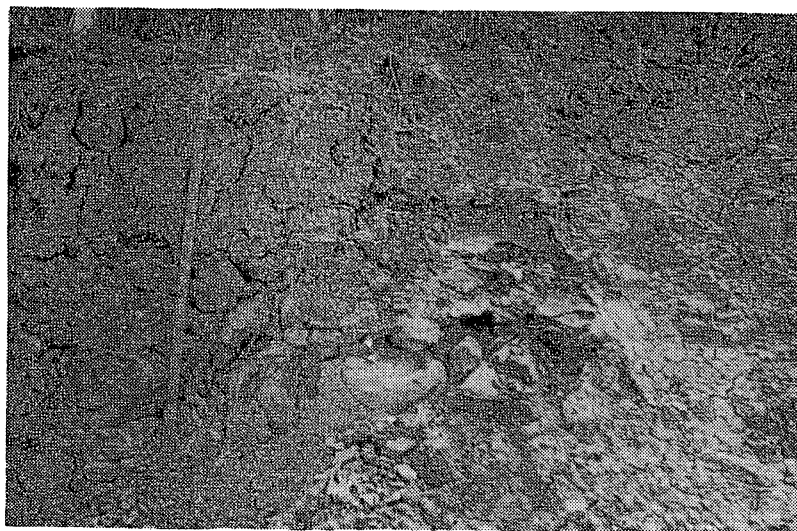


Fig. 2 A Profile of Inamine Soil.

(0.5-2mm) pores (<5%); no mottling; hardness 25; very sticky, very plastic; pH 8.1

A profile of Inamine series is given in Fig. 2

Matusaka et al. (1971) named Inamine series as Rendollic Udothent, Iju series as Lithic Rendollic Udothent, Onaha series as Rendollic Udifluent, and Ageta series as Rendollic Haplaquent on the basis of the Soil Classification, A Comprehensive System, 7th Approximation. Chinzei et al. (1967) named Inamine series as Eutrochrepts, Ageta series as Typic Haplaquepts. Classification of Jaagaru based on 7th Approximation will be necessary more investigation.

According to the description of Matusaka et al. and other investigations concerning Jaagaru, the general characteristics of the soil are summarized as follows.

- (1) Soils of this group have gray (hues of Y and chromas of less than 3) or yellowish brown (hues of Y and chromas of 3 or 4).
- (2) They show alkaline reaction (pH 8.0 to 8.5), and react severely with hydrochloric acid to vesicate carbon dioxide gas.
- (3) Clay texture in the typical form.
- (4) Moderate granular structure in the surface horizons but massive in the subsurface horizons.
- (5) Medium to low content of organic matter, usually one to three percent in surface horizons; the organic matter gradually decreasing with depth.
- (6) No eluvial and illuvial horizons.
- (7) High coefficient of expansion and contraction on wetting and drying.
- (8) Extremely plastic in consistence.
- (9) Clay minerals dominantly of the montmorillonite group.
- (10) Exchangeable complex nearly saturated with calcium.
- (11) Parent material is marl, which is calcareous gray clay, and nearly impervious.
- (12) Sola is generally deep.
- (13) Stage of weathering, relatively unadvanced.
- (14) Silica-Alumina ratio is about 4.0
- (15) Self mulching soil.

These characteristics of Jaagaru resemble closely those of grumusol, described by Harvey Oakes and James Thorp (1951), indicating Jaagaru might be grouped as one of the Grumusol.

2 Use of Niibi as the Soil Conditioner of Jaagaru

There are various kinds of soil conditioners supplied from manufacturing industries to improve physical properties of soils. However, they are usually expensive and their effectiveness is generally not consecutive. Therefore, the use of these kinds of soil conditioners for agriculture is limited.

Niibi can be used as soil conditioner of Jaagaru because it has the following advantages.

- (1) Large amount of deposits (approximately 20 million tons) of Niibi in Jaagaru area

scattered in several places.

- (2) It consists mainly of fine sand, and its effect is consecutive.
- (3) It is easily collected by bulldozing.
- (4) Cost of transportation is relatively cheap.

3 Mole Drainage

Mole drainage is aimed to achieve the same objective as tile drainage. As the internal drainage of Jaagaru is very poor, there are open drainage ditches of 40 to 50 centimeter in depth between the border line of each field.

It will be most effective to install the mole drainage 40 to 50 centimeter deep by connecting one end of the mole drainage to the open drainage ditches, for discharging excess water as soon as possible.

The installation of mole drainage and Niibi dressing are two principal means for improvement of Jaagaru in this study

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