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AN ATTEMPT TO IMPROVE TIDELANDS FOR MARINE BIVALVES

(1) Soil textures and chemical properties of tidelands in Kyunggi Bay

by

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海產貝類 增殖을 위한 干潟地 開拓에 關한 硏究
(1) 京畿灣 干潟地의 土性과 化學的 組成에 關하여

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摘 要

1. 未開拓狀態인 干潟地를 貝類養殖場으로 開拓하기 위하여 4種의 貝類 高密度 棲息地에 있어서 底質의 土性, 保水能, 水素이온濃度, 置換性 칼슘, 그리고 有機物 含量에 關한 基礎調査를 實施하였다.
2. 비쭉이, 동죽, 가무락, 그리고 바지락의 各 高密度 棲息地間에서는 土性에 差異가 있었다.
3. 保水能, 水素이온濃度, 置換性 칼슘의 含量은 4種貝類의 各 高密度 棲息地間에 有意差가 없었다.
4. 有機物의 含量은 비쭉이와 가무락 棲息地間을 除外한 다른 모든 棲息地間에서 매우 有意한 差를 볼 수 있었다.
5. 本 調査 結果로서는 아직 判斷키 어려우나 貝類養殖場의 適地選擇에 干潟地 土壤의 土性과 有機物의 含量이 重要한 要因으로 생각된다.

1. INTRODUCTION

There are broad tidelands, approximately 1.7 million acres, on the south and west coasts in Korea. However, a few acres of tidal flat have been used for raising bivalves which are one of the most important economic marine animals.

Although a number of investigators studied on the effect of some environmental factors no bivalves, there are a few papers on the physical and chemical compositions of tidal flat for bivalve culture.

Kurashige (1941) suggested that not only soil texture but other environmental factors such as heavy turbidity and hardness of bivalve bed affect on the survival of the bivalves. Ikematsu(1953) studied on the relation between water holding capacity and soil texture of the bivalve beds. Ikematsu and Wakita (1955, 1957) studied on the monthly changes of granular compositions of the bivalve beds which were scattered with sand and observed the

amount of setting clam seeds.

The present study was scheduled to investigate the current status of soil textures, water holding capacity, pH, exchangeable calcium, and the contents of organic matter in tidelands where four species of bivalves are densely populated.

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2. MATERIAL AND METHODS

Four sample plots were selected from the tidal flat in the Kyunggi-Bay, where each species of *Dosinia japonica*(*Yongyu Isl.*), *Mactra veneriformis* (Yongyu Isl.), *Cyclina sinensis* (Yongyu Isl.) or *Tapes philippinarum* (Mansok-Dong) was densely populated.

The soils were collected from different depths of 0—5 cm, 5—10 cm, 10—15cm, and 15—20cm below the surface of bed of each sample plot.

All determinations were carried out as follows:

Soil texture was analyzed by Kuhn's method and expressed as a percentage of clay, silt, fine sand, and coarse sand.

In determination of water holding capacity, dried soil was placed in 7dm cylinder and enough water is added to moisten the soil nearly but not quite to the bottom of the cylinder. The water content of the upper few centimeters of the column is then determined. Water holding capacity was defined as the percentage of moisture held in the soil.

The pH of soil suspension (the ratio of air dried soil to water was 1:2.5) was determined by the Beckmann pH meter.

Exchangeable calcium was precipitated by oxalate and titrated against standard ceric nitrate.

Organic matter of soil was determined by the loss on ignition. Sieved soil sample was dried in an oven at 100℃ for 2 hours, and ignition was accomplished in an electric muffle furnace at 45℃ for 12 hours.

3. RESULTS AND DISCUSSION

The soil textures at various depths of different beds were illustrated in Figure 1. The soil textures of various beds were different. Excepting 1(0—5cm) and 2(5—10cm) at *D. japonica* bed, soil textures of four different bepths showed quite similar compositions(Fig. 1).

Ikematsu(1953) also stated that there was no big difference in the soil textures among the depths of 0—2 cm, 2—5cm, and 5—10cm below the soil surface.

Data on soil textures were treated by statistical analyses in order to know the significance of meaning of Figure 1 (Table 1).

Clay percentages were 13.37% and 17.20%at *D. japonica* and *C. sinensis* beds respectively. This difference is highly significant. Clay percentages at *M. veneriformis* and *T. philippinarum* beds were 4.40%. and 6.89%. From these figures it can be said that there was no significant difference.

There was no significant difference in the silt contents among the *M. veneriformis*, *C. sinensis*, and *T. philippinarum* beds except *D. japonica* bed.

Table 1. Statistical analyses of Figure 1 (Soil textures)

Soil texture / Community	Clay (mean%) (0.01mm)	Silt (mean%) (0.01—0.05mm)	Fine sand (mean%) (0.05—0.25mm)	Coarse sand (mean%) (0.25mm〈)
Dosinia japonica	13.37±1.34**	6.96±1.55*	63.90±3.71*	16.77±4.37*
Mactra veneriformis	4.40±0.92	1.80±0.82	90.85±10.24*	2.95±1.32
Cyclina sinensis	17.20±2.10**	4.70±0.25	77.55±3.98*	0.55±0.21
Tapes philppinarum	6.89±1.04	3.49±0.19	42.82±2.42*	46.77±1.40
L.S.D. ※	3.71	3.49	13.22	13.91

* significant at the 5% level

** significant at the 1% level

※ L.S.D. Least significant difference

It was significant that there were differences in percentages of fine sand among all of four species beds.

The coarse sand contents showed no difference between *M. veneriformis* and *C. sinensis* beds. But it was significant that there were differences in the coarse contents among the beds of *D. japonica*, *T. philippinarum* and *M. veneriformis* - *C. sinensis*. Inspecting Table 1 it is noticed that there were distribution of each species within a restricted area depends on the soil texture of tidal flat.

Figure 2 shows relations between the different depths of soil strata and the values of water holding capacity, pH, exchangeable calcium, and organic matter of four species beds. It was hard to find the great variations of water holding capacity, pH, and organic matter contents except exchangeable calcium among the different depths of soil strata. There was no significant difference in water holding capacity, pH, and exchangeable calcium contents among four beds statistically (Table 2).

Table 2. "T" tests of Figure 2 (Chemical proerties)

Factor / Communities	Organic matter	Water holding capacity	Exchangeable calcium
Dosinia jap.-Mactra ven.	3.836*	0.991	0.237
Dosinia jap.-Tapes phi.	12.989**	0.975	1.309
Dosinia jap.-Cyclina sin.	2.116	0.873	1.078
Mactra ven.-Tapes phi.	11.342	0.834	1.042
Mactra ven.-Cyclina sin.	10.745**	0.927	0.872
Tapes phi.-Ciclina sin.	3.892*	0.728	0.492

* significant at the 5% level

** significant at the 1% level

Ikematsu(1953) stated that variation of water holding capacity may chiefly depend on

the soil textures and organic matter contents. He also noticed that water holding capacity runs parallel with the increasing amount of soil particles below 0.2mm, and varies conversely with the amount of soil particles above 0.2mm. The differences in soil organic matter contents among all of different beds except *D. japonica* - *C. sinensis* bed (Table 2) were highly significant.

From the results it is considered that the soil textures and the organic matter contents may be the most important factors restricting the distribution of each species of bivalves at different plot within the tidal flat. From the result of this investigation it can be explained the fact why each bed was densely populated by one species within a limited area of tidal flat.

4. SUMMARY

1. The basic investigations on soil textures, water holding capacity, pH, exchangeable calcium, and organic matter contents in four species bed were conducted in order to improve the natural flat for the bivalve beds.

2. It was statistically significant that there were differences in the soil textures among all beds of four species, *D. japonica, C. sinensis, M. veneriformis,* and *T. philippinarum.*

3. There was no significant difference in water holding capacity, pH, and exchangeable calcium contents among different bivalve beds statistically.

4. It was highly significant that there were diffences in soil organic matter content among all groups of beds except that of *D. japonica* - *C. sinensis.*

5. It is considered that the soil textures and soil organic matter contents are most important factors to restrict the distribution of each species bivalve within a certain limited area of tidelands.

5. LITERATURE CITED

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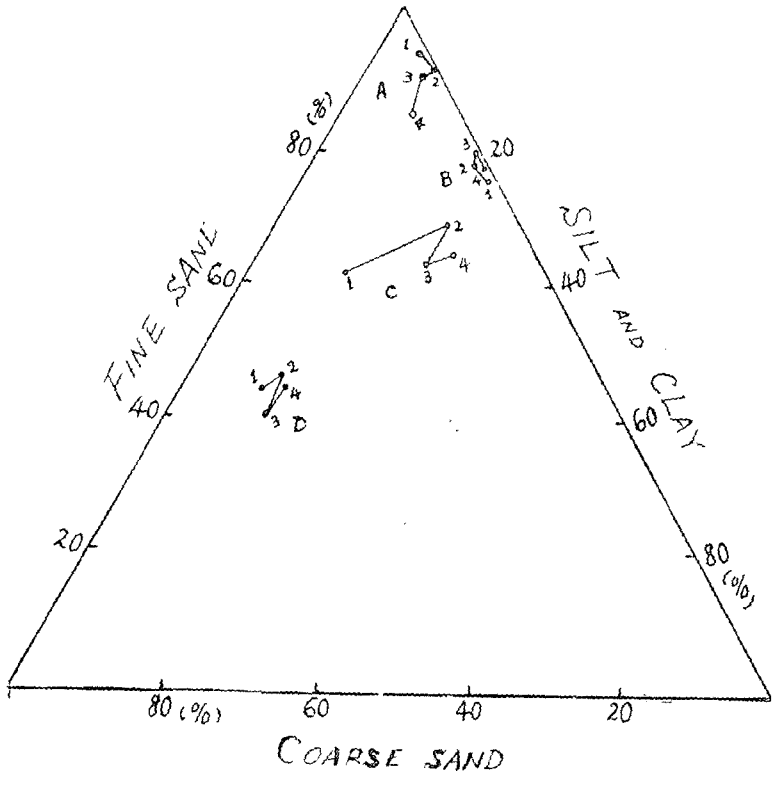

Fig. 1. Soil textures at different depths of four species beds.
A: *Mactra veneriformis* B: *Cyclina sinensis*
C: *Dosinia japonica* D: *Tapes philippinarum*
1: 0—5cm, 2: 5—10cm, 3: 10—15cm, 4: 15—20cm

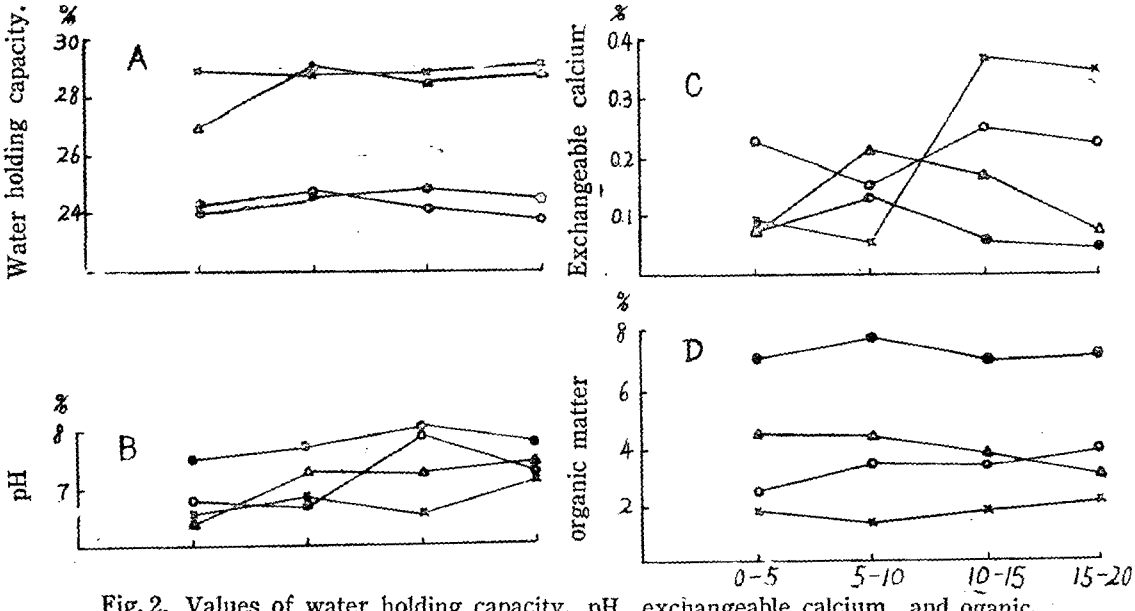

Fig. 2. Values of water holding capacity. pH, exchangeable calcium, and oganic matter at different depths of four species beds.
—○— *Dosinia japonica* —△— *Cyclina sinesis*
—×— *Mactra veneriformis* —●— *Tapes philippinarum*