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THE BASES OF DEVELOPMENT OF VIABLE DAIRY FARMING
IN THE KANTO DISTRICT

BY

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CHAPTER I

INTRODUCTION

1. The purpose of this study

Leading agricultural products in Japan changed from rice and cocoon in the prewar period to rice, livestock, milk, fruit and vegetable products in the post-war period.¹ Especially, these changes were notable during the period of rapid economic growth, and then dairy, horticulture, fruit and vegetable growing played an important part in the development of Japanese agriculture. As a whole, Japanese agriculture has made efforts to advance its productivity to the increasing of productivity in urban industries.² After Agricultural Foundation Law was enacted in 1961, the expansion of scale of farm business, the improvement of agricultural foundation, the spread of diversified farming with livestock, the mechanization and the rationalization of farming have accelerated viable farmings. Especially leading sections of agricultural enlargement have been highly selective.³ These agricultural changes indicate that subsistence farmings have been diminished, while highly commercial farmings such as dairy and vegetable growing have been increased. Simultaneously the regional expansion and the specialization of leading sections of agricultural enlargement have been advanced by adapting themselves to natural and socio-economic conditions.⁴

Dairy is one section of commercial farmings that have been developed rapidly in the post-war period. In about 1950, dairy farming, which kept a few dairy cows as a side line, spread to farms in various places. These farms kept a few dairy cows for the purpose of utilizing surplus of family labors, averaging labor distribution, using residual of agricultural products and by-products

of farms, stabilizing agricultural income, increasing farm income and maintaining organic fertilizer. Such dairy farming was developed in response to the policy of foundation of diversified farming with livestock and supported with high milk price at producers and large percentage of self-supplied feed.⁵ Although relative advantage of the dairy farming in agriculture has been lowered since around 1955, the farms keeping large dairy herds were given preferential treatment by the designation of the intensive dairy regions and enacting of Shortage Payment Systems of Milk Price (Stopgap Measure Act of Subsidy for Processing Milk Producers). As a result keeping large dairy herds has been further promoted, but small dairy farms as a side line have been reduced by degrees.

The dairy farming spread to farms in various places, so that various types of dairy farming were developed under influences of natural and socio-economic conditions.⁶ For instance, "dairying on paddy fields", which is related to rice cropping and its off-season cropping in alluvial lowlands, has been developed, "dairying on dry fields", which is related to dry field farming on diluvial uplands has been developed, and "mountainous dairying", which is related to grass lands and grazing lands in hilly regions and mountains has been developed. In suburban areas of large cities, in which dairy farms can not produce enough self-supplied feed, "suburban dairying" has been developed and characterized by keeping large dairy herds of milking cows of a few lactation, utilizing a great deal of purchased feed and advantage of high milk price.⁷ Such differentiations of dairy farming types result from that dairy farmers organize spatial farming systems with various elements of the dairy farming such as farm households, dairy cattle, land, dairy facilities and

equipments according to natural and socio-economic conditions. Above all, viable dairy farming has been developed with keeping large dairy herds after around 1970. This farming, therefore, has been developed with intensifying farming systems that consisted of various dairy farming elements in response to regional conditions.

In this study viable dairy farming is defined as the viable farming mainly composed of dairy farming. In Agricultural Foundation Law, the viable farming was defined as the family farming that home workers can engage in various farmings and have as much income as non-agricultural workers. The viable farms exert great efforts at all times to make their farm managements the most profitable, taking into account the size of their cultivated land and labor force and other conditions.⁸ In this definition important elements of viable dairy farming were the scale of agricultural management and agricultural labor force and agricultural income in the family farming. Farms practicing viable dairy farming, so-called viable dairy farms were defined as full-time farm households that more than two family workers were 16 to 65 years old and engaged mainly in dairy. In order to grasp characteristics of agricultural regions and rural villages, it is therefore very important to examine farming management of viable farms and the establishment conditions of these farms⁹ because viable farms play central parts in agricultural regions.

Because viable dairy farms have taken a leading part in dairy regions also, it is very important to examine farming management of viable dairy farms and establishment conditions of these farms in order to make clear the regional characteristics and the formation mechanism of dairy region. In present study, one of the central purposes is therefore to examine how various

elements of dairy farming have been organized with the development of viable farming in contexts of natural and socio-economic conditions. Furthermore, it is another purpose of this study to elucidate regional characteristics and the bases of development of viable dairy farming. Achievement of these purposes contribute to elucidate both characteristics of agricultural regions and regional bases of agricultural development.

2. Previous studies and problems

Before examining viable dairy farming in the Kanto district, the author shall try to review previous studies in terms of dairy in the Kanto district and to make clear their problems. Previous studies of dairy are divided broadly into three categories; i) studies of regional formation, ii) studies of farming types and iii) studies of dairy regions. The author shall examine each result of previous studies as to dairy in the following.

i) The formation of dairy regions

In the Kanto district during the Taisho era (1913-1925), the urban dairies (Sakunyu gyosha) were located in and around Tokyo city and supplied urban inhabitants with fresh fluid milk.¹⁰ Urban dairies were, at this time, mostly located within a 8 kilometer radius from the center of Tokyo as a typical type of suburban farmings.¹¹ Urban dairies is a typical type of the truck gardening zone around a central place in Thünen's land use rings.¹² These urban dairies continued to make a centrifugal movement to suburban areas according to the promulgation of Milk Control Act and the expansion of built-up areas of Tokyo city. Then urban dairy ranchers (bokujo) were distributed concentrically at a place where urban fronts and main arteries crossed each other.¹³ It is general phenomena for western countries

that dairy regions of suburbs moved to outer suburban areas and remote areas of large cities. These outward movements resulted from the increases of land taxable amounts and land speculations according to the advancement of urbanization.¹⁴

In the Showa era (after 1926), a part of fluid milk for inhabitants of Tokyo city was supplied from peasant dairy farms of the Awa region of Chiba prefecture and the Takata region of Shizuoka prefecture. As the percentage of farms in distant places producing fluid milk increased, dairy regions were distinguished between urban dairying regions and rural dairy regions.¹⁵ Furthermore, both keeping dairy cows and self-milkings diffused into farms in suburban areas of Tokyo city. The ratio of fluid milk supplied from outside Tokyo city amounted to 54.0 percent of all fluid milk in 1940.¹⁶ The metropolitan milkshed was described in detail according to the inflow of fluid milk into Tokyo city in 1930's. Regarding this Tokyo metropolitan milkshed, the urban dairies were distributed mostly within a 15 to 30 kilometer radius from the city center, while dairy farms were mostly distributed beyond that distance.¹⁷ But dairy regions were not developed sufficiently in the prewar period, since markets of dairy products was limited and the cereals cropping traditionally played an important part in Japanese agriculture. Then, dairy regions were virtually formed after World War II. The formation of dairy regions corresponded with the diffusion of diversified farmings with livestock and the growing demand for fluid milk.

In the post-war period it became easy to describe the urban milksheds because the demand for fluid milk for city people grew. The dairy farming spread to rural villages all over Japan, especially around Tokyo metropolis. With the increase of milk production by

dairy farms, the Tokyo metropolitan milkshed was analyzed from the viewpoint of von Thünen's model. Although the Tokyo metropolitan milkshed was delimited according to the inflow and the outflow of fluid milk by prefectures, the concentric structure of dairy farming was not clearly found in the Kanto district.¹⁸ After that, dairy regions were defined as regions which consisted of dairy farmers, dairy products companies and milk gathering facilities, and which the function of their central establishments such as dairy farms, milk gathering places, milk cooling stations and milk bottling plants reached. Dairy regions were delineated clearly as functional region or milkshed where a dairy farm was a foundation unit. Based on this definition the Tokyo metropolitan milkshed was analyzed and found that it consisted of hierarchical milksheds of milk gathering places, cooling stations and milk bottling plants. This Tokyo metropolitan milkshed has been spatially expanded into the whole of the Kanto district, the southeastern part of Fukushima prefecture, the eastern part of Nagano prefecture and the eastern part of Yamanashi prefecture.¹⁹ As a result dairy regions in the Kanto district are grasped as integrated milksheds centering on Tokyo metropolis.

It is notable that the Tokyo metropolitan milkshed expanded outward from 1955 to 1970. At the same time keeping large dairy herds and the intensification of suitable dairy regions have been advanced within the Tokyo metropolitan milkshed. These phenomena have been further advanced since 1970, so that it is an important subject for dairy studies to elucidate regional characteristics of dairy farming and regional conditions which supported the development of dairy region. In dairy regions, however, it is difficult to elucidate clearly regional characteristics and conditions in terms

of the development of dairy farming because previous studies emphasized more the function of milk circulation rather than function of milk production. These characteristics and conditions are not elucidated sufficiently by considering only the formation of dairy regions, but elucidations of these characteristics and conditions are sufficiently supplemented by regional classification of dairy farmings. In the following part, the author shall try to examine the regional types of dairy farming in previous studies of the Kanto district and its outskirts.

ii) The regional types of dairy farming

Dairy farming in the Kanto district has been diversified by natural and socio-economic conditions with progress of enlarging the scale of dairy farming and intensifying suitable dairy regions. According to the study of the Agricultural Experiment Station (1963), that is, "The Study of Structure on Dairy Feed Utilization in the Kanto and Tozan Districts",²⁰ the Kanto and Tozan districts were divided into three regions from natural conditions; these were warm lowland, semi-highland and cool highland regions. Additionally rural villages of the Kanto and Tozan districts were classified into four types from competitive relations between agriculture and non-agricultural industries; these types were suburban, pure, semi-mountainous and mountainous villages.²¹ Based on these regionalization and classification, the structure on feed utilization and the farming types were analyzed in dairy farms of various regions.²² As a result of these analyses, it became clear that various types of dairy farming were arranged successively in response to the natural conditions and the distance from Tokyo metropolis in the Kanto and Tozan districts. Regional types of dairy farming were classified into

commercial dairying and dairying with vegetables growing in suburban villages, paddy field dairying, dry field dairying and reclamation land dairying in pure villages (warm lands), dairying with sericulture, dairying with fruit growing and reclamation land dairying in semi-mountainous villages (semi-highlands), and dairying with sericulture and reclamation land dairying in mountainous villages (cool highlands). In regard of the feed utilization, furthermore, it became clear that the ratio of dependency on purchased concentrate was high in suburban villages, but the ratio of dependency on self-supplied feed increased as suburban villages to distant rural areas.

Generalizing regional types of dairy farming, locations of dairy farming were divided into suburban zone, paddy field zone of lowland villages, dry field zone of upland villages and dry field zone of cool highlands. According to the structure on feed utilization, dairy farming were divided into industrial dairying type, mixed farming dairying type, forage crops dairying type and grassland dairying type.²³ Therefore dairy farmings in the Kanto district were classified into some types by combining locations with dairy farming systems; industrial dairying type and mixed farming dairying type in suburban zone, mixed farming dairying type in paddy field zone and dry field zone of lowland villages, and mixed farming dairying type and forage crops dairying type in dry field zone of cool highlands. This classification was nothing but explanation of circumstances from 1955 to 1965. After 1970, dairy farmings in the Kanto district have been classified into industrial dairying type in suburban zone, industrial dairying type and mixed farming dairying type in paddy field zone of lowland villages, mixed farming dairying type and forage crops dairying

type in dry field zone of upland villages, and forage crops dairying type in dry field zone of cool highlands.²⁴ Various types of dairy farming have been simplified in both suburban and remote areas of Tokyo metropolis with the progress of keeping large dairy herds and the specialization of keeping dairy cattle. It is characteristic for suburban areas to keep large dairy herds intensively, but for remote areas of Tokyo metropolis to keep large dairy herds extensively. Therefore, various types of dairy farming have been successively arranged from suburban areas to remote areas of Tokyo metropolis with different intensification.²⁵

There are relatively many studies on dairy farming in suburban and remote areas of large cities. These studies give a full account of both classification and regional characteristics of dairy farming. Dairy farming in suburban areas has been generally classified as suburban dairying. Characteristics of suburban dairying have mostly been symbolized with terms of "Hitohara shibori cows (use milking cows only for one lactation) dairying" and "refuse dairying (kasu rakuno)" from the way of keeping dairy cattle and the structure on feed utilization.²⁶ Furthermore a characteristic of suburban dairying was emphasized by keeping large dairy herds, because urban areas made more rapid progress of keeping large dairy herds than rural areas in the Kanto district.²⁷ Dairy farms keeping large dairy herds in 1970, or dairy farms keeping more than 10 dairy cows, were collectively distributed in surrounding areas of Tokyo metropolis such as Kitatama county of Tokyo metropolis, Kawasaki and Yokohama cities of Kanagawa prefecture, Wako and Yashio cities of Saitama prefecture, and Matsudo, Ichikawa and Yachiyo cities of Chiba prefecture. Because dairy farms keeping large

dairy herds were located within a 30 to 40 kilometer radius from the metropolitan center and characterized by "Hitohara shibori cows dairying" and "refuse dairying", these farmings were classified into suburban dairying.²⁸ Suburban dairying has been generally supported by advantage of producers' milk price and lower price of transportation cost. In suburban dairying regions of Western Countries, political decisions such as zoning of producers' milk price and land use patterns were emphasized as forming factors of dairy regions.²⁹ On the other hand, it was an important condition for the formation of suburban dairy regions to maintain the stable feeding bases in the Kanto district.³⁰

In contrary to suburban areas, in remote areas of Tokyo metropolis, where the production cost of feed was lower than suburban areas, dairy regions were formed by improvement of transportation systems and cooling storage facilities.³¹ Some dairy regions have been developed on volcanic slopes located in the outer margin of the Kanto district, and most of reclamation settlements after World War II have become centers of dairy regions on volcanic slope. Thus dairy farmings in remote areas were classified into cool highland dairying or cool highland reclamations dairying in response to natural and socio-economic conditions.³² According to the study on land use patterns and farming types at the foot of Mt.Yatsugatake,³³ dairy regions in dry field farming zone of cool highlands were formed by regional differentiation of land use in response to soil fertility, that is, differentiating vegetable growing zone and forage crop cultivation zone. This regional differentiation resulted from the fact that farms selected land use patterns and farming types in response to land conditions.³⁴ On the other hand, in the study of dairy region at the foot of Mt.Nasu,³⁵ the author

elucidated that as dairy farms kept many cows and they specialized in dairying, settlement patterns changed from agglomeration to dispersion, dairy farmers increased their arable lands and possessed their farmland around their houses, homogeneous land use patterns were formed by converting their cropland into fodder crop fields and they were strongly linked up with various regional farming and marketing associations. Therefore, it may safely to say that dairy regions in remote areas of Tokyo metropolis have been developed by utilizing advantageous land conditions such as the large scale of arable land and collective landholding patterns in dry field farming zone of cool highlands.

In the Kanto district, there are fewer studies for dairy farming in outer suburban areas as compared with inner suburban areas and remote areas of Tokyo metropolis. Studies on regional types and characteristics of dairy farming in paddy field and dry field zones of lowland villages remains to be done. Furthermore, because regional types and characteristics of dairy farming in the Kanto district were explained mainly in individual phenomena, previous studies were not sufficiently examined areal differences of bases of development of dairy farming in the whole of the Kanto district. Additionally there were fewer consideration of regional types and characteristics in the structure of agricultural regions or dairy regions all over the Kanto district. In the following part, the author shall try to examine the previous studies on the structure of agricultural regions and dairy regions in the Kanto district.

iii) The structure of agricultural regions and dairy regions in the Kanto district

Agricultural regions of the Kanto district in 1950's were divided into six regions; suburban farming

region in Keihin conurbation area, mulberry field and barley and wheat growing region from the foot of the Kanto Mountains to the northwestern part of diluvial uplands, barley-wheat-upland rice and gourd (for dried gourd shavings) growing region in the northern part of diluvial uplands, barley-wheat-sweet potato and tobacco growing region in the northeastern part of diluvial uplands, barley-wheat-sweet potato and peanut growing region in the eastern part of diluvial uplands, and rice growing region in alluvial lowlands. These differentiations of agricultural regions have fundamentally resulted from expansion of the metropolitan areas, wide distribution of diluvial uplands and development of transportation network between metropolitan centers and rural villages.³⁶ Above all agricultural regions in the Kanto district in 1950's reflected natural conditions such as alluvial lowlands, diluvial uplands, hilly lands and mountains.

In 1960's agricultural regions were strongly affected by built-up areas of the Tokyo metropolitan area, because built-up areas centering on Tokyo metropolis expanded remarkably with the progress of rapid economic growth. According to the combination types of agricultural income by agricultural products, agricultural regions of the Kanto district were divided into six regions; suburban farming region, outer suburban commercial farming region, sericulture region, industrial crops growing region of mountains, fruit growing and truck farming region of warm lands or cool highlands, and rice growing and dairy region of periphery.³⁷ These regions showed a concentric pattern, since the influence of urban expansion was stronger than that of natural conditions. Then dairy farming was developed as a leading section of agricultural enlargement, so that farming types including dairy

farming appeared in suburban farming region (23 wards of Tokyo metropolis, Yokohama, Minamitama, Musashino, Iruma, Nishitama and Sagami-hara areas), sericulture region (Maebashi, Takasaki, Kiryu and Chichibu areas), fruit growing and truck farming region of warm lands or cool highlands (Agatsuma area) and rice growing and dairy region of periphery (Kimitsu, Isumi, Minamitasu and Kitamasu areas). This fact shows that dairy farming regions were mainly formed in both suburban and remote areas of Tokyo metropolis.

In the Kanto district in 1970's, because urbanization progressed further, the number of part-time farm household increased in rural and semi-mountainous villages. On the contrary commercial farming regions have been developed in various places, because demand for agricultural products have been strong and city people have wanted some agricultural products throughout the year. Therefore commercial production enterprises with high returns have been enlarged, the agricultural management has specialized into leading sections of agricultural enlargement such as dairy, fruit growing and horticulture. Surveying agricultural regions of the Kanto district from the above mentioned viewpoint, suburban farming regions, contract farming regions of rural hinterland and subsistence farming regions of periphery have been concentrically arranged centering on metropolitan centers, and horticulture regions have been distributed like "agricultural island" in outer suburban farming regions and in cool highlands.³⁸ Although dairy region isn't mentioned in this spatial structure, specialized dairy regions have been distributed like islands in and around suburban farming regions and cool highlands.³⁹ In summary, it is demonstrated that regions with high productivity have been developed in suburban, outer suburban and remote areas of Tokyo metropolis.⁴⁰

As mentioned above, agricultural regions in the Kanto district are latently influenced by natural conditions, but are more strongly influenced by expansion of the built-up areas. As a result agricultural regions have been concentrically arranged centering on the metropolitan center. Because dairy regions are influenced by cities as markets of milk, it was indicated in previous studies that regions of dairy products have been concentrically arranged centering on large cities.⁴¹ In dairy regions of the United States, for instance, regions where dairy farms produced market milk, condensed milk, cheese and butter were concentrically arranged centering on metropolitan centers in the order.⁴² This concentric structure was based on areal differences of dairy farming returns according to carrying costs of dairy products. In the Kanto district dairy farms didn't produce cheese and butter traditionally, so that cheese and butter producing regions were not developed. Additionally the whole of the Kanto district has been included in the Tokyo metropolitan milkshed, fluid milk has been utilized for drinking. Therefore, the structure of dairy regions in the Kanto district was not clearly organized by areal differences of dairy products. The structure of dairy regions in the Kanto district, however, has been organized by functional dairy regions consisted of dairy farms and dairying facilities.

Milk industry as agribusiness consists of dairy farms, dairy products companies and milk gathering facilities which organized dairy farmers into some groups. Applying the concepts of areal functional organization to milk gathering process from dairy farms to milk bottling plants,⁴³ dairy regions can be delineated according to milk gathering functions. The fluid milk from dairy farms was transported to milk

bottling plants for Tokyo through milk gathering places of rural communities and cooling stations, and each of their central establishments had a functional unit in which the milk gathering function reaches. Then each of these establishments gathered fluid milk from the lower order establishment as functional dairy region i.e., milkshed. For instance, the third order milkshed was delimited as the extent of the milk bottling plants by including together the second order milksheds of their milk cooling stations, and the dairy products company which controlled several milk bottling plants for Tokyo, constituted the center of fourth order milkshed by including together the third order milksheds of their milk bottling plants. Dairy products companies were centers of the fifth order milkshed, i.e., the Tokyo metropolitan milkshed. Therefore, the Tokyo metropolitan milkshed consisted of the first order milksheds to the fifth order milkshed, and milk gathering systems showed the hierarchical structure.⁴⁴

The whole area of the Tokyo metropolitan milkshed could be classified into three dairy regions from the viewpoint of areal differences of milk gathering systems. These regions formed a concentric pattern as a whole and each of them had the following characteristics.⁴⁵ The first (inner) functional dairy region was the sphere in which fluid milk from dairy farms was carried directly to the milk bottling plant for Tokyo, taking the advantage of the location close to the metropolitan center. This region was characterized by many milking plants, specialized dairy farms and suburban dairying. The second functional dairy region was the sphere in which fluid milk from dairy farms was carried to milk cooling stations, and was characterized by existence of many milk cooling stations and keeping large dairy herds. The third (outer) functional dairy

region was the largest in the Tokyo metropolitan milkshed and characterized by normal milk gathering system; fluid milk bottled by milk bottling plants for Tokyo was gathered from the dairy farms through the milk gathering places and the milk cooling station. The first region was within 40 to 50 kilometer radius from metropolitan centers. The second region was arranged beyond the outer radius of the first region, and the third region was arranged beyond the outer radius of the second region.

As mentioned above, such structure of dairy regions in the Kanto district explained circumstances in about 1970, but didn't analyze the situation in response to keeping large dairy herds and intensification of suitable dairy region in 1970's. Furthermore this structure of dairy regions was analyzed in terms of milk gathering system, but was not analyzed in terms of dairy farming systems. Therefore, it may not be said that bases and areal differences in dairy regions of the Kanto district had been sufficiently examined. These problems are the subjects for future studies.

3. Methodology

In this study the author deals with viable dairy farming which become a core of dairy region in the Kanto district and make an effort to elucidate its bases of development by investigation of viable dairy farms. Viable dairy farming in the Kanto district has been developed and diversified from place to place with suiting to natural and socio-economic conditions. In these circumstances, it is necessary to explain systematically areal differences of viable dairy farming and general conditions which give support to viable dairy farming. In this study, therefore, the author analyzes various elements of dairy farming and various

conditions which give support to viable dairy farming.

Important elements of dairy farming are farm household (directivity and contents of farm management, scale of farm business, family agricultural labor force, distribution of labor and so on), dairy cattle (number of dairy cattle, milking cows, milking cows of a few lactation, much delivered cows, calf, heifer and so on), land (land use, cultivating crops, landholdings, settlement patterns, road network and so on) dairy facilities and equipments (cow shed, barn, silo, milker, milk cooler, barn cleaner, farm tractor, accumulation of capital, ability of capital raising and so on). These elements are related to each other and integrated into dairy farming systems. Therefore, changes in one element sensitively affect other elements and finally make the whole of dairy farming systems change.⁴⁶ Existing bases of viable dairy farming and its areal differences are elucidated by transitionally and spatially analyzing how dairy farming systems change with the progress of viable dairy farming.

To put it in the concrete, the author elucidates changes of various elements which constitute dairy farming, especially elements in regard to farm household and dairy cattle. Changes of these elements are related to the whole of dairy farming systems, and simultaneously make landscape change. Because landscape reflects dairy farming systems on land surfaces, changes of various elements which constitute dairy farming are reflected in settlement, road, landholding and land use patterns, and arrangement patterns of dairy facilities and equipments. Therefore, landscape analyses are suitable methods in order to elucidate establishment conditions and regional characteristics of viable dairy farming. Furthermore in present study, the author compares landscapes in different dairy farming regions

which are formed by dairy farming systems, and considers their areal differences to elucidate the bases of development and regional characteristics of viable dairy farming.

In procedure of this study, at first the author delineates distribution patterns of viable dairy farms in the Kanto district in order to identify areal differences of viable dairy farming. Secondly the author tries to make clear the relations between distribution patterns of viable dairy farms and various conditions which give support to viable dairy farming. These conditions are divided broadly into natural conditions (topographical conditions, land conditions and so on) and socio-economic conditions (relation between markets and producers, transportation conditions, regional organizations such as dairy cooperative associations and dairy products companies). Furthermore, viable dairy farms will be classified into some types according to natural and socio-economic conditions, and farming elements such as kinds of dairy cows, structure on feed utilization, kinds of farm householeds in a dairy region and sources of farm income. Then the regional structure of viable dairy farming in the Kanto district is elucidated from spatial arrangement patterns of these regional types. The author selects some study areas from each regional type of viable dairy farming and does case studies according to methodology above mentioned. Finally the author considers bases of development of viable dairy farming in the Kanto district according to comparision among existing conditions and regional characteristics of viable dairy farming in study areas.

CHAPTER II

DEVELOPMENT OF VIABLE DAIRY FARMING IN THE KANTO DISTRICT

1. Distribution of viable dairy farming and its changes

This section deals with the distribution of viable dairy farming in and around the Kanto district. Viable dairy farming can be defined by various features of farming, but it can be described and explained comprehensively by the number of dairy cows kept by a farm. This index often reflects other features of viable dairy farming. Therefore, the present study focuses on the number of dairy cows per farm, by which viable dairy farming types are classified. According to the previous studies on livestock economics, the minimum number of dairy cows that enabled farmers to carry out viable farming was five in 1960, ten in 1970 and fifteen in 1980.⁴⁷ Based on this information a viable farm could be defined as a farm raising more than five dairy cows in 1960 and more than fifteen dairy cows in 1980. Distribution maps for 1960 and 1980 are shown in Figure 1 by using municipality data of the agricultural censuses.

Figure 1-a shows the distribution of viable dairy farming in 1960, that is, the distribution of dairy farms keeping more than five dairy cows. Viable dairy farms were distributed in the western part of Chiba prefecture spreading from Yachiyo, Narashino and Funabashi cities to Matsudo and Kashiwa cities, in the western suburbs of Tokyo metropolis from Adachi, Itabashi, Nerima and Setagaya wards to Fuchu, Chofu and Machida cities, and in the central and southern parts of Kanagawa prefecture including Minami, Kohoku and Totsuka wards of Yokohama, Kawasaki and Sagami-hara cities and

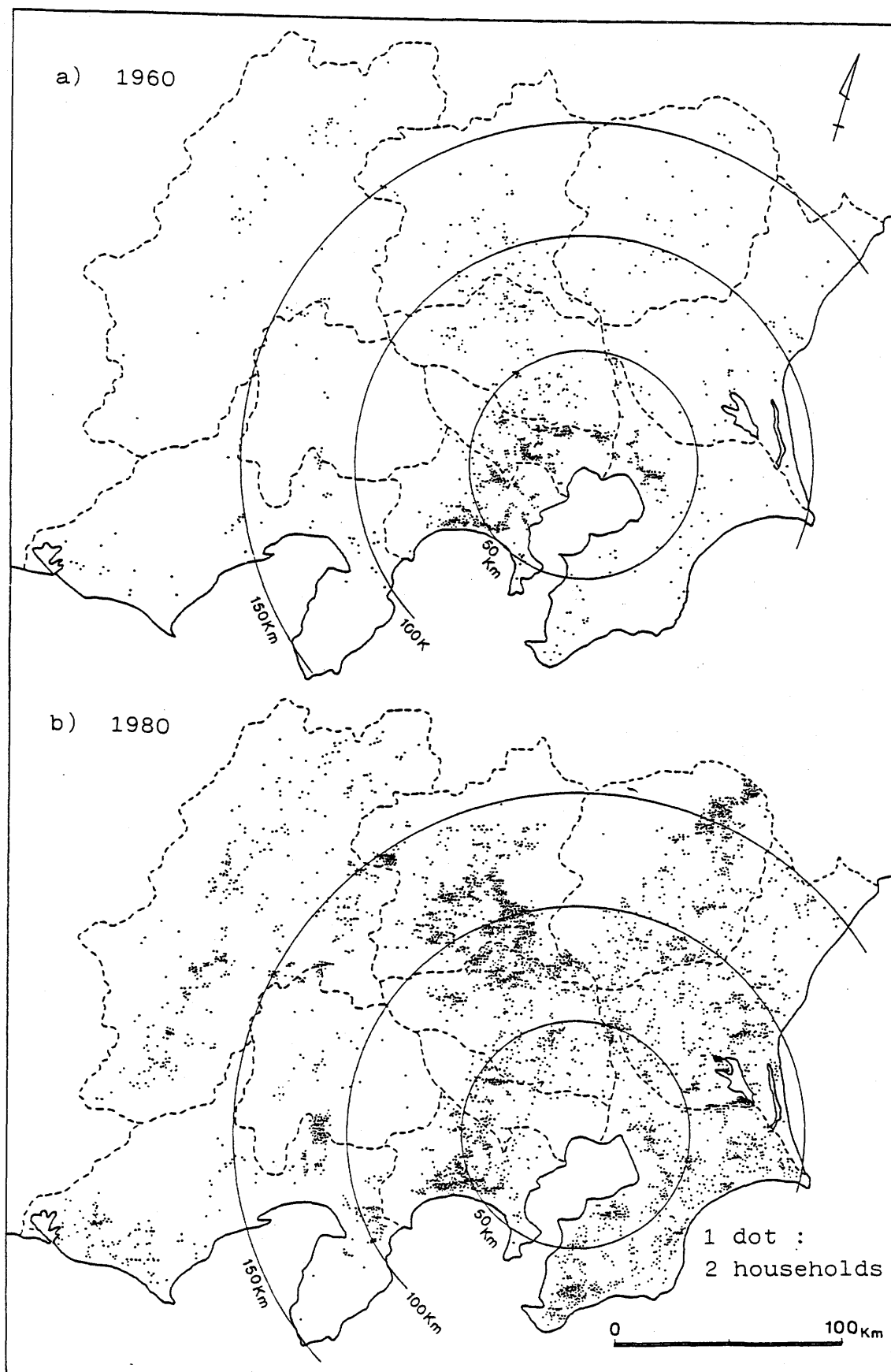


Figure 1 Distribution of Viable Dairy Farms in and around the Kanto District in 1960 and 1980
(Data source: Agricultural censuses)

Shonan region from Fujisawa to Hiratsuka cities. In other words most viable dairy farming regions were concentrated within a 40 kilometer radius from the center of Tokyo, but some regions like Shonan region were located about 70 kilometers from the center of Tokyo. Viable dairy farming regions were often distributed in the suburban agriculture region, and viable dairy farming played an important role in suburban agriculture.

Around suburban dairying regions, viable dairy farms were relatively concentrated in diluvial uplands of Saitama prefecture including Tokorozawa, Sayama and Fukaya cities and Tsurugashima town, but the density of viable dairy farms was lower than that of suburban regions. In the northern Kanto viable dairy farms were mainly distributed in diluvial uplands near Mito and Tsuchiura cities of Ibaraki prefecture, in dry and paddy field regions' around Utsunomia city of Tochigi prefecture, and around Maebashi and Takasaki cities at the southern foot of Mts. Akagi and Haruna of Gunma prefecture. However, viable dairy farms in the northern Kanto, on the whole, were dispersed. Generally speaking, viable dairy farming was developed only in the suburbs of metropolis and regional centers. This was due to the facts that milk was almost consumed by city people and cooling, storing and transporting technology and facilities were not well advanced at that time.

On the other hand, Figure 1-b shows the distribution of viable dairy farming, which is defined as dairy farms raising more than fifteen dairy cows, in and around the Kanto district in 1980. This indicates that viable dairy farming regions could be found in the suburbs of metropolis within a 50 kilometer radius from the center, in outer suburban areas in the 50 to 100 kilometer radius, and remote areas beyond 100 kilometer

radius. Viable dairy farming regions in 1980 expanded outward as compared with those in 1960. Within a 30 kilometer radius from metropolitan centers such as Tokyo, Yokohama and Kawasaki, viable dairy farming regions almost disappeared, while they survived only in the areas extending from the southern parts of Hachioji city to the Sagami-hara upland. These areas were part of the heartland of suburban dairying along with Shonan region and the southwestern part of the Shimofusa upland. Therefore, viable dairy farming regions were developed mainly in the 40 to 50 kilometer radius from the metropolitan center. However, dairying environments were deteriorating with the expansion of residential areas in the metropolitan suburbs, and viable dairy farming tended to move out to peripheral regions.

As viable dairy farms moved outward, the viable dairy farming regions were concentrated in the 50 to 90 kilometers from the metropolitan center, that is, outer suburban region. In Chiba prefecture viable dairy farming regions were concentrated in the eastern part of the Shimofusa upland and the Boso hill. In particular Awa region which has a long history of dairying grew up to be a viable dairy farming region. In Ibaraki prefecture viable dairy farms were concentrically distributed in uplands around Lake Kasumigaura and in alluvial plains along the mid- and down-stream sections of the Tone River. In addition, in the area extending from the northern part of Saitama prefecture to the southern part of Gunma prefecture, continuous distribution of viable dairy farming spread out, and the most densely concentrated dairy farms could be found in this region. This includes Fukaya city and Okabe, Menuma and Hanazono towns in the northern part of Saitama prefecture, and Nitta and Yabuzuka towns and Azuma village of the southern part of Gunma prefecture.

The regions where viable dairy farms are concentrated were formerly rice cultivation regions or dry field regions, and dairy farming in 1960 was characterized by a subsidiary section of farming. Each farmer had only two or three dairy cows. In other words, dairy farming had a role only to compensate the shortage of income from cash crops such as rice, wheat, barley, sweet potatoes and silk worms. However, dry field farming and sericulture were stagnant and dairy farming became a main activity in some regions from 1970 to 1980. In these regions clearing of forests on the uplands and improvement of road network made dairy environment much better, and many viable dairy farms were concentrated by making efficient use of their accessibility to metropolitan markets. Accessibility to metropolitan markets was one of the important factors for dairy farming regions, but it also forced the expansion of residential areas. Therefore, the growth of residential areas entered into competition rivalry with development of dairy farming, and it often prevented dairy farmers from increasing their cultivated fields and the number of dairy cows they raised. In this way viable dairy farming regions were moved further outward.

The distribution map of viable dairy farming in 1980 (Figure 1-b) shows that viable dairy farming regions were also found in the remote areas of the Kanto district, within the 100 to 160 kilometers from the metropolitan center. For example, viable dairy farms were densely distributed at the foot of the Mt. Nasu and Nasu plain of Kuroiso city and Nasu town located in northern Tochigi prefecture. In Gunma prefecture viable dairy farming regions could be found not only at the southern foot of Mts. Akagi and Haruna, but also at the northern foot of Mt. Asama. Especially in Naganohara

town at the northern foot of Mt. Asama about 80 percent of dairy farms were viable farms and a typical viable dairy farming region was developed.

Viable dairy farming regions in the 100 to 160 kilometer radius from the metropolitan center was also found around the Kanto district. The regions were distributed at the foot of Mts. Yatsugatake and Fuji. Main dairy farming regions at the foot of Mt. Yatsugatake were in Minamimaki village and Fujimi town of Nagano prefecture and in Takane village and Nagasaka town of Yamanashi prefecture. The dairy regions at the foot of Mt. Fuji were in Kamikuishiki village of Yamanashi prefecture and Fujinomiya city of Shizuoka prefecture. In addition viable dairy farming is concentrated in Mishima and Gotenba cities and Tagata region. These are also considered to be remote area dairying regions around the Kanto district.

These regions have such conditions as remoteness from the metropolitan center and volcanic slopes. Volcanic slopes were formerly on the margin of cultivation, and they were reclaimed just after World War II. Dairy farming along with cereals and pulses farming was introduced. Although small scale dairy farming resulted from poor dairy environments and low accessibility to metropolitan markets, dairy farming gradually became important in the commercial section of farming and the scale of dairy farming enlarged as dairy environments were greatly improved afterward. In addition, many viable dairy farms moved into these regions from suburban or outer suburban regions. In this way, viable dairy farming regions have been developed on volcanic slopes located in the outer margin of the Kanto district.

As mentioned above the regions where viable dairy farming was concentrated were located in the suburbs of

the metropolitan center and around the Kanto district in 1960. After that the viable dairy farming regions moved outward and they were also developed in the outer suburbs and the remote areas from the metropolitan center. The locations of viable dairy farming regions in terms of natural conditions are alluvial lowlands and diluvial uplands of outer suburbs or volcanic slopes in the remote areas from the metropolitan center.

2. Types of viable dairy farming and their distribution

As we discussed in the previous section, regions where viable dairy farming is concentrated have such natural conditions as alluvial lowlands, diluvial uplands and volcanic slopes. In addition, they have such socio-economic conditions as suburbs, outer suburbs and remote areas from the metropolitan center. Taking both conditions into account, we can classify the locations of viable dairy farming in the Kanto district into diluvial uplands in the suburbs, alluvial lowlands and diluvial uplands in the outer suburbs and volcanic slopes in the remote areas. However, it is not logical to define types of viable dairy farming based on the locations. The types should be classified by the elements of dairy farming. Among various elements of viable dairy farming the important ones are kinds of dairy cows, structure on feed utilization, kinds of farm households in a dairy farming region and sources of farm income.⁴⁸ Data on the elements of dairy farming were collected at dairy cooperative associations, agricultural cooperative associations and reclamation cooperative associations. In addition to these data, agricultural censuses, previous studies and results of the present writer's own researches were utilized to define types of viable dairy farming. Practically regional types of viable dairy farming in the Kanto

district were determined based on the combination of the elements of dairy farming and the natural and socio-economic conditions. The types are "suburban dairying", "outer suburban dairying" and "remote area dairying" (Figure 2).

In the case of "suburban dairying", more than 90 percent of dairy cows are milking cows including much delivered cows and milking cows of a few lactation, and the rest are Holstein steers for meat. Especially about 30 percent of all cows are milking cows of a few lactation represented by Hitohara shibori cows, and most multipara cows are much delivered ones. Purchased concentrate must be feeded to milking cows of a few lactation and much delivered cows. Therefore, the ratio of cncentrate to all feed is more than 50 percent. Purchased feed including such roughage as rice straws occupies about 90 percent of the total, and the ratio of self-supported feed is only 10 percent. This is well shown in income and expenditure of dairy farms: the ratio of feeding cost to the value of sold milk is about 70 percent;⁴⁹ and the ratio of net income to gross income is only 20 percent. In the regions of suburban dairying only 10 percent of all farms are engaged in viable dairy farming, and they are dispersed.

In the case of "outer suburban dairying on alluvial lowlands", the ratio of milking cows to the total is from 80 to 90 percent. About 20 percent of all cows are dairy bulls for meat, and this ratio is the highest among the types of viable dairy farming. Dairy farms of this type especially intend to increase milk yield and they raise many much delivered cows and milking cows of a few lactation, which occupy 60 and 20 percent of all milking cows respectively. The figures are lower as compared with the case of "suburban dairying". The ratio of purchased concentrate of this type of dairying

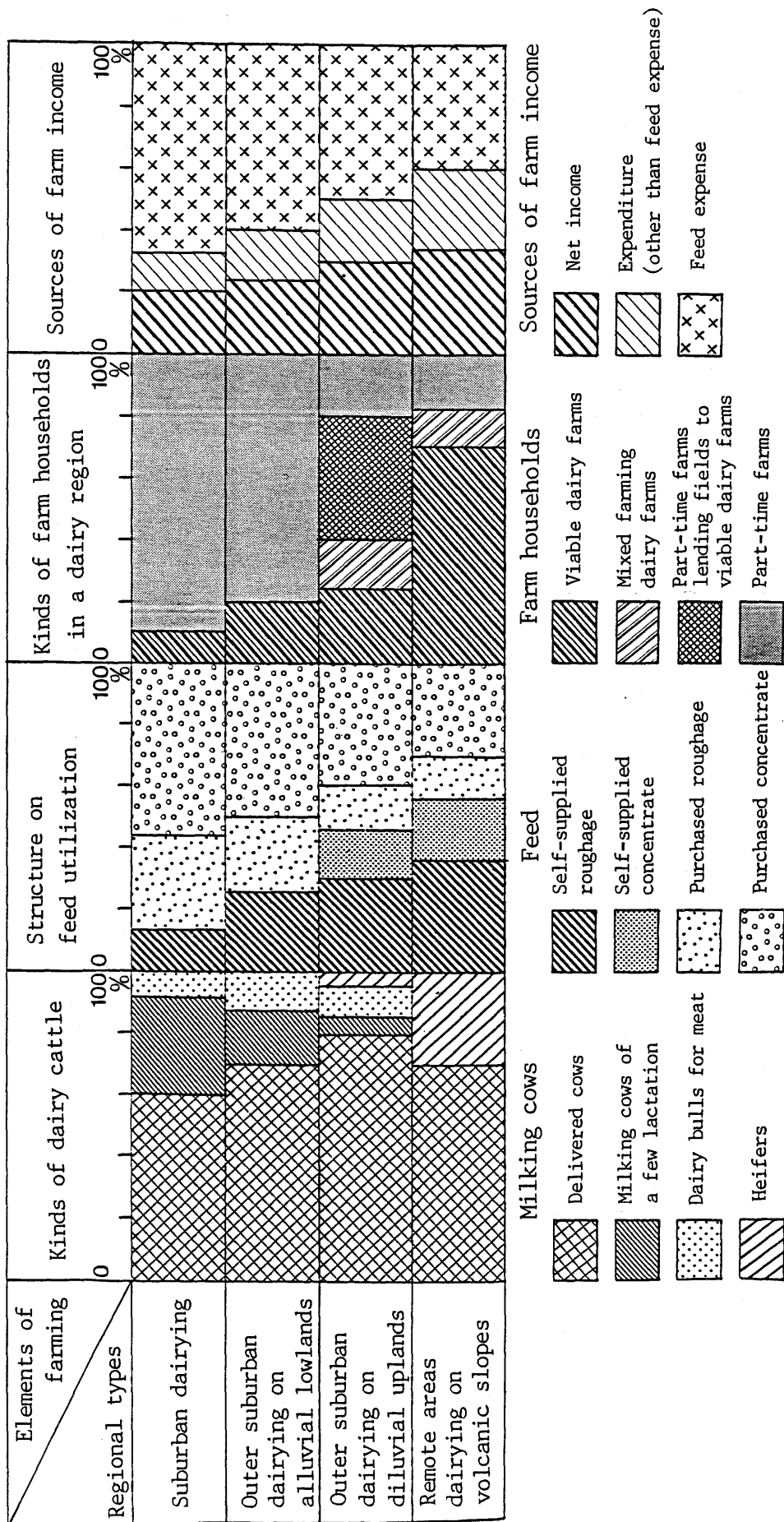


Figure 2 Regional Types of Viable Dairy Farming
(Data sources: Data from dairy cooperative associations, agricultural cooperative associations and reclamation agricultural cooperative associations. Agricultural censuses. Results of previous studies. Field surveys.)

is about 50 percent, and all purchased feed including roughage reaches about 80 percent. On the other hand, dairy farmers only produce roughage by themselves which is about 20 percent of all feed required. The ratio of feeding cost to the value of sold milk is about 70 percent and the ratio of net income to gross income is about 20 percent. Differentiation of viable dairy farms from the other part-time farmers is clear in the regions where this type of viable farming is dominant.

On the other hand, "outer suburban dairy farming on diluvial uplands" is characterized partly by raising all the following cattle: delivered cows, milking cows of a few lactation, dairy bulls for meat and heifers. Dairy farmers intend to increase milk yield as much as possible by saving their expenditure. Therefore, milking cows occupy about 80 percent of all cows, but milking cows of a few lactation and much delivered cows are only 10 percent of all respectively. In places heifers are raised and the ratio of them to all cows is about 10 percent. Production of self-supplied feed must be expanded to save expenditure for feed. Self-supplied feed including both roughage and concentrate is about 40 percent of the total feed. However, about 60 percent of all feed is purchased one such as rice straws and formula feed, and it shows that the basic characteristics of viable dairy farming are the same as those of other types in terms of dependency on purchased feed. This is also reflected in the income and expenditure structure of farms, and the ratio of feeding cost to the value of sold milk falls to 50 percent. Although the figure is low, the ratio of net income to the gross income still remains 30 percent because of the increase in payment to buildings and facilities. In the regions of this type of viable dairy farming, mixed-farming dairy farms and part-time farms existed

together, and dairy farmers are about 40 percent of all farms. About half of the dairy farms are engaged in viable farming and they rent fields from other part-time farmers.

"Remote area dairying" places much importance to saving expenditure and increasing in milk quality. Therefore, delivered cows account for only 70 percent of all cows, and the rest are heifers for renewal. In addition, much delivered cows are only 10 percent of all multipara ones, and high quality registered cows are about 80 percent of all milking cows. In terms of structure on feed utilization, self-supported feed is about 60 percent if roughage and concentrate are added up. Rice straws and purchased formula feed are mainly utilized in winter, but the ratio of them to all feed is only 40 percent. Feeding cost amounts to only 40 percent of the value of sold milk. However, the ratio of net income to gross income is still 30 percent, because of more payment to machines and buildings. Viable dairy farms account for more than 70 percent of all farms, and the density of viable dairy farms are highest in this type of regions.

As we discussed above, four regional types of viable dairy farming are established in and around the Kanto district through applying such index as natural and socio-economic conditions and four important elements of dairy farming. These types are "suburban dairying", "outer suburban dairying on alluvial lowlands", "outer suburban dairying on diluvial uplands" and "remote area dairying". Distribution of the regional types is shown in Figure 3. This illustrates a concentric structure centering on metropolitan centers. The structure consists of arrangements of "suburban dairying", "outer suburban dairying on alluvial lowlands", "outer suburban dairying on diluvial uplands"

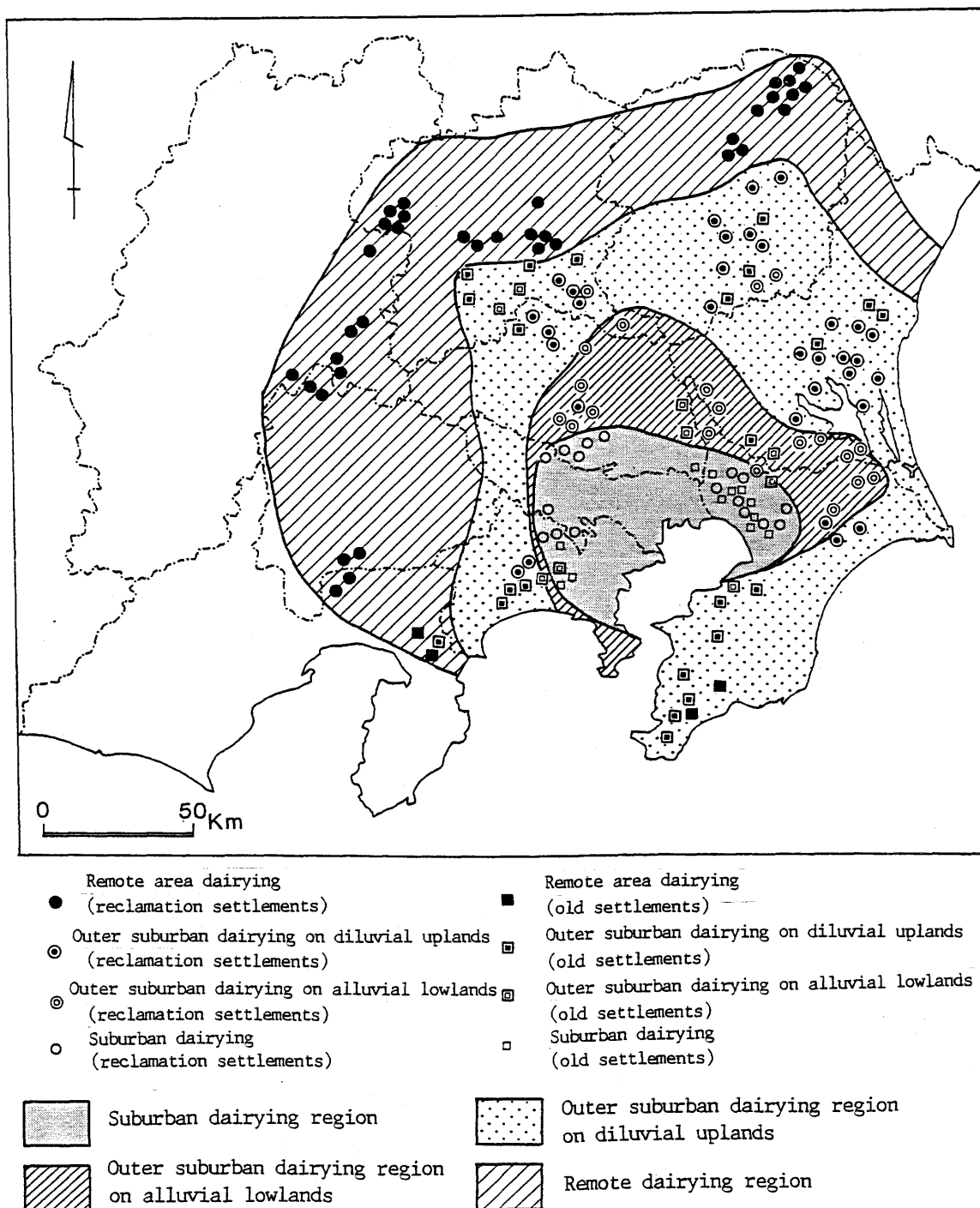


Figure 3 Regional Types of Viable Dairy Farming and Their Spatial Structure in and around the Kanto District
(Data sources: Data from dairy cooperative associations, agricultural cooperative associations and reclamation agricultural cooperative associations. Agricultural censuses. Results of previous studies. Field surveys.)

and "remote area dairying" successively from the center to the margin.

"Suburban dairying" is distributed mainly within a 40 kilometer radius from the metropolitan center, and the regions where this type of farming is dominant are called "suburban dairying region". Especially "suburban dairying regions" can be found concentrically in an area spreading from Yachiyo, Narashino and Funabashi to Matsudo and Kashiwa cities of Chiba prefecture, in and around Sayama, Iruma and Tokorozawa cities of Saitama prefecture, in Mizuho town and Machida city of the Tokyo metropolitan region, and in an area from Sagami-hara to Yamato cities of Kanagawa prefecture. In the regions where suburban dairy farming is concentrated, there is a keen competition between agricultural and urban land use, and viable dairy farms tend to move out to outer suburban and remote areas. A large number of viable dairy farms exist in old rural settlements because milking industries were established before World War II and a tradition of peasant dairying related to the industries still survive in the suburbs of the metropolis.

"Outer suburban dairying on alluvial lowlands" is located in the 40 to 70 kilometer radius from the metropolitan center, and this zone is called "outer suburban dairying region on alluvial lowlands". The zone is narrow in the section from suburbs of Tokyo to Kanagawa prefecture, and it disappears in the southern part of Chiba prefecture. On the other hand, this zone widely expands in tongue shape on alluvial lowlands extending from northern Chiba to Saitama prefectures, from eastern Saitama to southeastern Gunma prefectures, and in southern Tochigi prefecture. Therefore, the regions where "outer suburban dairying on alluvial lowlands" is concentrated can be found mainly on

alluvial lowlands in the down and mid stream sections of the Tone River, in reclaimed lands Lake Kasumigaura and on alluvial lowlands along the Ara River. Viable dairy farming is developed mainly in rural settlements reclaimed just after World War II.

On the other hand, "outer suburban dairying on diluvial uplands" is mostly distributed beyond "outer suburban dairying regions on alluvial uplands". This type of viable dairy farming is concentrated in the 70 to 100 kilometer radius from the metropolitan center. The zone of "outer suburban dairying regions on diluvial uplands" is narrow in the section from western Saitama to western Kanagawa prefectures under the influence of the Kanto Mountains. This type of farms are concentrated in the Higashiibaraki, Namekata and Niihari uplands of Ibaraki prefecture, in the Utsunomiya, Ujiie and Mooka uplands of Tochigi prefecture, in the Omama alluvial fan of Gunma prefecture, in the Ara River alluvial fan of Saitama prefecture and in the Aiko upland and the Hatano basin of Kanagawa prefecture. Especially important regions of this type of farming are located in rural settlements reclaimed just after World War II. In addition, this type of farms are also developed in the Boso hill of Chiba prefecture, in the Obata and Iwanoya hills of Gunma prefecture, and the Oiso hill of Kanagawa prefecture. Most of them exist in old rural settlements.

"Remote area dairying" is located beyond "outer suburban dairying regions on diluvial uplands", and its distribution areas are in the 100 to 160 kilometer radius from the metropolitan center. In other words, "remote area dairying regions" are developed along the mountains surrounding the Kanto district. Especially great number of viable dairy farms are located on volcanic slopes of Mts. Nasu, Akagi, Haruna, Asama,

Yatsugatake and Fuji. Those areas were mostly reclaimed just after World War II.

Viable dairy farms have moved to outer suburban and remote areas from suburban areas. This tendency has encouraged to develop "outer suburban dairying on alluvial lowlands", "outer suburban dairying on diluvial uplands" and "remote area dairying". The present study focuses on sample areas of the three types as mentioned above, and discusses their characteristics and conditions. Motoshinshimakaitaku, Azuma village of Ibaraki prefecture is selected as a representative of "outer suburban dairying on alluvial lowlands", Shinseikaitaku, Dejima village of Ibaraki prefecture as that of "outer suburban dairying on diluvial uplands", and Oyaharakaitaku, Naganohara town of Gunma prefecture as that of "remote area dairying".

CHAPTRE III

DEVELOPMENT OF VIABLE DAIRY FARMING IN OUTER SUBURBAN AREAS OF TOKYO METROPOLIS: A CASE OF ALLUVIAL LOWLANDS

1. Changes of agricultural management with the development of dairy farming

Clear changes are observed in agricultural management with the development of dairy farming in Motoshinshimakaitaku, Azuma village of Ibaraki prefecture. Figure 4 shows the transition in the number of dairy cattle, dairy farms and cultivated farmland by main crops. The development process of dairy farming is divided into three periods. First is the introduction period from 1953, when land settlement began, to 1963. Second is the period from 1964 to 1971 when the number of dairy farms was stable and that of dairy cattle began increasing. In the third period from 1972 onward the number of dairy cattle and the acreage of forage crops began increasing rapidly, while the number of dairy farms began to decrease quickly.⁵⁰

i) The introduction period of dairy farming (1953~1963)

The Motoshinshimakaitaku is located on the southeastern shore of Lake Kasumigaura, at the mouth of the Shin-Tone River. Land reclamation was planned in 1938 and started in 1946. In 1948 the reclamation project was designated as a five years national emergency reclamation plan, and was carried out by Ibaraki prefecture instead of the Ministry of Agriculture and Forestry. In the master plan, the cultivated acreage would be 414.7 hectares and the number of farm households would amount to 191, in the total reclamation area of 567.5 hectares consisting of

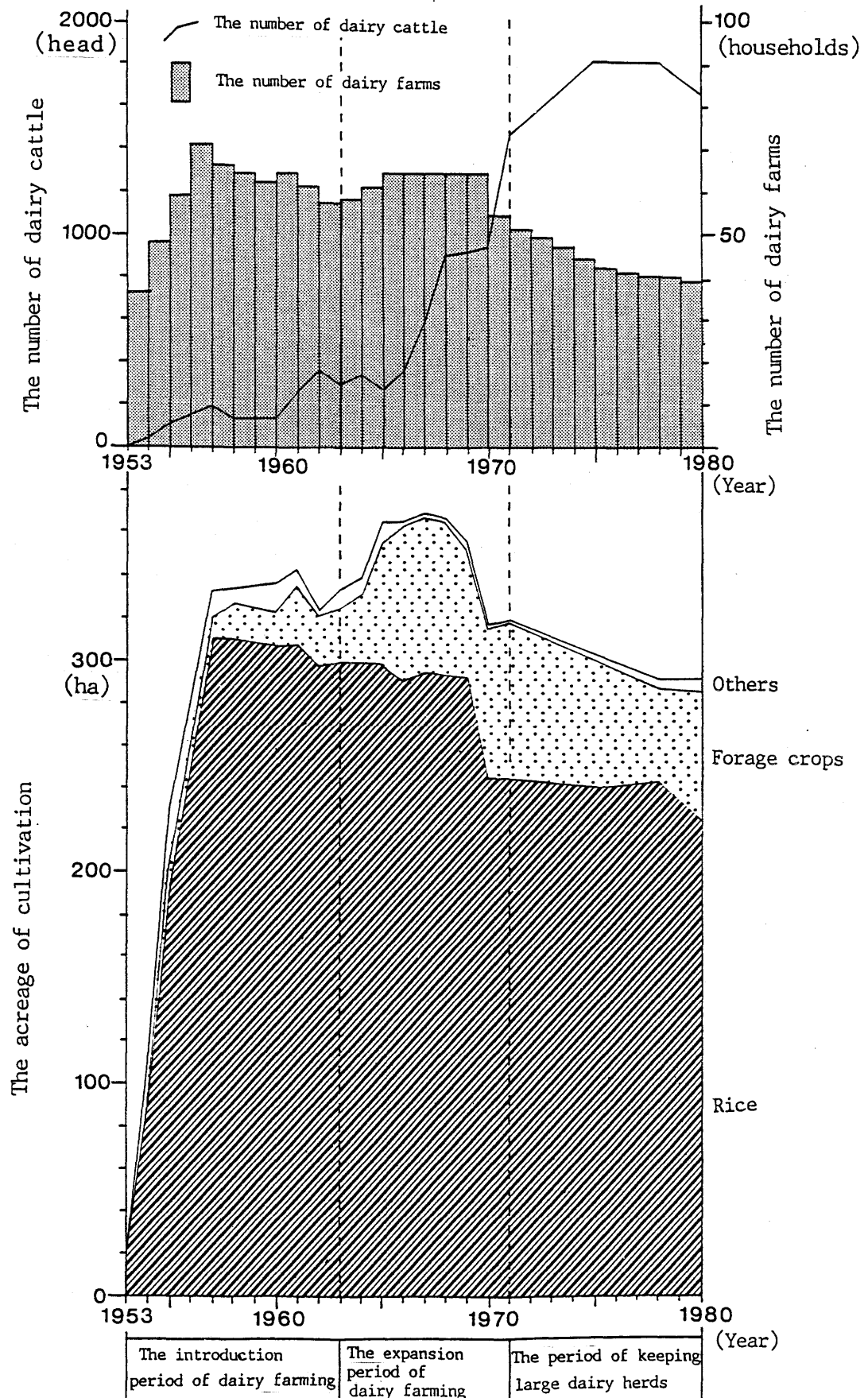


Figure 4 Changes of the Number of Dairy Cattle and Dairy Farms, and the Acreage of Cultivation by Main Crops in Motoshinshimakaitaku of Azuma Village, Ibaraki Prefecture
(Data source: Investigation of reclamation farming results, agricultural censuses and movement statistics of dairy cattle)

public water in Lake Kasumigaura (554 hectares) and private land (13.5 hectares).⁵¹ This reclamation land was settled in three periods, in 1953, 1954, and 1956. At the first period, 24 farm households settled from Yamagata prefecture, 12 from Yamanashi and one from Ibaraki prefectures. At the second period, 90 farm households came from Ibaraki prefecture, 8 from Chiba and one from Yamanashi, Nagano and Fukushima prefectures respectively. And at the last period, 38 farms settled from Ibaraki, 9 from Yamagata, 5 from Chiba prefectures and one from Tokyo (Ogasawara Island). Farmers from Yamagata and Yamanashi prefectures were repatriates from the Manchuria reclamation settlements. They moved to this settlement from another reclamation settlement which turned to an exercise ground of U.S. Army. On the other hand, farmers from Ibaraki and Chiba prefectures, were second or third sons in rural villages, who settled there to solve local food shortage.

Dairy farming in Motoshinshimakaitaku was began by 36 reclamation farms at the first period, based on their farming policies of producing rice and dairy products. These farmers, with no experience in dairy farming, established a working group for dairy farming. In 1954 they introduced 34 calves and two milking cows utilizing reclamation farming funds. Some farms began milking in 1955 and after 1956 all farms of the working group milked. Rice cultivation on paddy fields began in 1953 as the leading agricultural product, but much rice died from poor drainage and the rice yield per 10 ares was only 210 kilograms in 1953.⁵² The improvement of land conditions, constructing horizontal fields and culverts, continued until about 1960. Farmers made such improvements in the slack season from November to late February, at a pace of about 30 ares a year. Combination of rice and milk was adopted due to the stability of

milk prices, the stable income and works all around the year, and the improvement of soil fertility by growing forage crops after rice harvest. They appropriated the income from rice for the enlargement of farm management, while the monthly income from milk provided living expenses.

In Motoshinshimakaitaku, settlement of 191 farm households was completed by 1960, improving 310 hectares of paddy fields and 15 hectares of dry fields. In 1960, the acreage of paddy fields was 307.3 hectares, while occupied the greater part of the cultivated area by crops. The yields of rice per 10 ares increased to 427 kilograms. Forage crops (14 hectares), vegetables (5.6 hectares), wheat and barley (3.2 hectares), potatoes (2.3 hectares), and industrial crops (1.3 hectares) followed rice in their acreage of cultivated field. Dairy cattle amounted to 126 head, and the number of dairy farms increased to 62. Farmers from Yamagata and Yamanashi prefectures occupied 46 out of 62 dairy farms, playing a leading part in dairy farming of Motoshinshimakaitaku. On the other hand, 129 specialized rice cropping farms accounted for 67.5 percent of all farms, most of which came from Ibaraki and Chiba prefectures. Some of them once kept dairy cattle to advance rice productivity with stable manure, but they soon stopped dairy farming. This fact indicates that the settled farms were divided into two groups by their origins; dairy farmers and specialized rice farmers. After all the farmers from Ibaraki and Chiba prefectures, who were second and third sons of rural villages, did not adhere to dairy farming and made much of rice cropping depending on the relationship with their original villages and head families.

In a standard dairy farm, there were two family members engaged in agriculture. They were usually in

their twenties or thirties. They cultivated rice for 1.5 hectares from spring to summer, and after the harvest 0.8 hectares were planted in clover. Sweet potatoes, peanuts and watermelons were also cultivated in the dry fields, though such crops were unimportant, occupying less than 0.1 hectare respectively. In the dry field, Italian ryegrass was also cultivated for 0.1 hectare as cattle feed.⁵³ After all, the dairy farm kept two milking cows and two heifers by feeding clover and Italian ryegrass (which were about 70 percent of all feed required), rice straws and vegetable refuses (about 20 percent), and purchased formula feed (about 10 percent). Considering the ratio of feed costs to the value of sold milk at the standard dairy farm was less than 10 percent, dairy farms of Motoshinshimakaitaku in this period depended heavily on the self-supplied feeds (Figure 5-a).

Most of the dairy farms had a shed enough to keep five cows in their housing lot. They milked with their hand three times a day; in the morning (4 to 7 o'clock), at day (12 to 14), and in the evening (18 to 20). Each dairy farm marketed fluid milk to milk plants in Sahara city of Chiba prefecture and Itako town of Ibaraki prefecture until 1955. As fluid milk production increased, the Motoshinshima Agricultural Cooperative Association joined the Kanakouzu Dairy Cooperative Association, which is the Tone Dairy Cooperative Association at present, so that the fluid milk from dairy farms was sent to the dairy cooperative to be sold to the Kanto Dairy Products Company in Narashino city of Chiba prefecture. Fluid milk was bottled there to be marketed as fresh milk.

Milk accounted for 20 to 30 percent of the total agricultural income of dairy farms. Thirty six dairy farms derived income from rice (60 percent), milk (30

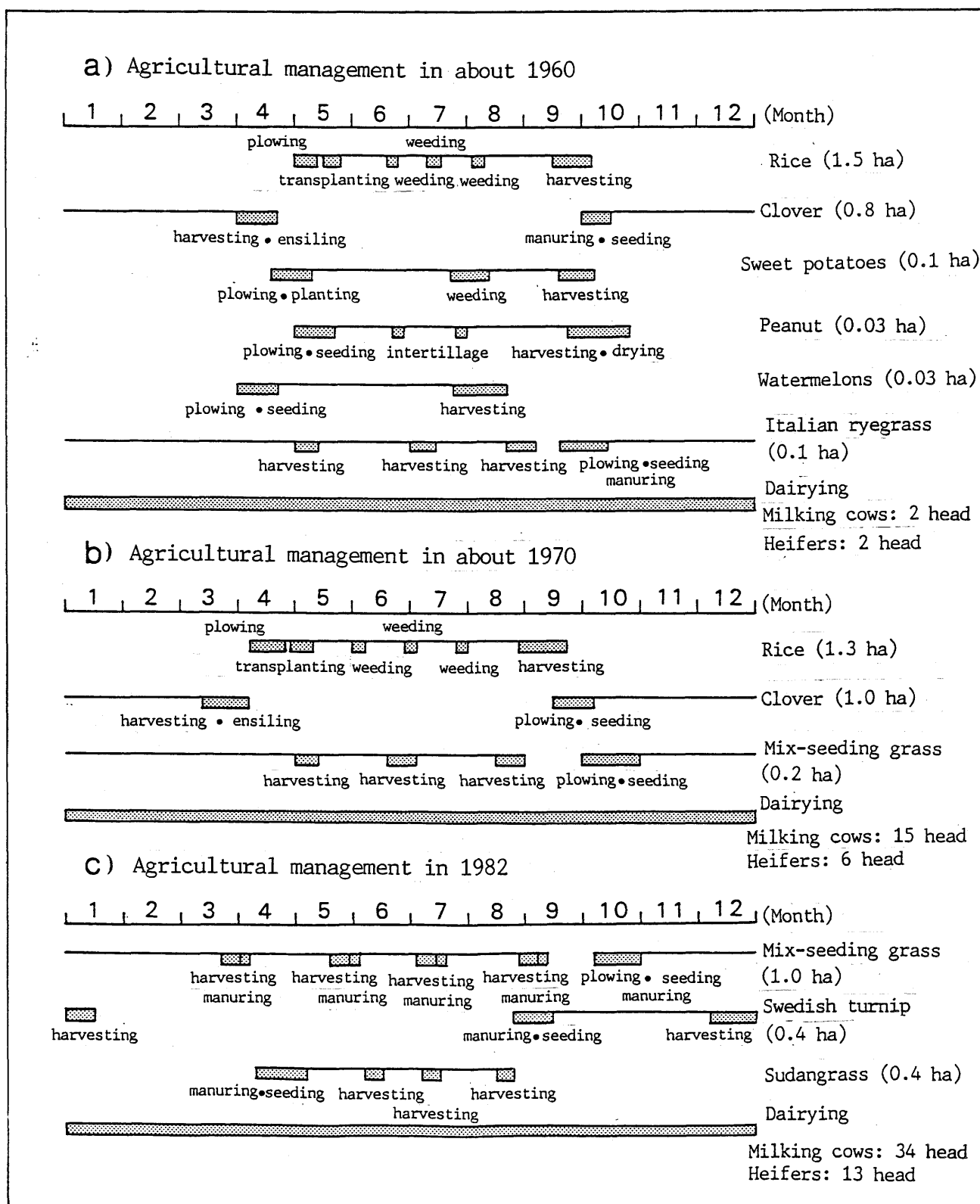


Figure 5 Transitions of Agricultural Management on a Standard Dairy Farm of Motoshinshimakaitaku in Azuma Village of Ibaraki Prefecture
(Data source: Hearing survey)

percent), and non-agricultural income (10 percent), and 18 dairy farms from rice (70 percent), milk (20 percent), and non-agricultural income (10 percent). Major sources of non-agricultural income were day labor wages such as engineering and construction works during the winter. Such income was applied to the enlargement of the scale of farm. In Motoshinshimakaitaku at the introduction stage of dairy farming, therefore, there existed no viable dairy farming. Dairy farms were enough to rice cultivation and dairy activities were subsidiary parts of economy, while they also depended on non-agricultural income.

The number of dairy cattle per farm increased to more than five head about 1960, so that the development of dairy farming brought about competition with rice cultivation for labor at the farm with two family members engaged in agriculture. Therefore, eight dairy farms from Yamanashi prefecture began co-operative dairy farming in 1961. They constructed a large barn and introduced bucket style milkers utilizing agricultural modernization funds. They entrusted each member farm with roughage production of 40 ares for the co-operative. Such feed grass was combined with sweet potato runners gathered from dry field farms in Rokko upland of Ibaraki prefecture. Some farmers in the co-operative went to work in Tokyo because of the lessened labor requirement in dairy farming. The establishment of co-operative dairy farming thus rationalized cattle feeding and milking works. However, cattle feeding control was not complete, quantity and quality of fluid milk soon decreased, and many cattle become ill. Thus the co-operative was forced to close.

As mentioned above, viable dairy farming was not yet developed in Motoshinshimakaitaku at the introduction period of dairy farming. But farmers were

able to establish dairy farming combining it with rice cultivation, because the settlement, situated within the Tokyo metropolitan milkshed, enabled farmers to sell fluid milk for city consumption. Especially farmers who came from Yamagata and Yamanashi prefectures, without local connection with surrounding rural villages, aimed at establishing dairy farming in cooperation with each other. This is evident from the fact that a working group for dairy farming was organized by those from Yamagata and Yamanashi prefectures and that the improvement of land infrastructure in lowlands was undertaken by the group in order to cultivate forage crops after rice harvest.

ii) The expansion period of dairy farming
(1964~1971)

In the expansion period of dairy farming, cooperative dairy farming was discontinued and the number of dairy cattle per farm increased rapidly from 5 head in 1965 to 15 in 1970. Furthermore, dairy farms with more than 20 cows began to appear around 1967, which increased to 30 farms in 1970. As dairy cattle increased, farmers began to milk with machines and to feed cattle twice a day; in the morning (from 5 to 8 o'clock) and in the evening (18 to 20). Annual yields of fluid milk also increased from 280.3 tons in 1960 to 2,289 tons in 1970, so that the dairy farms in Motoshinshimakaitaku joined the Tone Dairy Cooperative Association in 1966 and shipped fluid milk to the milk gathering place established in their settlement. Tank lorries of the Association collected fluid milk once a day.

As the number of dairy cattle and the fluid milk production increased, rice fields reduced, while the area planted in forage crops enlarged. In 1970 the acreage of rice was 244.4 hectares and that of forage

crops 72 hectares, indicating that the rice acreage decreased by 62.9 hectares and that of forage crops increased by 58 hectares as compared with 1960. After all the acreage of forage crops per dairy farm enlarged from 0.3 hectares in 1960 to 1.1 hectares in 1970. The acreage of rice per dairy farm was 0.8 hectares in 1970, which was 0.5 hectares smaller than that of rice growing farm.

Increase of dairy cattle, milk yields and forage crop fields influenced agricultural management in Motoshinshimakaitaku. Table 1 indicates that the settled farms were divided into dairy farms at the mix farming stage and rice growing farms at the part-time farming stage. Although milk production was combined with rice in the management of dairy farms, dairy constituted the major part of economy and rice was giving way to the secondary role. This is proved by the fact that the "milk (70 percent) + rice (30 percent)" type farm in income combination numbered 30, or 46.9 percent of all dairy farms. They were full-time dairy operation where married couples in their forties and fifties or they and their son engaged in agriculture. Therefore it is not too much to say that viable dairy farming was established.

In a standard viable dairy farm, 1.3 hectares of paddy rice was cultivated from April to September, and after the harvest 1.0 hectare was planted with mix-seeded Italian ryegrass, orchardgrass and clover. Such feed grass was harvested three times a year in early June, late July and late August, for soilage and hay feed (Figure 5-b). Viable dairy farms kept more than 20 dairy cows utilizing ensilaged mix-seeding grass (accounting for 40 percent of all feed required), soilage and hay feeds (10 percent), and rice straw and vegetable refuse (10 percent) as subsistence feed. In

Table 1 Changes of Agricultural Management in Motoshinshimakaitaku of Azuma Village, Ibaraki Prefecture. (1970, 1982)

Year	1970					1982				
Contents of management Stage of management	Farm income combinations	The average number of dairy cattle (head)	The average acreage of arable land (hectares)	Family members engaged in agriculture	Households	Farm income combinations	The average number of dairy cattle (head)	The average acreage of arable land (hectares)	Family members engaged in agriculture	Households
The specialized stage						M(100)	50	1.4	H+W+S+B	21
						M(80)+C(20)	80	1.4	H+W+S+B	11
The mixed farming stage	M(70)+R(30)	20	1.5	H+W	21					
	M(70)+R(30)	22	1.6	H+W+S	9					
	M(60)+R(30)+O(10)	15	1.5	H+W	2					
	M(60)+R(30)+O(10)	15	1.5	H+W	4					
	M(50)+R(40)+O(10)	10	1.5	H+W	10					
	M(40)+R(40)+O(20)	8	1.5	H+W	9					
The part-time farming stage (rice single-cropping farming)	R(60)+M(30)+O(10)	5	1.5	H+W	6					
	R(70)+M(20)+O(10)	5	1.5	H+W	3					
	R(70)+O(30)		1.5	H+W	13					
	R(60)+O(10)		1.5	H+W	21					
	R(60)+F(20)+O(20)		1.5	H+W	8					
						R(60)+O(40)		1.5	H+W	61
	R(70)+O(30)		1.5	H+W	3					
	R(60)+O(40)		1.5	H+W	11					
	R(60)+F(20)+O(20)		1.5	H+W	7					
						R(50)+O(50)		1.5	W	30
	R(60)+O(40)		1.5	H+W	21					
	R(50)+O(50)		1.5	W	11					
	O(60)+R(40)		1.5	W	8					
						O(60)+R(40)		1.3	W	40
	R(60)+F(20)+O(20)		1.5	H+W	5					
						R(50)+F(40)+O(10)		1.5	H+W	5

Note: M. Milk, R. Rice, F. Horticulture, O. Non-agricultural income, C. Beef cattle, H. A householder, W. His wife, S. His successor, B. His daughter-in-law, and the figure in parentheses shows percentage.

(Data sources: Movement statistics of dairy cattles, data from Dejima village office and hearing survey)

addition, they purchased inexpensive refuse feed, soybean curd dregs, beer draff and strained lees of soy, and formula feed. Therefore, the ratio of feeding cost to the value of sold milk increased to about 40 percent, being four times as large as that of 1960. This indicates that the dairy farming in Motoshinshimakaitaku depended substantially on purchased feed.

Development of the viable dairy farming was due mainly to that the capital for enlarging farm management was accumulated by stable rice income and that farm loans were readily available. Especially comprehensive facility loans were started in 1969,⁵⁴ which encouraged dairy farms to convert paddy fields in dry fields, to enlarge or rebuild barns, and to introduce new dairy equipments and cows. In order to utilize these loans, applicants have to show strong desires, ability and farming skill to be viable as dairy farmers, and to ensure family labor force for the enlargement of farming scale. Most dairy farms in Motoshinshimakaitaku had more than two family members in their forties engaged in agriculture, some of which had successors to the farm, and their dairy farming was going well. Therefore, they had good access to comprehensive facility loans. In Motoshinshimakaitaku 14 dairy farms received this fund in 1969 and 1970, all of them developing viable dairy farming.

On the other hand, there were 34 non-viable dairy farms in Motoshinshimakaitaku, 25 of which combined dairy with rice. According to the farm income combination of these farms, six belonged to the "milk (60 percent) + rice (30 percent) + non-agricultural income (10 percent)" type, ten were the "milk (50 percent) + rice (40 percent) + non-agricultural income (10 percent)" type, and nine, the "milk (40 percent) + rice (40 percent) + non-agricultural (20 percent)" type.

The average number of dairy cattle was less than 15 head (Table 1). Although enlargement of the number of dairy cattle was an important condition for the development of viable dairy farming, they increased very slowly in these farms. This was not only because they were not able to accumulate capital from rice enough to enlarge farming scale, but also because they could not have access to such loans as agricultural improvement funds and modernization funds. Although they received non-agricultural income from construction and engineering works in the Kashima industrial area, it was not sufficient for the enlargement of farming scale. Since they had to purchase feed, which accounted for 30 to 40 percent of all the feed required, some of them applied non-agricultural income to the feeding cost.

Another type was the mixed farming in which rice cultivation was the main section dairy activities being subsidiary. According to the farm income combination of this type of farming, the "rice (60 percent) + milk (30 percent) + non-agricultural income (10 percent)" type has six farms and the "rice (70 percent) + milk (20 percent) + non-agricultural income (10 percent)" type, three. Therefore, this type of mixed farming was similar to that of the introduction period of dairy farming. The average number of dairy cattle was less than five head, and they had already given up enlarging the scale of operation. This was due to the fact that these dairy farmers, who combined rice growing with dairy cattle keeping, mainly came from Ibaraki and Chiba prefectures and began to keep dairy cattle to fertilize paddy fields.

As mentioned above, at the expansion period dairy farming in Motoshinshimakaitaku, dairy farming surpassed rice growing in importance. In each farm dairy farming became the main part of economy and rice became a

subsidiary crop. The dairy farmers who accumulated capital from rice income and had access to various agricultural loans, could increase the number of dairy cattle to more than 20 head and establish viable dairy farming. Some viable dairy farms ensured successors to dairy farming, moderating the labor competition between dairy farming and rice growing.

iii) The period of keeping large dairy herds (after 1972)

As the scale of dairy farming enlarged, smaller scale dairy farms declined. The number of dairy farms decreased from 64 in 1970 to 43 in 1975, and to 39 in 1980, while the average number of dairy cattle per farm increased substantially from 15 in 1970 to 42 in 1975. But the number of dairy cattle per farm remained 42.5 in 1980, because of the overproduction of fluid milk all over the country and of the adjustment of milk production started in 1975. Owing to the rapid increase of dairy cattle, annual milk yields in Motoshinshimakaitaku amounted to 7,405 tons in 1975. The producer's milk price in Motoshinshimakaitaku, however, was 46.9 yen per kilogram, being 3.5 yen less than that of other settlements under the control of the Tone Dairy Cooperative Association, due to the running cost of large cooling station and transportation costs. The dairy farms in Motoshinshimakaitaku succeeded from the Tone Dairy Cooperative Association to cut the intermediate cost of milk transportation and organized the Motoshinshima Dairy Cooperative Association in 1973. Thus the dairy farms become able to sell their fluid milk to dairy products companies through the Motoshinshima Dairy Cooperative Association saving intermediate costs. Their milk price reached 52 yen per kilogram, which was higher than their former price by 5 yen and than the price of other settlements by 1.5 yen.

The Motoshinshima Dairy Cooperative Association purchased a tank lorry in 1973 to collect fluid milk from each farm.

Due to the increase of dairy cattle and milk yields and to the adjustment of rice production. Started in 1970, the dairy farms in Motoshinshimakaitaku further reduced the scale of rice production. The average rice acreage per dairy farm declined to 0.6 hectares in 1975 and 0.2 hectares in 1980. Rice in the economy of dairy farms lost its commercial role in the mixed farming, only meeting the subsistence needs. After 1972 many dairy farms stopped rice production. On the other hand, the acreage of forage crops per dairy farm increased to 1.4 hectares in 1975 and 1.6 hectares in 1980. This was due to the following reasons. Firstly, the dairy farms could avoid the competition of labor force between rice and dairy by converting to feed crops. Second, they could fertilize forage crop fields with much night soil, cattle droppings and stable manure. And thirdly, they could take over the reduction of rice fields of specialized rice farms of Azuma village of Ibaraki prefecture.⁵⁵

Examining the characteristics of the enlargement of dairy farming based on the number of dairy cattle and the acreage of arable land per dairy farm (Figure 6), the scale of dairy farming in Motoshinshimakaitaku was enlarged only by the increase of dairy cattle, without the increase of farmland. Therefore, the differentiation of dairy farming remarkably proceeded only in aspect of the scale of dairy cattle. The agricultural management of 172 farm households of Motoshinshimakaitaku in 1982 shows that they are clearly divided into viable dairy farms and part-time rice growing farms. This resulted from the facts that some dairy farms developed into viable dairy farms by enlarging the number of dairy

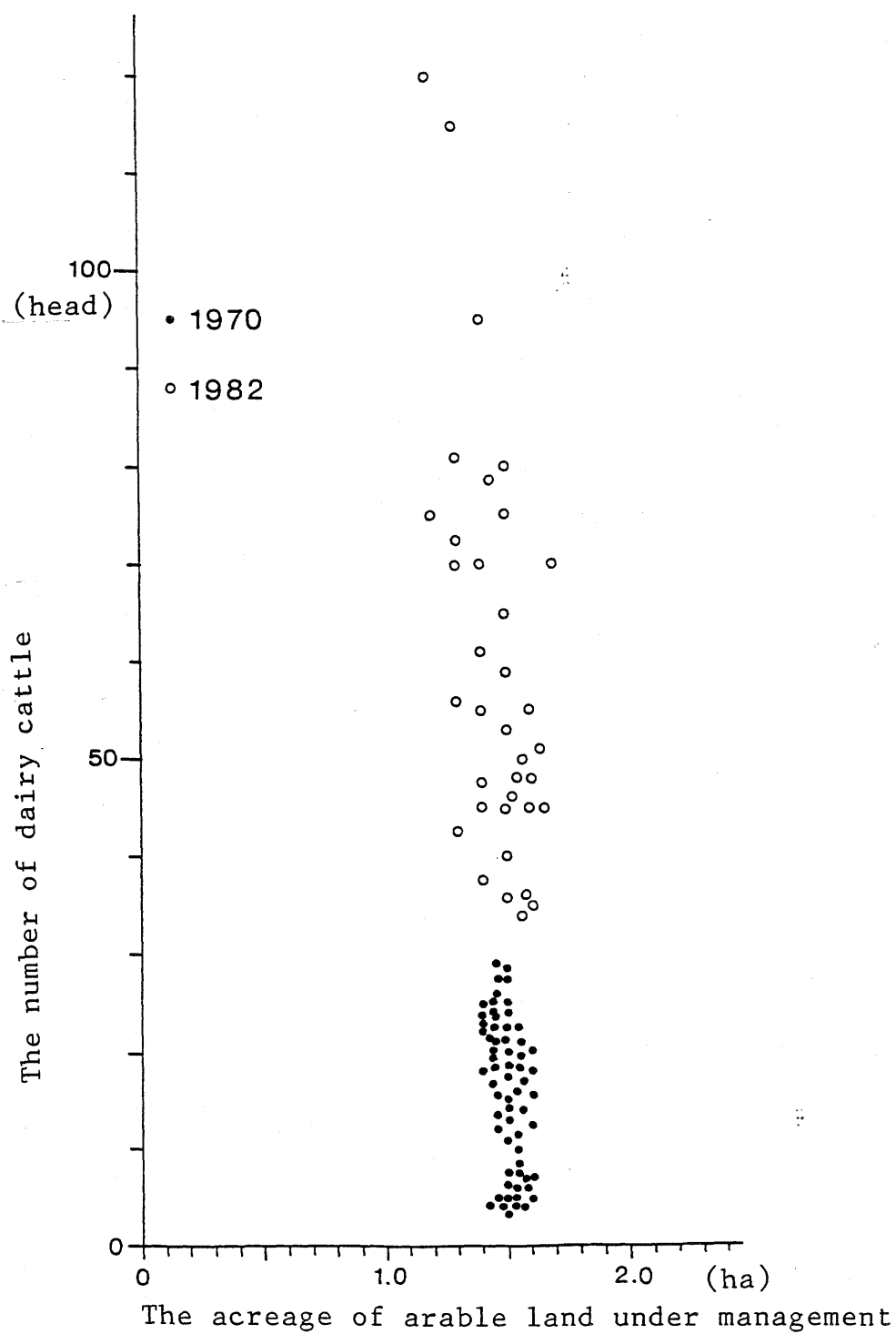


Figure 6 Changes of the Scale of Dairy Farming in
Motoshinshimakaitaku of Azuma village,
Ibaraki Prefecture
(Data sources: Movement statistics of dairy cattle, data from
Azuma village office and hearing survey)

cattle and others became part-time rice growers giving up dairy activities, and that already established rice growing farms become part-time farms engaging in non-agricultural works.

All of 36 dairy farms in 1982, all undertaking viable dairy farming, consisted of two types of farms; specialized dairy farms and mixed farming farms (Table 1). The former, numbering 32 farms, accounted for 88.9 percent of all viable dairy farms. Eleven farms combined milk production with fattening of Holstain steers for meat, and their farm income combination was "milk (80 percent) + beef cattle (20 percent)". The average number of dairy cattle was 80 and the average acreage of farmland under management, 1.4 hectares. This shows that cattle increased rapidly since 1970. Four of them, which were not viable as dairy farms in 1970, established viable dairy farming utilizing subsidies, introducing multiparas and milking cows, and securing family agricultural labor over two generations.

Other viable dairy farms at the specialized stage numbered 21, which obtained all the farm income from fluid milk. These farms also held family agricultural labor forces over two generations, and in 1982 the average number of dairy cattle was 50 and the average acreage of farmland under management amounted to 1.4 hectares. As comparing with that in 1970, dairy cattle increased rapidly but the farmland remained unchanged. These viable dairy farms used all their arable land for cultivating forage crops such as mix-seeding grass and Swedish turnip for soilage. In the standard viable dairy farm, mix-seeding grass for soilage and hay occupied 1.0 hectare out of the total area of 1.4 hectares. Mix-seeding grass was harvested four times a year. On the rest of arable land, Swedish turnip was cultivated from September to January, and sudangrass or dent corn, from

April to August. After the harvest of Sudangrass and dent corn, at the beginning of September, the farmer plowed and manured the field and mix-seeding grass was sown. At the same time 0.6 hectares formerly planted in mix-seeding grass were plowed and Swedish turnip was sown after manuring. Thus the crop rotation of with mix-seeding grass, Swedish turnip and Sudangrass or dent corn was undertaken in this field (Figure 5-c).

As the self-supplied feed accounted for only 20 percent of all the feed required, viable dairy farms depend heavily on the purchased feed. Refuse such as soybean card dregs, beer draff and strained lees of soy shared 30 percent, while formula feed (40 percent of all feed) was purchased from the Motoshinshima Dairy Cooperative Association and rice straw (10 percent), from rice growing farmers in Azuma and Ohno villages and Tamatsukuri town of Ibaraki prefecture. The ratio of feeding cost to the value of sold milk amounted to 70 percent. This figure shows that viable dairy farming in Motoshinshimakaitaku, substantially depended on the refuse and formula feed, was sensitive to the price of purchased feed.

Regarding four dairy farms at the mixed farming stage, the average acreage of arable land under management was 1.5 hectares in 1982, which was equal to the figure of 1970. But the average number of dairy cattle increased rapidly to 35 in 1982, and successors of the family farming also engaged in dairy farming as additional family labor force. Furthermore, their farm income combination was the "milk (90 percent) + rice (10 percent)" type, being viable as dairy farms. These farms as well as viable dairy farms at the specialized stage, however, depended largely on purchased feed, which accounted for 70 percent of all the feed required. In other words, their viable dairy farming developed with

keeping large dairy herds irrespective of the scale of arable land under management. The ratio of feeding cost to the value of sold milk amounted to 70 percent, being equal to that of viable dairy farms at the specialized stage, because they increased dairy cattle without enlarging production bases of subsistence feed. Therefore, viable dairy farms at the mixed farming stage seem to have changed into the specialized stage by enlarging the number of dairy cattle taking advantage of various loans and subsidies, and by stopping rice growing.

On the other hand, there were 28 farms which stopped dairy farming from 1970 to 1982. Their agricultural management changed from mixed farming into the single cropping of rice at the part-time farming stage. Examining the farm income combination, 19 farms belonged to the "rice (60 percent) + non-agricultural income (40 percent)" type and 9 farms were the "rice (50 percent) + non-agricultural (50 percent)" type. Because the farms in both types had no one to succeed farming, it was difficult for them to utilize such loans as comprehensive facilities funds and agricultural modernization funds. Thus the enlargement of dairy farming stagnated and they stopped keeping dairy cattle. The differentiation of dairy farming and rice growing was determined whether or not family agricultural labor was available. Most of the farms which shifted from dairy farming into the single cropping of rice came from Ibaraki and Chiba prefectures, and they did not try to enlarge the scale of dairy farming at the cost of investing substantially in buildings, facilities and equipments. This fact also caused the stop of their dairy farming.

As mentioned above, the dairy farms in Motoshinshimakaitaku were divided into two groups with

the adjustment of rice production as a turning point: one is the group of farms that changed from mixed farming to viable dairy farming at the specialized stage, and the other is those which stopped keeping dairy cattle and changed into part-time rice growers. Viable dairy farms, however, could not enlarge their production bases of self-supplied feed and were forced to depend on purchased feed which accounted for 80 percent of all the feed required. Therefore, their viable dairy farming was realized by depending heavily on purchased feed. Because they enlarged the scale of management utilizing with various loans, they had to maintain the high quality and quantity of milk to pay off their debts. Therefore, viable dairy farms purchased much delivered and postpartum cows for milking, and they sold cows when their milk yields decreased to a certain level. This type of dairy farming is called "Hitohara shibori" dairying, which all of these viable dairy farms practiced. Milking cows for "Hitohara shibori", which were purchased from stock farms in Hokkaido and Chiba prefecture through stock merchants, varied from five to 40 head per farm. The "Hitohara shibori" dairying was popular from 1973 to 1978, but it is now stagnated due to the adjustment of milk production and to the poor beef cattle prices.⁵⁶

2. Changes of landscape with the development of dairy farming

i) Settlement and road patterns

Examining the changes of settlement and road patterns in Figure 7, the dirt road changed into the paved road with the development of dairy farming, but the settlement pattern remained unchanged. This reclamation settlement has farms along the main roads. Generally reclamation settlements on lowlands and

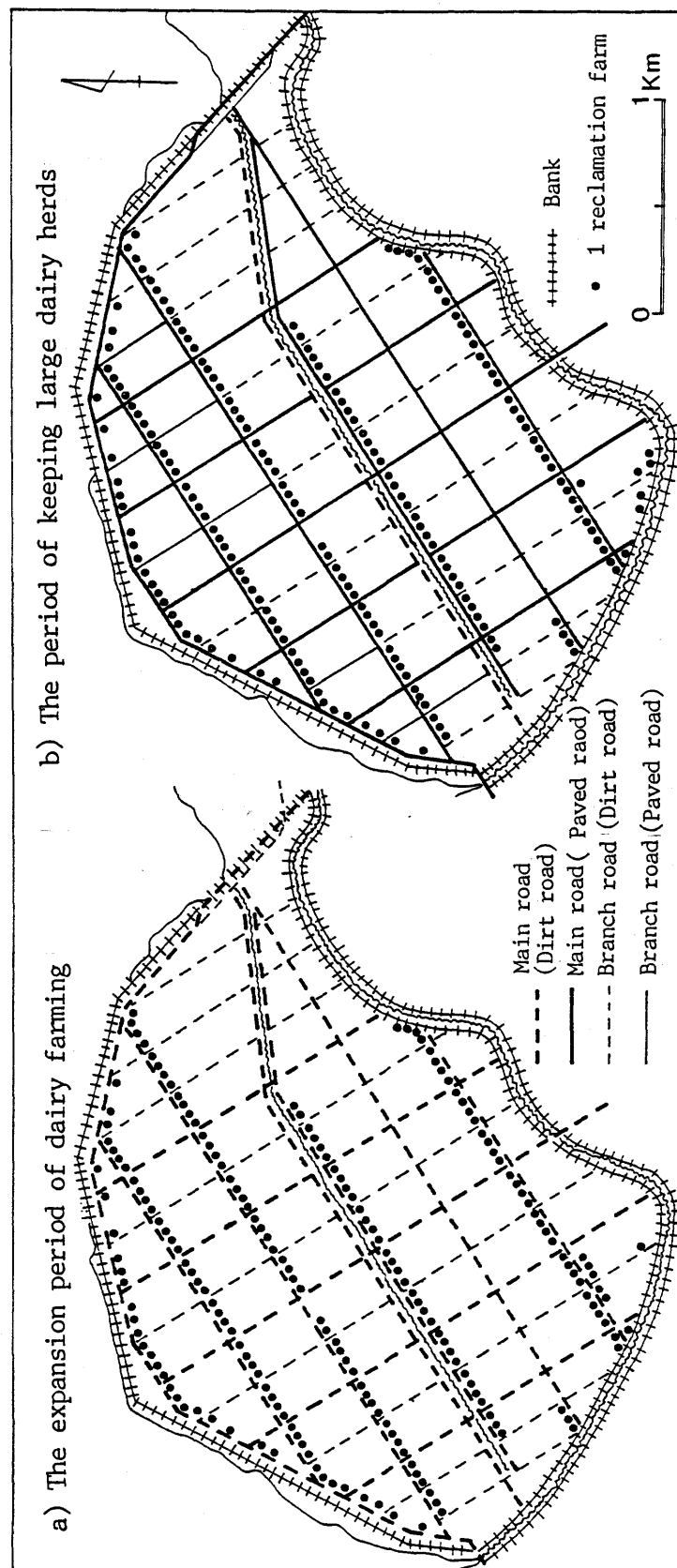


Figure 7 Changes of Settlement and Road Patterns in
Motoshinshimakaitaku of Azuma Village,
Ibaraki Prefecture
(Data sources: Aerial photographs and field survey)

uplands have dispersed settlement patterns rather than the agglomerated form from the beginning in pursuit of farming advantages and because of the facility of constructing roads and supplying electricity.⁵⁷ In Motoshinshimakaitaku too, farmhouses were systematically arranged in the construction of settlement.

A rectangular land block surrounded with main roads was settled by eight farms. The land block was divided into eight strips, which were owned by each farm. Farmhouses were built along the major road. The place of origin, former address, and settled year brought the farms grouping. As shown in Figure 8-a, the early settled farms from Yamagata and Yamanashi prefectures were concentrated from the shore of Lake Kasumigaura to the second row in the northern part of Motoshinshimakaitaku, while the farms from Ibaraki and Chiba prefectures were concentrated in the southern part of the settlement. Such settlement patterns were planned considering the cooperative operation in farming and cattle raising and the cooperative use of farm machinery and equipments, where eight farms of each block functioned as a unit.

These settlement patterns have influenced considerably the agricultural management and farm policies. The farms from Yamagata and Yamanashi prefectures settled at the first period aimed at the cooperative and mechanized farming and the perfect double croppings based only on the family labor forces. Therefore, they combined rice growing with dairy cattle. In the farms settled at the second and third periods, the initial goal of farming was scarcely practiced. In Motoshinshimakaitaku, the reclamation farms were divided into dairy farms and rice growing farms since the early years of reclamation. Figure 8-b indicates the distribution of dairy farms and former-dairy farms.

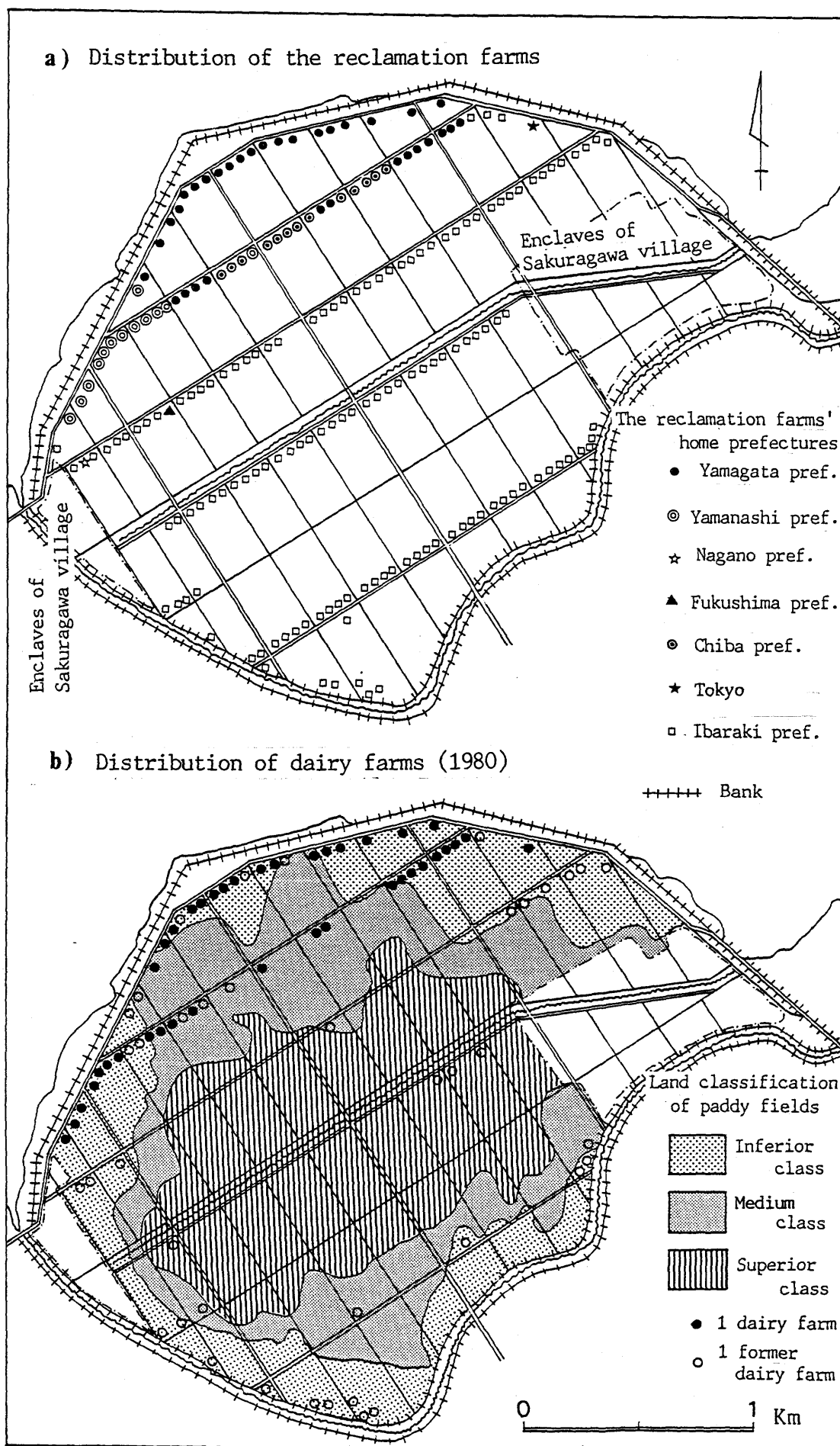


Figure 8 Distribution of the Reclamation Farms and Dairy Farms in Motoshinshimakaitaku of Azuma Village, Ibaraki Prefecture (Data sources: Essays in celebration of completion of Motoshinshima reclaimed land, reports on land use and agriculture of Azuma village and hearing survey)

According to this figure, most dairy farms in Motoshinshimakaitaku came from Yamagata and Yamanashi prefectures and were distributed in areas where paddy fields were classified into medium and inferior classes. Former dairy farms were also located where land conditions were inferior. Rice single-cropping farms, however, were found where paddy fields were of superior class.⁵⁸ It may safely be said that selection of rice growing and dairy cattle partly reflected land conditions.

The present patterns of main and branch roads were almost completed, except for the pavement of roads, at the introduction period of dairy farming. Seven main roads east to west and seven main roads north to south were constructed at an interval of 400 meters. They were five meter wide to be adaptable to the mechanization of farming. The main road that runs through the center of this settlement and the one leading to Route 125 were seven meter wide. Branch roads were constructed at intervals of 100 meters within each land block surrounded with main roads, and all branch roads were connected with main roads (Figure 7-a). Motoshinshimakaitaku, therefore, had the complete road patterns connecting this settlement with other regions and a farm with other farms and with its fields at the introduction period of dairy farming.

At the expansion period of dairy farming, the main roads running through the center of the settlement and leading to Route 125 were paved for the convenience of milk gathering cars of the Tone Dairy Cooperative Association. Greater changes occurred in road conditions at the period of keeping large dairy herds. As milk yields increased rapidly, milk became gathered at individual farm by large tank lorries. All the main roads were paved so as to provide facilities for milk

gathering. Thus the milk gathering operation became efficient and the fluid milk became free from spoilage during gathering and transportation. Milk production was improved in quality and quantity.

ii) Landholding patterns

Landholding patterns including the size, form, arrangement and landownerships of fields are analyzed (Figure 9). Each farm was provided with a parcel of 1.8 hectares based on the initial plan of reclamation. Each parcel had the rectangular form, the frontage and depth being 50 and 360 meters respectively. The frontage of each land was on the main street. Where this principle was not able to be applied near the bank of Lake Kasumigaura, a parcel of 1.8 hectares was arranged to each farm. Motoshinshimakaitaku, therefore, had the rectangular landholding patterns with many strips on the main roads running across the settlement. Most farms applied 0.1 hectare facing the road to their housing and held 1.7 hectares of arable land adjoining their housing lot. The reclamation farms were thus uniform in terms of their landholdings.

Irrigation and drainage were freely controlled by the dual-purpose canals constructed on one side of the field. The Lake Kasumigaura was the water source and the irrigation canals extended from the diversion weir constructed under the banks for to 64 kilometers. Drainers in each field led to branch drainage canals, which were connected to the main drainage canals which run through the central part of the reclamation settlement. Water was then pumped up and drained to Lake Kasumigaura.

The initial landholding patterns mentioned above were maintained from the introduction period of dairy farming through the period of keeping large dairy herds. This characterized the landholding pattern of

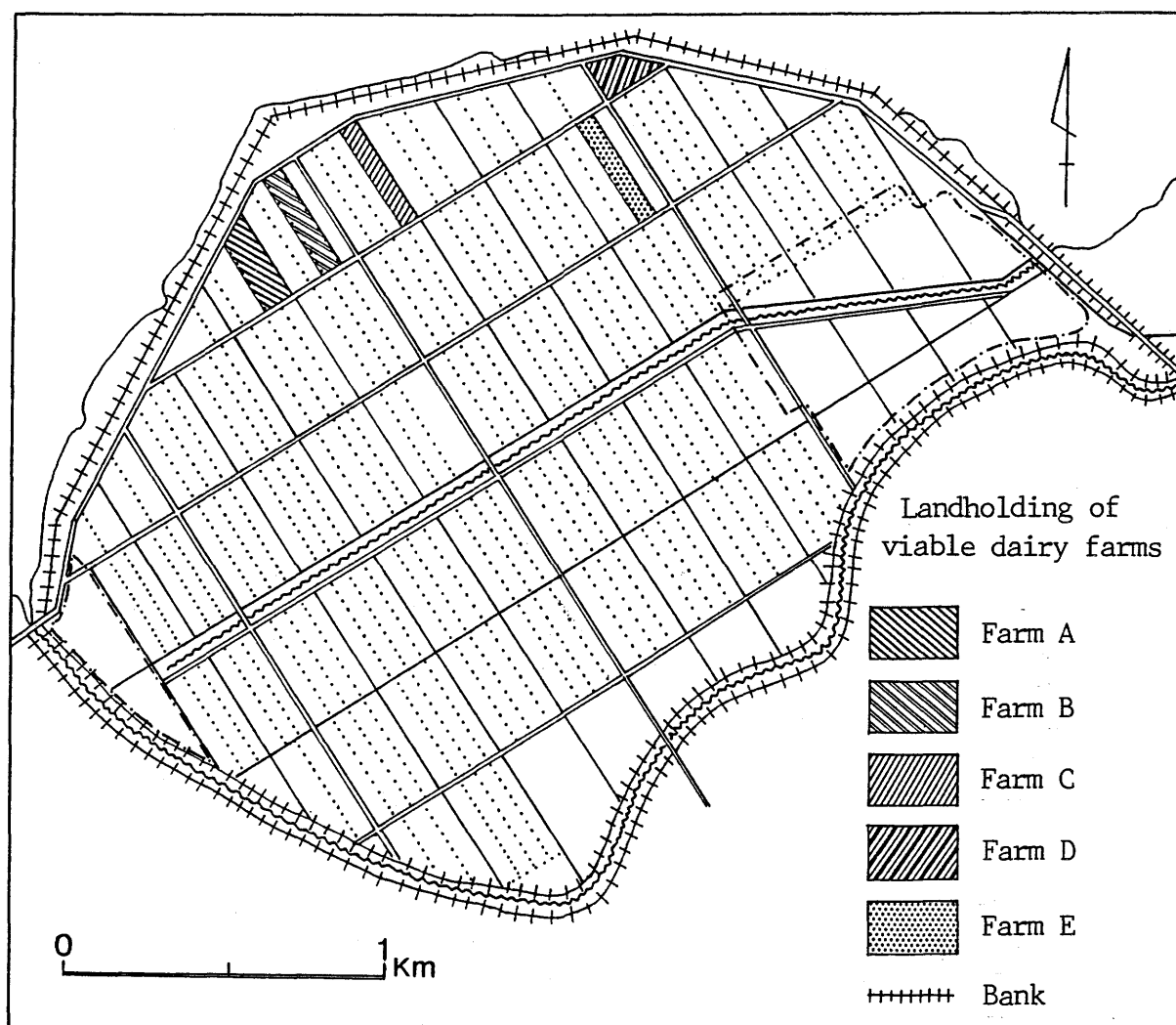


Figure 9 Landholding Patterns in Motoshinshimakaitaku of
Azuma Village, Ibaraki Prefecture (1982)
(Data sources: Cadastral maps, cadaster and hearing survey)

Motoshinshimakaitaku, while making the viable dairy farming heavily dependent on purchased feed. It is generally recognized that the development of viable dairy farming and the increase, of dairy cattle are accompanied by the enlargement and centralization of arable land.⁵⁹ But these changes of landholding patterns were not recognized in Motoshinshimakaitaku. Although some viable dairy farms tried to enlarge the farming scale by renting land on the riverbed of the Tone River or along Lake Kasumigaura, the majority had no more than the originally distributed land. Rather, the cultivated land has decreased due to the construction of large-scale barns and stockyards within their parcel.

Arable land did not increase with the development of viable dairy farming not only because dairy farms did not hold undeveloped land and forest to be converted into arable land, but because they could not rent farm land from part-time farms. Part-time farms and former dairy farms in Motoahinahimalaitaku maintained commercial rice cropping utilizing agricultural machinery and small family agricultural labor forces without lending out unused farmland to dairy farmers. In addition, development of lease farming was hindered by the fact that dairy farms and those oriented to rice cultivation were spatially differentiated from the beginning of reclamation.

iii) Land use patterns

At the introduction period of dairy farming, the rectangular land of 1.8 hectares which each reclamation farm owned was divided into three parcels: the housing lot (0.1 hectare), 0.2 hectares of dry field, and 1.5 hectares of paddy field. The housing lot faced the main road. The dry field, adjoining the housing lot, was used as kitchen garden and grassland, and the paddy field was adjacent to it. Black locust was planted as the

windbreak and shade on the northern and western sides of the housing lot.⁶⁰ This land use pattern was common to both dairy farms and rice growing farms, so that this settlement had homogeneous land use patterns. Regarding the use of paddy field during the winter, however, the land use of dairy farms differed from that of rice growing farms. Dairy farms cultivated Italian ryegrass as a winter crop after the harvest of rice. This crop rotation system was practiced by all dairy farmers through the effort of the working group so as to cooperatively cultivate and harvest the grass. On the other hand, most rice growing farms could not practice winter cropping on their paddy fields because of the ill-drainage.

At the expansion period of dairy farming, land use patterns of dairy farms became distinct from those of rice growing farms. Figure 10 indicates the land use pattern of the northern part of Motoshinshimakaitaku in May, 1970, restored with aerial photographs and interviews. This figure shows that each rice growing farm used 0.1 hectare near the house to cultivate vegetables and the rest of arable land for paddy fields. Rice was grown in the paddy field in spring and summer, and the field returned fallow after the harvest. The housing lot of dairy farms was enlarged to about 0.3 hectares, where cow sheds of the stall-barn type were built in the north-south direction. These sheds were thus well-ventilated protecting dairy cattle from high humidity. Considering the reclamation of marsh and Holstein's low degree of tolerance to high temperatures and humidity, such facility was important. The arable land adjacent to the housing lot was divided into the vegetable garden of 0.1 hectare, paddy field of 0.4 to 1.3 hectares, and forage crop field of 0.2 to 1.0 hectares. The differentiation of the acreage of paddy

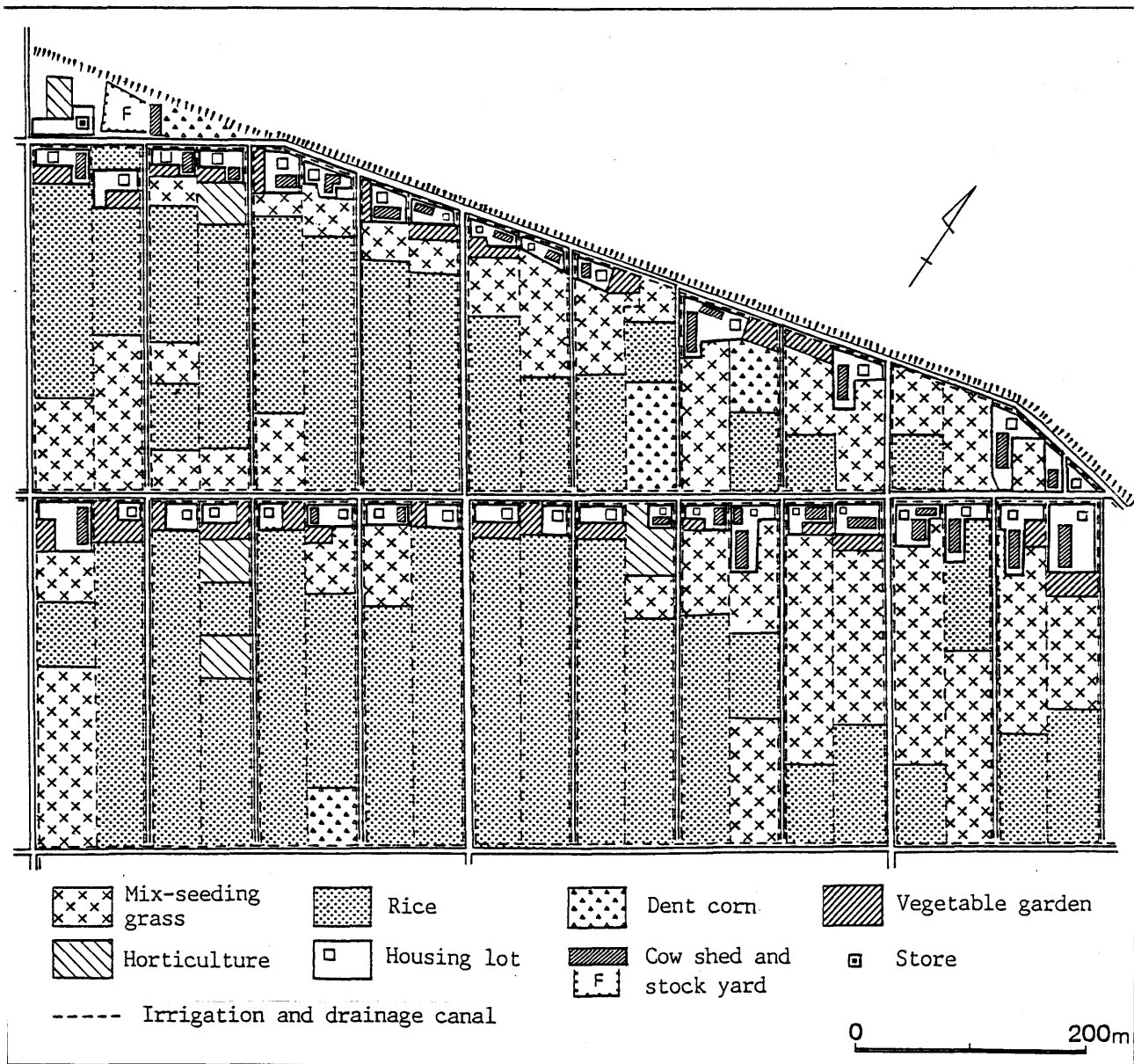


Figure 10 Land Use Pattern at the Expansion Period of Dairy Farming in the Northern Part of Motoshinshimakaitaku, Azuma Village of Ibaraki Prefecture (May, 1970)
(Data sources: Aerial photographs and hearing survey)

fields and forage crop fields among dairy farms was caused by the number of dairy cattle.

Regarding the land use pattern of viable dairy farms in the expansion period of dairy farming, the average acreage of rice were 0.5 hectares and that of forage crops including winter crops in the paddy field, 1.5 hectares. On the other hand, dairy farms which were not yet viable had 1.0 hectare of rice and 1.2 hectares of forage crops including the winter crop after rice harvest. But both viable dairy farms and non-viable dairy farms combined dairy farming with rice cultivation which may be called "Suiden rakuno". Furthermore, dairy farms mainly cultivated mix-seeding grass, including the winter crop in paddy fields. This reflected the adaptation pattern and management policies of dairy farms in Motoshinshimakaitaku which produced such roughage as grass and rice straw within their limited land and depended a great deal on the refuse feeds such as concentrates.

During the period of keeping large dairy herds, the land use pattern of dairy farms differed strikingly from that of other farms. According to the land use map of the northern part of Motoshinshimakaitaku in May, 1982 (Figure 11), most farms without dairy activities cultivated rice on all the arable land excepting the vegetable garden, while dairy farms had forage crops, especially mix-seeding grass, in the entire field. Mix-seeding grasses consisted of Italian ryegrass, orchardgrass and clover, which were cultivated and harvested at the same time. In this way labor was saved in seeding and harvesting. They were harvested three to four time a year allowing a long term use. The dairy farms which used to cultivate forage crops and rice began to specialize in forage crops at the time of the rice production adjustment. The development of viable

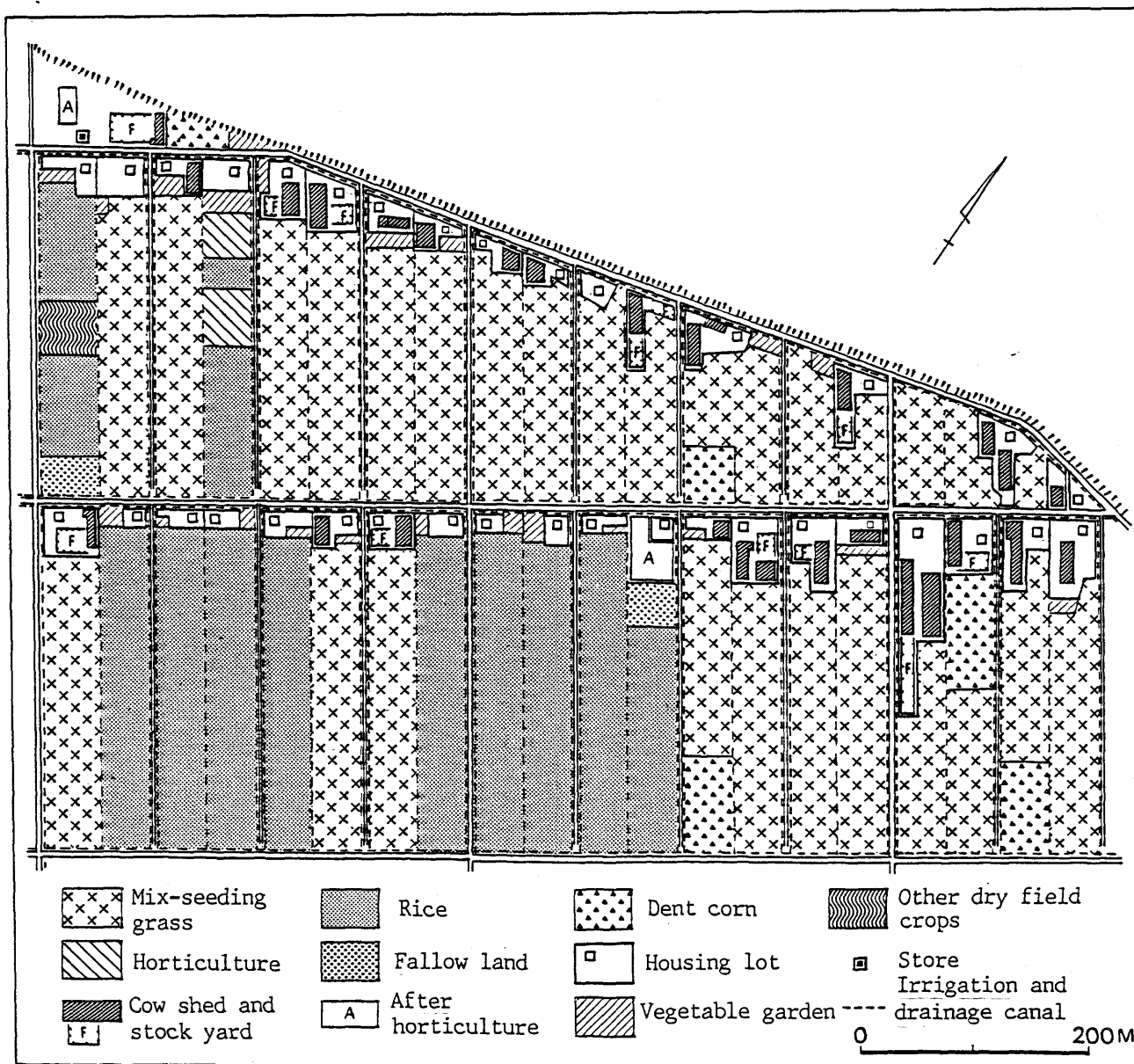


Figure 11 Land Use Pattern at the Period of Keeping Large Dairy Herds in the Northern Part of Motoshinshimakaitaku, Azuma Village of Ibaraki Prefecture (May, 1982)
(Data source: Field survey)

dairy farming with the increase of dairy cattle also promoted this change. The production bases of self-supplied feed were thus enlarged. In addition, with the development of the specialization in viable dairy farming, housing lots were enlarged to more than 0.4 hectares because of the need of larger barns and stockyards. Large-scale cow sheds of the stall barn type were constructed by raising the ground level to decrease the humidity and to be well-ventilated. Stockyards adjacent to the cow shed were also raised to improve poor drainage for protecting dairy cattle from high humidity.

As mentioned above, the land use pattern of dairy farms was in a marked contrast to that of other farms, with the development of viable dairy farming. In Motoshinshimakaitaku as a whole, forage crops predominated over the northern part and rice over the southern part. These regional differences of land use were caused by the arrangement, attributes and management policies of reclamation farms. In the northern part where dairy farms were concentrated, the land use of dairy farms became specialized in forage crops, while the actual bases of their feed production remained almost unchanged because of the enlargement of housing lot and the restrictive landholding patterns. Therefore, the roughage production being the central activity, the land use pattern which mix-seeding grass was formed. Insufficient roughage and concentrates were purchased.

iv) Arrangement patterns of dairy facilities and equipments

In order to examine arrangement patterns of dairy facilities and equipments, introduction of dairy facilities, equipments and dairy cattle at the sample farms of Motoshinshimakaitaku was chronologically

Table 2 Introduction of Dairy Facilities, Equipments and Cattle in the Sample Farms of Motoshinshimakaitaku, Azuma Village of Ibaraki Prefecture

Stage of management	The specialized stage					The mixed farming stage		
Sample farms	Viable dairy farms						Part-time rice growing farm (former-dairy farms)	
Year	A	B	C	D	E	F	G	H
Before 1964	B.S.T.C	B.S.T.C	B.S.T.C	B.S.T.C	B.S.T.C	B. S. T	B. S. T	B. S. T
1965	—	1	UC.M 2	1	1	—	—	1
1966	1	1	R 1	UC.M 1	—	—	—	1
1967	2	UC.M	2	2	1	1	1	2
1968	B' 2	1	1	.....1	2	1	2	—
1969	UC.M 1	1	.....1	R 2	UC.M	UC.M	UC.M	UC.M 2
1970	2	2	2	—	2	1	1	—
1971	R.....1	1	⊗.N 4	2	—	2	1	B' 1
1972	2	R 1	5	⊗.N 3	1	—	R 1	2
1973	1	1	7	T 8	R	—	B' 1	R 1
1974	2	B' 2	T 6	8	1	R 1	2	—
1975	⊗.BC.P.M3	BC.P 2	BC.P 7	BC.P 6	⊗.N 8	B'BC 4	1	—
1976	6	4	5	7	BC.P 8	8	—	1
1977	T 6	⊗.N 7	5	5	3	3	—	—
1978	7	T 5	2	5	2	⊗.N.P 7	—	—
1979	2	3	2	3	1	4	—	—
1980	2	2	2	2	1	2	—	—

Note: B. Cow shed, B'. Extension of cow shed, ⊗. Rebuilding of cow shed, T. Compost shed and board, S. Silo, C. Power cutter, R. Farm tractor, UC. Unit cooler, M. Bucket milker, P. Pipeline milker, BC. Bulk milk cooler, N. Barn cleaner, the figure shows the number of introduced dairy cattles, and a broken line shows the year when viable dairy farming was established.
(Data sources: Movement statistics of dairy cattles and hearing survey)

analyzed (Table 2). Cow sheds, silos and compost boards existed in the housing lot at the introduction period of dairy farming. Sheds were simple, small-scale stall barn without stanchion, to keep only five dairy cows. One or two small-scale pit silos were used in addition to simple stack silos at need. Compost boards had been constructed by 1960 utilizing the reclamation farming funds. Especially in the northern part of Motoshinshimakaitaku where soil fertility was poor, the construction of compost boards was promoted by the working group of dairy farming for compost and stable manure. Although power cutters were also introduced in this period, only half of dairy farms actually owned the machinery. The rate of diffusion was much less than that of power cultivators.

In the expansion period of dairy farming, the stratification occurred among dairy farms with the increase of dairy cattle. Where more than 10 dairy cows were kept, bucket milkers and unit coolers were installed within the cow sheds in order to raise milk quality and to save labor. These equipments, introduced originally in 1965, were owned by all farms by 1969. The Tone Dairy Cooperative Association, to raise milk quality, promoted the installment of milkers and coolers utilizing the agricultural modernization funds. Most dairy farms purchased small-scale farm tractors in this period for cultivating rice and forage crops. Regarding dairy equipments, there was little difference among dairy farms. On the other hand, the homogeneous arrangement pattern of dairy facilities began to disappear due to the appearance of viable dairy farms which rebuilt and enlarged their cow sheds.

In the period of keeping large dairy herds, dairy facilities and equipments remarkably increased and expanded. Since 1972 viable dairy farms purchased as

many dairy cows possible, increasing their specialization in dairy farming, so that they had to produce enough milk to pay various expenses and payment. Therefore, most animals they purchased were much delivered cows and milking cows of a few lactation, including "Hitohara shibori" cows. This type of introducing dairy cattle found in Motoshinshimakaitaku in outer suburbs of Tokyo metropolis is general in the dairy regions closer to Tokyo.⁶¹ This was mainly due to the restrictive landholdings, dependency on purchased feed and geographical advantages located within the Tokyo metropolitan milkshed.

With the increase of dairy cattle, cow sheds were rebuilt to the stanchion stall barn where 50 to 80 cows were kept and barn cleaner, pipeline milkers and bulk milk coolers were established. In specialized viable dairy farms, large-scale compost boards were newly constructed within the arable land or housing lot. The compost and stable manure gathered there were not only utilized to fertilize their arable land, but also sold to horticulturists on the Rokko upland in the southeastern part of Ibaraki prefecture. Among dairy facilities few silos were constructed throughout the expansion period and the period of keeping large dairy herds. This was due to that mix-seeding grass was mainly utilized for soilage and hay feed rather than for silage. Silos were not constructed also because forage crop acreage was not enough to require such storage facilities. In viable dairy farms, however, refuse silos, or Kaus silos, were constructed adjacent to, or inside of, cow sheds instead of normal silos.

As mentioned above, the enlargement and expansion of dairy facilities and equipments were characteristics common to viable dairy farms, and they were arranged in the same manner at all viable dairy farms. The

enlargement and expansion of dairy facilities and equipment were indispensable for the formation of viable dairy farming in Motoshinshimakaitaku. The dairy farms which were not able to satisfy this condition, therefore, were forced to stop dairying and to become part-time farms and rice single-cropping farms. These facilities and equipments were established utilizing various kinds of loans such as agricultural modernization fund mainly between 1970 to 1975 when successors to farming were ensured at dairy farms.

3. Conditions of viable dairy farming and their regional characteristics

The management of viable dairy farms has changed from the mixed farming stage to the specialized one with the development and specialization of viable dairy farming. In this development process the author shall examine the establishment and bases of development of viable dairy farming considering farm households, dairy cattle, land, dairy facilities and equipments as being elements of the spatial organization of dairy farming system centered on each dairy farm. As these elements constituting the dairy farming system are related to each other, changes in one element sensitively affect others and eventually the entire dairy farming system, transforming the spatial organization.⁶²

Figure 12 indicates changes of the arrangement of agricultural facilities, arable land and land use in a sample viable dairy farm at the specialized stage. In 1965 it was conducting viable dairy farming at the mixed farming stage combining dairy farming with rice, while in 1980 it was at the specialized stage. The mixed farming raising three to five dairy cows changed into the viable dairy farming at the mixed farming stage by increasing cows from ten to fifteen. The increase of

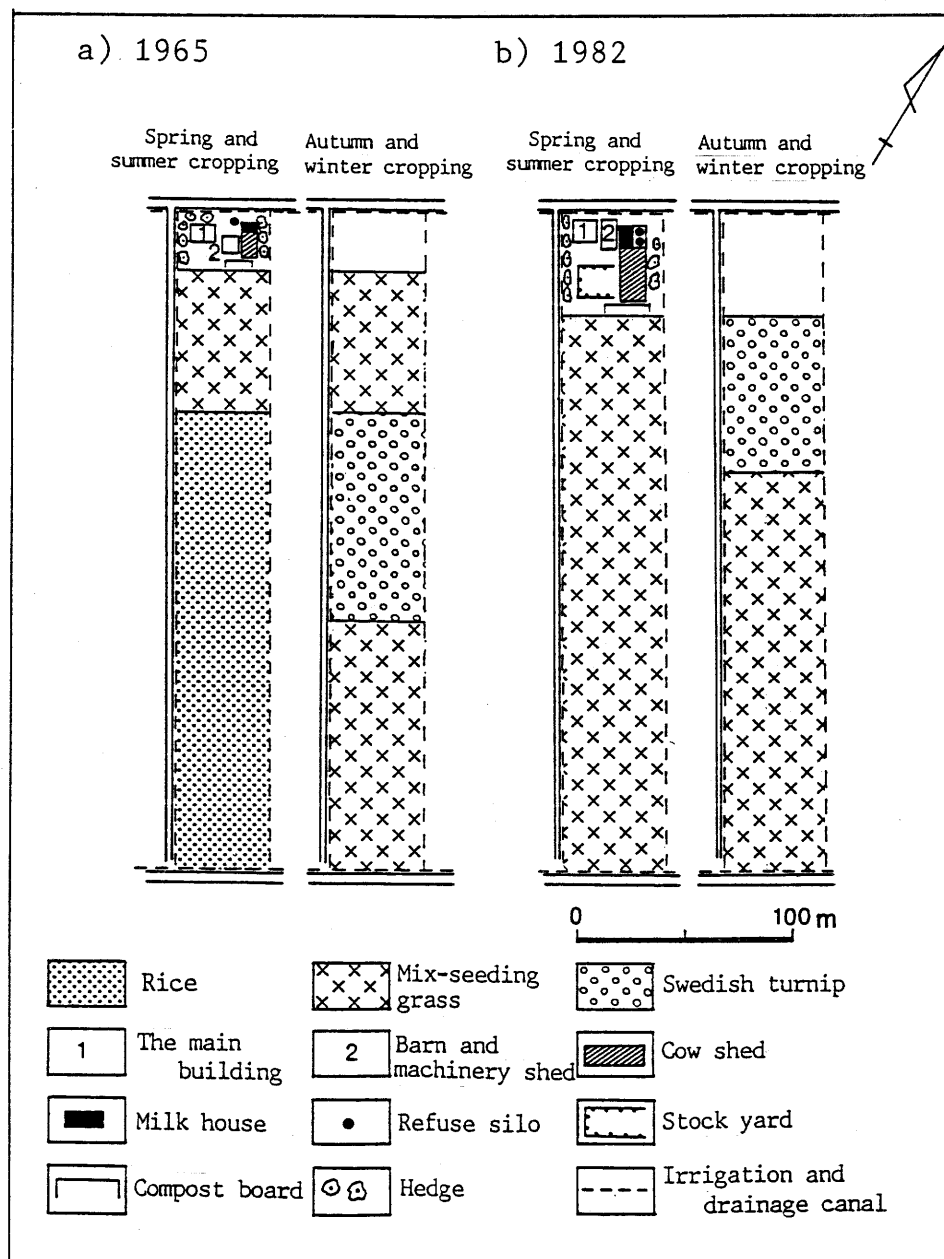


Figure 12 Changes of Arrangement of Agricultural Facilities, Arable Land and its Land Use in a Sample Viable Dairy Farm at the Specialized Stage in Motoshinshimakaitaku of Azuma Village, Ibaraki Prefecture (Data sources: Aerial photographs and field survey)

dairy cattle preceded all other changes, followed by the transformation of occupational structures and land use patterns changed. Then arrangement patterns of dairy facilities and equipments changed. In this way the spatial organization of dairy farming was reconstructed. The increase of dairy cattle largely depended on the accumulation and availability of capital, farm management policies, and farming ability.

Regarding the occupational structures of dairy farms, householders stopped engaging in non-agricultural wage labor such as industrial, commercial and engineering works, and two family members, including him became engaged in agriculture. In other words, agricultural labor forces of farms became focused on dairy farming. Regarding changes of arable land use, the acreage of commercial rice cultivation decreased, while forage crops increased. Because dairy farms were not able to enlarge the farmland in Motoshinshimakaitaku, they improved land and infrastructure to undertake the paddy-dry field rotation, producing the winter feed crop. Thus the feed production bases were enlarged and the arable land use was intensified by crop rotation. Looking at the dairy facilities and equipments, the size of cow sheds was enlarged with the increase of dairy cattle and a milk house was constructed adjacent to cow sheds with the installment of milkers and coolers. Dairy facilities and equipments were thus enlarged as the number of dairy cattle increased. Most viable dairy farms utilized a great deal of formula and refuse feeds to supplement the self-supplied feed, and some constructed refuse silos inside or beside cow sheds. These facilities and equipments were arranged within the original housing lot, so that their land use was also intensified.

In viable dairy farms of the mixed farming stage,

family agricultural labor force was firstly enlarged, which was followed by the increase of dairy cattle and feed production, and then the enlargement of dairy facilities and equipment took place. Thus viable dairy farming evolved from the mixed farming stage into the specialized stage. In Motoshinshimakaitaku family members were the main labor force of dairy farming, and its enlargement was achieved by ensuring family labor over two generations. As family labor force was enlarged with farming successors ensured, the number of dairy cattle increased to more than 30 head per farm. It then required the expansion of feed production and the entire arable land in dairy farms were used to produce feed. The enlargement of feed production bases, however, was insufficient because the arable land as a whole was not actually enlarged. Formula and refuse feeds were given to dairy cattle to make up for the shortage of subsistently producted feed. Therefore, the dairy region needed to be located where dairy farms could utilize cheap refuse feed, being supplementary with refuse production regions. Dairy farms in Motoshinshimakaitaku purchased beer draffs from a brewery in Toride city of Ibaraki prefecture and strained lees of soy from soy source plants in Choshi and Noda cities of Chiba prefecture through traders, so that they had good accessibility to cheap refuse feed.

As the number of dairy cattle per dairy farm increased to more than 30 head, the traditional arrangement of arable land and housing lot within each dairy farm was transformed. The housing lot was enlarged to accommodate the large-scale cow shed, compost board, and stockyard. Then barn cleaners and pipeline milkers were installed in large-scale cow sheds. Pipeline milkers were connected with the bulk milk cooler inside a milk house constructed on the north side of a cow

shed. Refuse silos were installed in the opposite side of a milk house, in which soybean curd dregs, beer draffs and strained lees of soy purchased from traders were temporarily stored. Therefore, the enlargement of dairy facilities and equipments advanced with the specialization in viable dairy farming, which tended to be spatially arranged regardless of the usual framework of land use.

The development process of viable dairy farming in Motoshinshimakaitaku is summarized in Figure 13. Viable dairy farming was established by intensifying the spatial organization constituted from farm household, dairy cattle, land, dairy facilities and equipments while maintaining the traditional pattern of landownership and the arrangement of housing lot and arable land. But this spatial organization needed to be further enlarged and expanded to develop into the specialized stage of viable dairy farming. Alluvial lowlands, originally fit for rice, were occupied by rice growers. Furthermore, it was difficult for dairy farms to enlarge their feed production bases by leasing farmland from part-time farms. Therefore, in viable dairy farms of Motoshinshimakaitaku the traditional arrangement of the farming space was broken, but its enlargement was restricted. Within the restricted framework, the spatial organization was intensified. Viable dairy farms utilized a great deal of cheap purchased feed such as refuse to keep dairy cows. In other words, the viable dairy farming in Motoshinshimakaitaku compensates the low potentiality of enlarging arable land with high accessibility to cheap commercial feed.

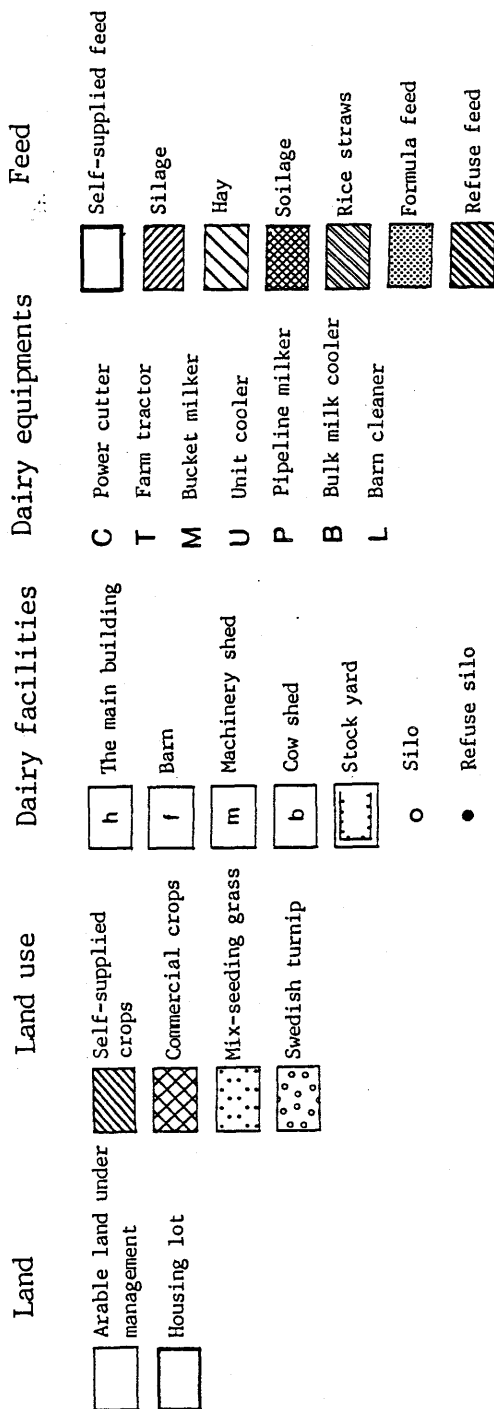
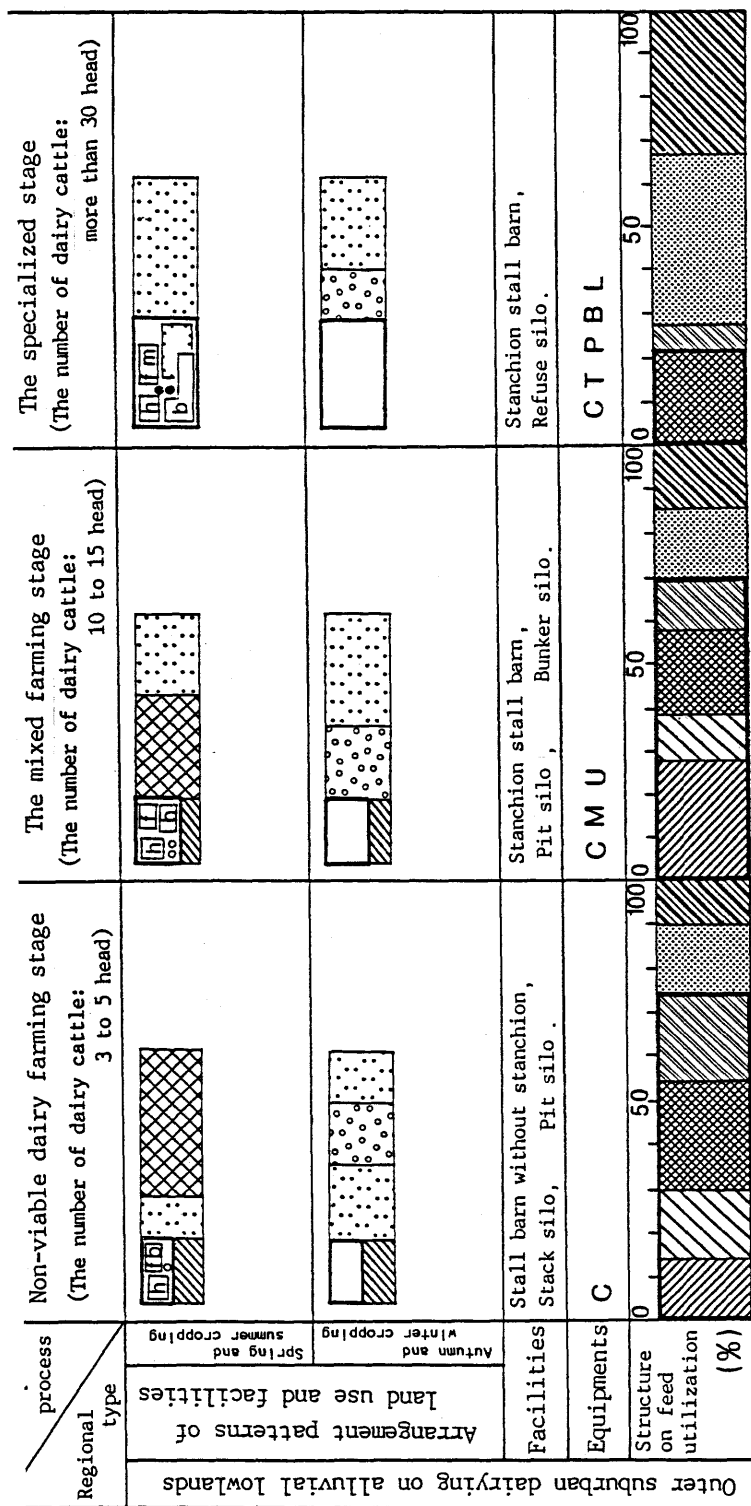


Figure 13 The Development Process of Viable Dairy Farming in Motoshinshimakaitaku of Azuma Village, Ibaraki Prefecture

CHAPTER IV

DEVELOPMENT OF VIABLE DAIRY FARMING IN OUTER SUBURBAN AREAS OF TOKYO METROPOLIS: A CASE OF DILUVIAL UPLANDS

1. Changes of agricultural management with the development of dairy farming

Shinseikaitaku, Dejima village of Ibaraki prefecture, is located in the northwestern part of Dejima upland, which is a part of Niihari uplands, and once belonged to former Shishiko village. The land before reclamation and settlement was covered with coppices of red oak and Nara oak. This land had been used as the turnout airfield of the Japanese navy during World War II. In order to examine changes of agricultural management with the development of dairy farming in Shinseikaitaku, Figure 14 was prepared showing the transition in the number of dairy cattle and dairy farms and the acreage of cultivated farmland by main crops. It indicates that the development process of dairy farming in Shinseikaitaku is divided into three periods. First is the introduction period from 1947, when land settlement and reclamation started to 1957. The second period is from 1958 to 1970 when mixed farming combining rice growing with dairy developed with the increase of paddy fields following the construction of Dejima Irrigation Canal. The third period after 1971 is when the number of dairy cattle and the acreage of forage crops increased rapidly, while dairy farms decreased.

i) The introduction period of dairy farming (1947~1957)

The reclamation of Shinseikaitaku started in 1947 by settlers who belonged to the Kandatsu Hotoku

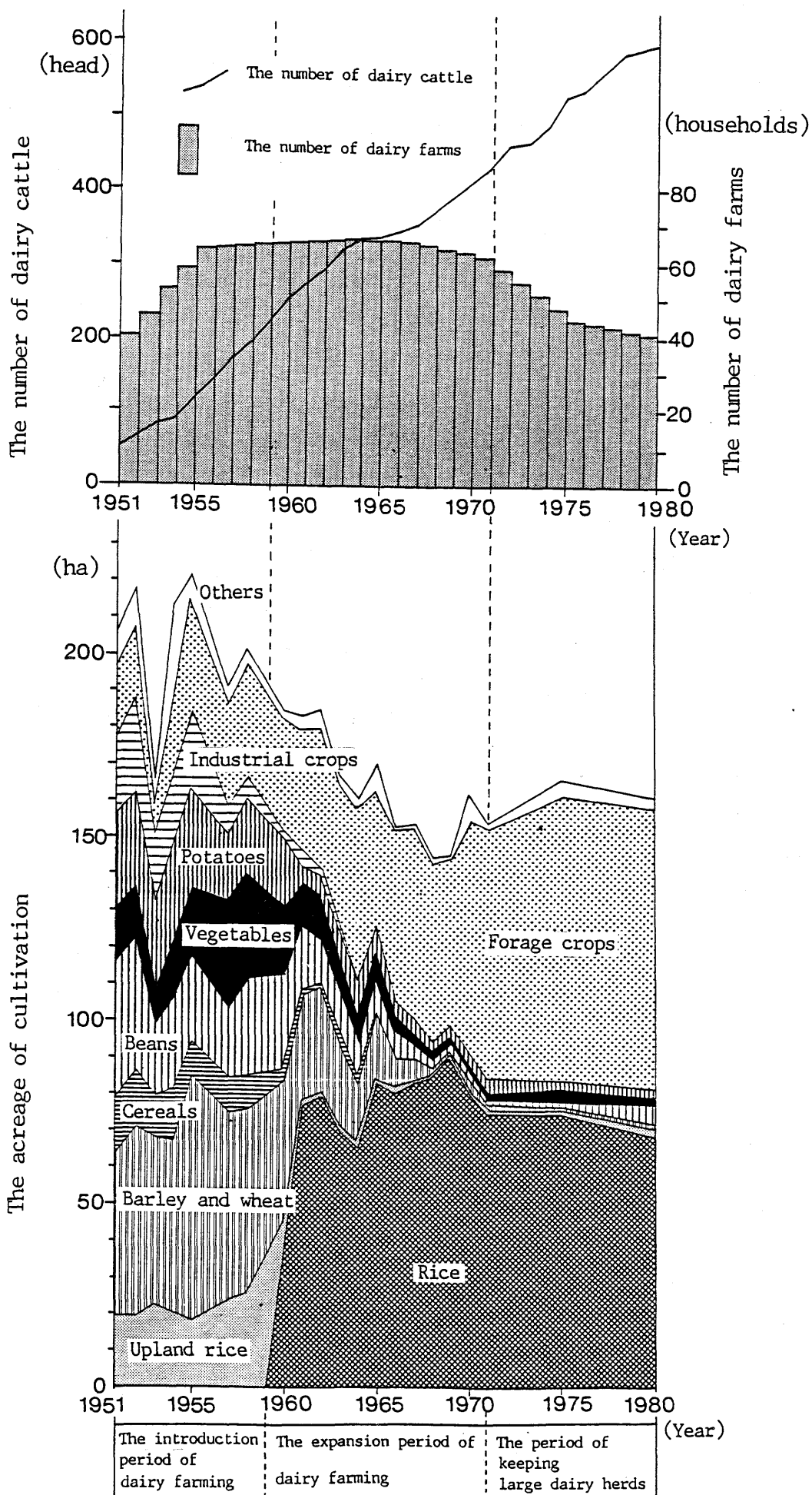


Figure 14 Changes of the Number of Dairy Cattle and Dairy Farms, and the Acreage of Cultivation by Main Crops in Shinseikaitaku of Dejima Village, Ibaraki Prefecture

(Data sources: Investigation of reclamation farming results, agricultural censuses and movement statistics of dairy cattle)

Reclamation Association (35 households), the Matsushima Reclamation Association (12 households), the Yamato Reclamation Association (20 households) and the Gosei Reclamation Association (20 households). These reclamation associations were combined to form the Shinsei Reclamation Agricultural Cooperative Association in 1955. The central role in this association was played by the former Kandatsu Hotoku Reclamation Association, to which many repatriates from Manchuria belonged. According to Figure 15 which shows settled farmers' past records in Shinseikaitaku, Manchurian repatriation farms amount to 38 households in the present reclamation farms. Former Manchuria reclamation farms, including those took part in "the youth volunteer army of Manchuria reclamation", amount to 45 households accounting for about 60 percent of all reclamation farms in Shinseikaitaku. These farms took a leading part in the construction of this reclamation settlement. For example, these reclamation farms adopted cooperative cultivation which they undertook in Manchuria, establishing the farming pattern called "the third farming type (Daisan eino ruikei)". In other words, a "group (Kumi)" consisted of five reclamation farms was organized to function as a unit of cooperative cultivation. Cooperative cultivation was practiced throughout the agricultural production, but agricultural profits were gained by each reclamation farm. Thus the farming system combining cooperative cultivation with individual management was carried out at the beginning of reclamation.⁶³ Such a farming type attracted the attention of agronomists, who pointed out that agricultural labor productivity was raised by cooperative cultivation and agricultural land productivity also increased by the cooperative introduction and improvement of farming techniques.⁶⁴

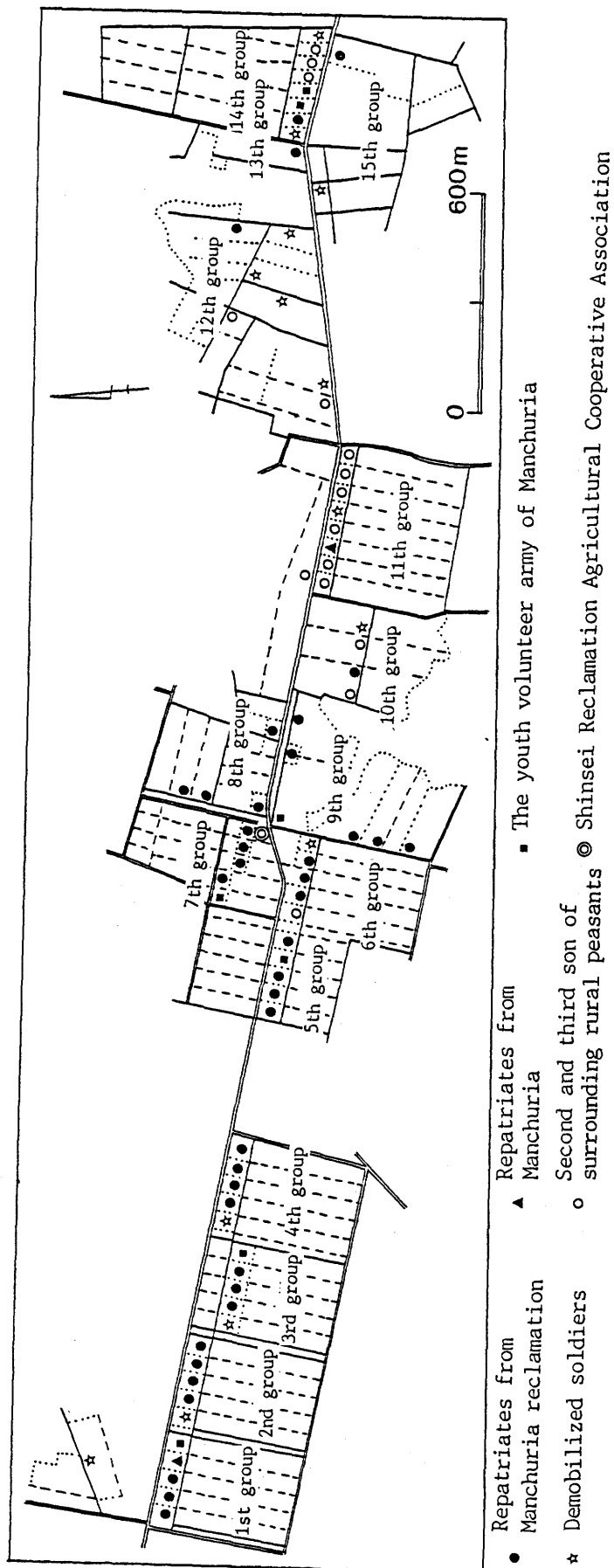


Figure 15 Settled Farmers' Past Records in Shinseikaitaku
of Dejima Village, Ibaraki Prefecture
(Data sources: History of 30 years in Shinseikaitaku and
hearing survey)

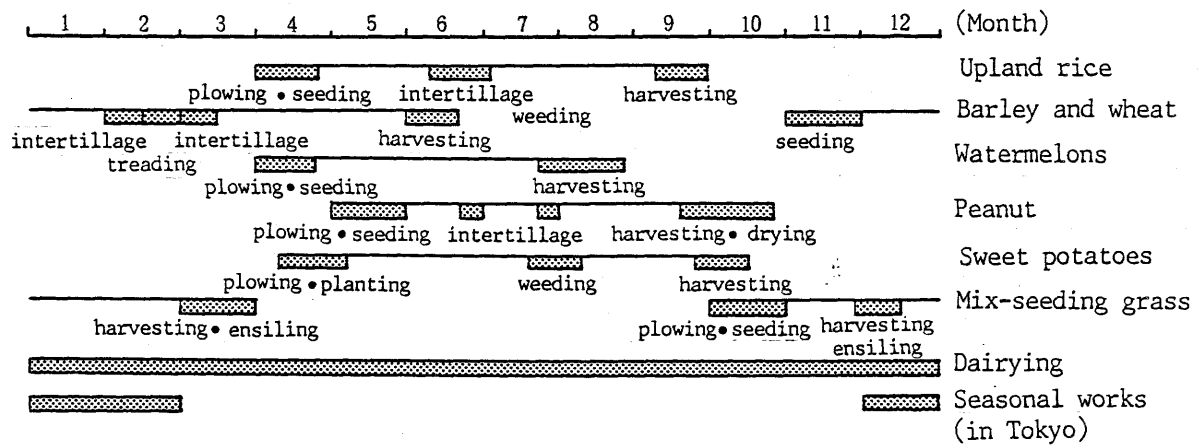
The total acreage of cultivated farmland in Shinseikaitaku was 31.9 hectares in 1947, which were planted in upland rice (7.0 hectares), wheat (7.0 hectares), barley (3.5 hectares) and sweet potatoes (8.7 hectares) as subsistence crops. Yields per 10 ares of these crops were only 70 percent of the average in Ibaraki prefecture, upland rice and wheat being 90 kilograms respectively, barley, 60 kilograms, and sweet potatoes, 937.5 kilograms. Because these crops were low in productivity, the reclamation farmers gathered fallen leaves from neighboring coppices and made compost in order to fertilize their farmland. As these compost were not enough to raise productivity and increase crop yields, manure of horses and cattle was also used. Seven horses were purchased in 1947 with the subsidy of Ibaraki prefecture, and dairy cattle were also introduced in the following year. A horse was allotted to each group. Each reclamation farm built a simple stable and raised a horse in a shift of 15 days. While they gathered each bringing feed and bedding for their horse, the farm which was on duty of keeping the horse took the responsibility of horse management and gained manure. Moreover, the horse was used for cooperative cultivation, whose working was six to ten times as efficient as the traditional cultivation by man power in Dejima village of Ibaraki prefecture.

The farm which introduced dairy cattle had an experience in dairy farming in Manchuria. This farm purchased a dairy cattle from the Tsuchiura Milk Cooperation for 60,000 yen, which marked the beginning of dairy farming in Shinseikaitaku. Around 1948, milk yield per head a day was 9 to 16.4 liters, which brought a stable gross income of about 9,000 yen to a farm per month. Since manure was useful to fertilize the reclaimed farmland, farmers payed attention to dairy

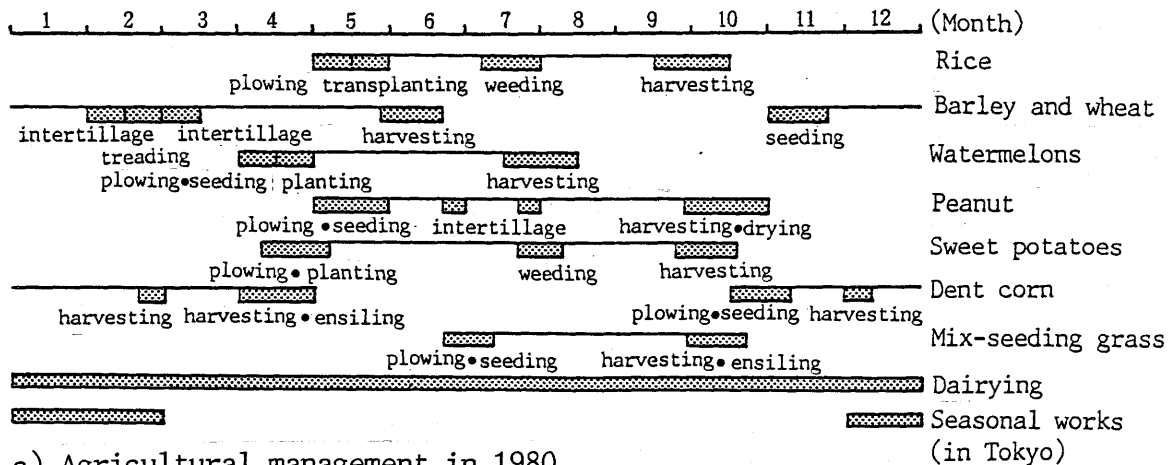
farming. Furthermore, most of the reclamation farmers, influenced by Mr. Kanji Kato of Japan National High School (Nihon kokumin kotogakko), intended to establish diversified farming with livestock. These contributed to the introduction of dairy farming. In 1949, seven cows were introduced utilizing subsidies from Ibaraki prefecture. In the next year dairy cattle increased to 50 head, which were kept by 40 households. As the number of dairy farms increased, they joined the Tsuchiura Dairy Cooperative Association in order to raise producers' milk prices and to strengthen their influence in this association. Naturally they shipped their fluid milk to the association instead of the Meiji Dairy Products Company in Ishioka city of Ibaraki prefecture.

In 1955, the number of cows increased to two head per farm, and the cooperative cultivation was discontinued with the establishment of dairy farming. The originally distributed farmland was 1.5 hectares per reclamation farm, which were used as dry fields. At a typical reclamation farm around 1955, upland rice (18 ares) was cultivated as a subsistence crop, wheat and barley (100 ares), pulses (28 ares), sweet potatoes (36 ares) and watermelons (10 ares) were grown as commercial crops, and forage crops occupied about 40 ares. Cash income was obtained from the sales of those commercial crops, fluid milk and chicken eggs, but they were not enough to purchase dairy cattles. Farmers not only temporarily worked away from their home but also engaged in construction works every day in order to gain supplemental cash income (Figure 16-a). Viable dairy farming had not yet been developed by this time. Regarding the farm income combination, the "dry field crops (60 percent) + milk (20 percent) + non-agricultural income (20 percent)" type was the largest group in Shinseikaitaku amounting to 45 households. In

a) Agricultural management in about 1955



b) Agricultural management in about 1960



c) Agricultural management in 1980

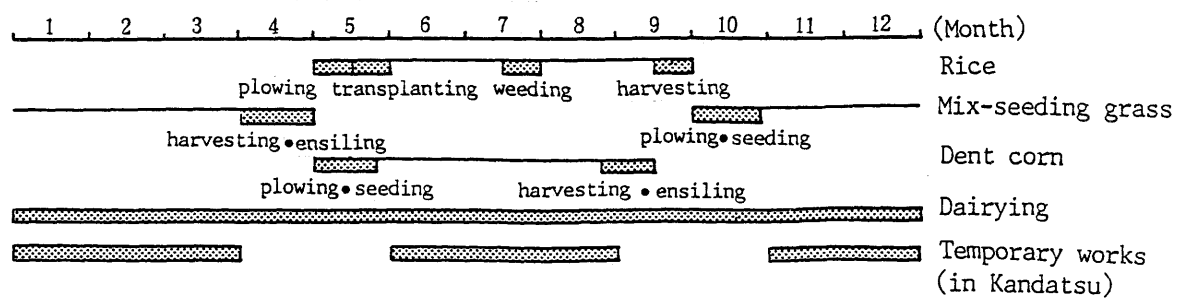


Figure 16 Transitions of Agricultural Management on a Standard Dairy Farm of Shinseikaitaku in Dejima Village of Ibaraki Prefecture
(Data source: Hearing survey)

each reclamation farm, a householder and his wife of 25 to 35 years old engaged in farming and their attitudes toward farming were positive and active. But both dry field farming and dairy farming required them to work hard, and the peak of agricultural labor requirement was reached in the spring and autumn. Because the reclamation farming was based on the family labor force, it was necessary to introduce mechanical power such as farm tractors to supplement agricultural family labor force. The Shinsei Reclamation Agricultural Cooperative Association purchased a farm tractor and its attachments utilizing the agriculture, forestry and fishery loan from the Central Cooperative Bank for Agriculture and Forestry.⁶⁵

In a typical dairy farm about 1955, feeding and milking with hands were carried out three times a day; in the morning (4 to 6 o'clock), at day (12 to 14) and in the evening (18 to 20). The 36 litter cans were filled with fluid milk. Those milked in the morning were carried to the milk gathering places in the reclamation settlement by seven o'clock in the morning. Those milked at day and in the evening were cooled and preserved in well water and were also carried to the milk gathering places by seven in the next morning.⁶⁶ A small truck of the Tsuchiura Dairy Cooperative Association picked up fluid milk cans at each milk gathering place. Dairy cattle were mainly kept with self-supplied feed. Not only forage crops such as mix-seeding grass, rye, and Swedish turnips, but also wild grass, refuse of vegetables, leaves and stems of corn, and runners of sweet potatoes were utilized to keep dairy cattle. Therefore, the ratio of self-supplied feed at a typical dairy farm amounted to more than 90 percent, while the ratio of feeding cost to the value of sold milk remained about five percent.

In the introduction period of dairy farming, as mentioned above, the mixed farming where dry field farming was a leading section and dairy farming was a subsidiary section was a common type in Shinseikaitaku. Manchuria repatriates played an important role in the development of this type of farming. Soil fertility was maintained and improved with the forage crop rotation in fields, and compost and stable manure greatly fertilized the farmland and advanced the field maturing process. This enabled the reclamation farms to practice double and triple croppings a year, and their arable land use became intensified. Combining dry field farming with dairy farming, furthermore, agricultural works became harder, but labor distribution became averaged. Additionally, the marketing for their fluid milk was established by their joining the Tsuchiura Dairy Cooperative Association, and their milk prices were stabilized at high level about 25 yen per kilogram. The reclamation farms supplemented unstable agricultural produce prices of dry field crops by dairy farming, gaining high agricultural income. In this period, however, because dairy farming was small-scale and a part of the farm income was non-agricultural, viable dairy farming had not yet been developed.

ii) The expansion period of dairy farming
(1958~1971)

The plan to reclaim Dejima upland to paddy fields by pumping up water from Lake Kasumigaura had been already proposed before World War II. After the War this plan became realized as one of the reclamation projects by Ibaraki prefecture, that is, the Dejima ten villages area construction project (Dejima jukkason chiku kensetsu jigyo), based on the emergent reclamation project of Japan. This project aimed at newly developing 480 hectares of paddy fields and 40 hectares of dry

fields and stably supplying water for the existent paddy fields of 1,000 hectares by the construction of Dejima irrigation canal (Dejima yosui). This irrigation canal was opened in 1955 from the Teno settlement of former Kami-Otsu village situated on the shore of Lake Kasumigaura to the diversion weir of Shinseikaitaku extending for 4,480 meters. Accordingly the reclamation farms in Shinseikaitaku undertook the conversion of dry field into paddy field in order to start rice cultivation.

The acreage of dry fields converted into paddy fields amounted to 40.5 hectares by 1960, and rice became a major commercial crop. Simultaneously the acreage under such subsistence crops as upland rice and cereals decreased rapidly from the latter half of the 1950's to the first half of the 1960's (Table 3), because rice became an important subsistence crop. Such development of rice growing was due to the fact that traditionally 50 ares of dry fields were required to produce subsistence upland rice, whereas ten ares of paddy fields were enough to produce subsistence food as well as the surplus for sale at relatively high prices. In addition, rice yield in Shinseikaitaku was about 480 kilograms per 10 ares around 1960, the productivity being equal to the neighboring rice growing farms. Gross income of the reclamation farms increased rapidly from 10,000 yen per farm in 1955 to around 35,000 yen per farm in 1960. Because the reclamation farms in Shinseikaitaku aimed at the improvement of soil fertility with stable manure and at the establishment of diversified farming with livestock, they avoided being specialized in rice on their paddy field and became to practice the mixed farming combining rice with dairy.

According to Figure 16-b which shows agricultural management about 1960, rice was cultivated from the

Table 3 Changes of the Acreage of Main Crops
Cultivation in Shinseikaitaku of Dejima
Village, Ibaraki Prefecture

Crops	1950	1960	1970	1980
	(ha)	(ha)	(ha)	(ha)
Rice	0.0	40.5	86.6	67.9
Upland rice	19.5	9.2	3.3	3.9
Wheat	39.0	11.0	1.9	0.0
Barley	6.0	32.3	0.8	0.0
Cereals	13.2	5.3	0.2	0.2
Sweet potatoes	19.5	10.8	2.1	0.4
Potatoes	6.5	5.5	0.3	1.2
Soybean	3.0	0.3	0.1	0.2
Peanut	19.5	1.8	3.8	5.1
Watermelons	6.5	8.8	1.1	0.0
Forage crops	19.5	21.8	54.2	75.1
Others	51.9	6.6	7.1	6.1
Total	204.1	153.9	161.5	160.1

(Data sources: Investigation of reclamation farming
results and agricultural censuses)

middle part of May to the first ten days of October, and the average acreage of rice was 70 ares per farm. After the harvesting, paddy fields of 70 ares were converted into dry fields by draining completely, and mix-seeding grass was sown for about 30 ares. Mix-seeding grass was harvested three times a year; in the first ten days of December, in the last ten days of February, and in the middle part of April. Harvested mix-seeding grass was processed into silage feed and became important self-supplied roughage together with rice strow. The rest of the fields were cultivated by Chinese milk vetch to maintain and improve soil fertility. Dry fields were plowed in the first ten days of May, and were converted into paddy fields again. Because Shinseikaitaku is located on diluvial uplands where conditions of irrigation and drainage are good, it was easy for the reclamation farms to practice paddy-upland rotation by controlling weirs and inlets for irrigation water. In the dry fields, watermelons, peanuts and sweet potatoes were cultivated as commercial crops, and dent corn was raised as a forage crop. The acreage of these commercial crops, however, tended to decrease with the development of rice and dairy farming (Table 3). The peaks of labor requirement in a series of agricultural works were reached in May and October, so that agricultural labor force tended to be short in the reclamation farms which depended on family labor of only a householder and his wife. Therefore the farm tractors, which the Shinsei Reclamation Agricultural Cooperative Association managed, were frequently used for plowing fields. At the same time, organization of "groups (Kumi)" was still maintained to practice joint operations of agriculture.

The number of dairy farms in 1960 amounted to 66, which accounted for 90 percent of all reclamation farms in Shinseikaitaku. Each of these dairy farms kept two to

three dairy cattle. Thus the dairy farms were not hierarchically differentiated according to the number of dairy cattle. They used self-supplied roughages such as rice straw, mix-seeding grass raised as a winter crop on drained paddy fields and Swedish turnip, as well as the concentrats such as dent corn and purchased formula feed.⁶⁷ Self-supplied feed accounted for 85 percent of all the feed required. This was also understood by the fact that the ratio of feeding cost to the value of sold milk was as low as 15 percent. Furthermore, dairy farms gained manure of about 20 tons per cattle, which were used for fertilizing arable land before plowing paddy fields and seeding grass at the rate of a ton per 10 ares. Land productivity in Shinseikaitaku was improved with the utilization of these organic fertilizers. In 1965, for example, rice yield of Shinseikaitaku amounted to about 540 kilograms per 10 ares, exceeding that of neighboring settlements.

Agricultural management of 73 farms in Shinseikaitaku is shown in Table 4. According to this table, the number of dairy farms in 1965 amounted to 62 households, accounting for 85 percent of all reclamation farms. All of these dairy farms, combining rice with dairy, were at the mixed farming stage. Four dairy farms had already developed viable dairy farming, because their farm income combination was the "milk (50 percent) + rice (50 percent)" type. These viable dairy farms had enlarged their feed production bases by converting undeveloped accessory land into arable land and had increased dairy cattle to 12 head per farm. Moreover, they stopped cultivating commercial crops in dry fields by degrees and became to adopt the crop rotation system in which forage crops played a leading part. However, family members engaged in agriculture were only a householder and his wife, and were not different from

Table 4 Changes of Agricultural Management in Shinseikaitaku of Dejima Village, Ibaraki Prefecture. (1965, 1982)

Year	1965					1982				
Contents of management	Farm income combinations	The average number of dairy cattle (head)	The average acreage of arable land (hectares)	Family members engaged in agriculture	Households	Farm income combinations	The average number of dairy cattle (head)	The average acreage of arable land (hectares)	Family members engaged in agriculture	Households
Stage of management										
The specialized stage						M(100)	50	3.0	H+W+S+B	12
The mixed farming stage	M(50)+R(50)	12	1.8	H+W	4	M(70)+R(30)	25	1.6	H+W+S	5
	R(60)+M(30)+O(10)	10	1.6	H+W	7					
	R(70)+M(20)+O(10)	5	1.6	H+W	1					
	R(60)+M(30)+O(10)	10	1.5	H+W	1	M(60)+R(20)+O(20)	15	1.6	H+W	5
	R(50)+M(30)+O(20)	8	1.5	H+W	1					
	R(50)+M(30)+O(20)	6	1.4	H+W	3					
	R(50)+M(30)+O(20)	6	1.4	H+W	2	M(50)+R(30)+O(20)	10	1.5	H+W	7
	R(70)+M(20)+O(10)	5	1.5	H+W	3					
	R(50)+M(30)+O(20)	5	1.4	H+W	2	R(50)+M(30)+O(20)	7	1.4	H+W	7
	R(70)+M(20)+O(10)	4	1.5	H+W	5					
	R(50)+M(30)+O(20)	5	1.4	H+W	1					
	R(60)+M(30)+O(10)	5	1.4	H+W	3					
	R(70)+M(20)+O(10)	4	1.4	H+W	3					
	R(50)+M(30)+O(20)	5	1.4	H+W	2					
	R(60)+M(30)+O(10)	5	1.5	H+W	2					
The part-time farming stage (former-dairy farm)	R(50)+M(30)+O(20)	5	1.4	H+W	10	O(50)+R(40)+U(10)		1.0	W	4
	R(60)+M(20)+O(20)	5	1.4	H+W	4					
	R(70)+M(20)+O(10)	3	1.5	H+W	4	O(60)+R(30)+U(10)		0.8	W	33
	R(80)+M(10)+O(10)	2	1.5	H+W	4					
	R(70)+O(20)+U(10)		1.5	H+W	9					
	R(80)+U(10)+O(10)		1.5	H+W	2					

Note: M. Milk, R. Rice, U. Dry field crops, O. Non-agricultural income, H. A householder, W. His wife, S. His successor, B. His daughter-in-law, and the figure in parentheses shows percentage.

(Data sources: Movement statistics of dairy cattle, data from Dejima village office and hearing survey)

those of other dairy farms.

Many dairy farms at the mixed farming stage combined rice growing, the major part of farming with dairy as and a subsidiary section. Regarding the farm income combination, the "rice (50 percent) + milk (30 percent) + non-agricultural income (20 percent)" and "rice (60 percent) + milk (30 percent) + non-agricultural income (10 percent)" types amounted to 17 households respectively and were the largest of all types. The "rice (70 percent) + milk (20 percent) + non-agricultural income (10 percent)" type number 16 households. The non-agricultural income was gained out of works away from their homes and everyday construction works during farmers' leisure season. Most of income was utilized to purchase dairy cows, while a part of it was used for living expenses. In these dairy farms, therefore, viable dairy farming was undeveloped. But some of them made efforts to develop viable dairy farming by converting accessory land to arable land and increasing dairy cows by degrees.

On the other hand, a part of dairy farms stopped keeping dairy cattle and developed rice cultivation as a leading section of commercial production. Agricultural family labor force and the acreage of arable land in these farms did not differ from those of dairy farms. Therefore, the discontinuance of dairy farming was due to the lack of experience in dairy farming. Former dairy farms numbered 11, and those engaged in agriculture were mainly a householder and his wife. Regarding the farm income combination, the "rice (70 percent) + non-agricultural income (20 percent) + dry field crops (10 percent)" type amounted to nine households, the largest of all types of these farms. Then followed is the "rice (80 percent) + dry field crops (10 percent) + non-agricultural income (10 percent)" type, numbering two

households. All the farms in both types engaged in non-agricultural works during the winter to make up for the shortage of living expenses.

Generally speaking, dairy farming at this stage occupied the subsidiary position of rice growing and depended on forage crops during the winter and rice straw. The number of dairy cattle was not large enough to enlarge dairy farming, and most of the dairy farms gained their enlargement capital from non-agricultural income sources. This was due not only to the increasing opportunities for non-agricultural employment during at the time of rapid economic growth but to the good location of Shinseikaitaku in the outer suburbs of Tokyo metropolis. Although viable dairy farming did not usually develop in such circumstances, it was established in some dairy farms which could enlarge the number of dairy cattle. In the expansion period of dairy farming, after all, the establishment and development of viable dairy farming based on the availability of capital and techniques for increasing dairy cattle, because the acreage of arable land, agricultural family labor force, and dairy facilities and equipments did not differ among dairy farms.

iii) The period of keeping large dairy herds (after 1972)

The number of dairy cattle in Shinseikaitaku increased rapidly after 1972, amounting to 596 head in 1980. On the other hand, the number of dairy farms tended to decrease after the peak of 66 households in 1960, and decreased rapidly to 41 households in 1980 which accounted for 56 percent of all reclamation farms in Shinseikaitaku. Therefore, the number of dairy cattle per farm was 15 head in 1980, marking the beginning of the period of keeping large dairy herds. But it is also characteristic for the development of dairy farming in

Shinseikaitaku that many farms stopped keeping dairy cattle. This was due to the fact that commuters from part-time farms increased reflecting the socio-economic as well as locational advantage highly accessible to the Kandatsu Station of Joban Line and to the Kandatsu Industrial Complex. After all most part-time farms stopped dairy farming and practiced the mixed farming which combined rice with subsistence vegetable growing. As opportunities of non-agricultural employment increased, the second generation tended to give up farming and to engaged in non-agricultural works. The lack of farming successors was one of the reasons why the part-time farms stopped keeping dairy cattle.

Comparing the relation between the number of dairy cattle and the acreage of arable land under management in 1982 with that in 1965, we know that hierarchical differentiation advanced in the number of dairy cattle as well as in the acreage of arable land under management (Figure 17). The enlargement of dairy farming scale in the period of keeping large dairy herds differed from that in the expansion period, and was attended not only with the increase of dairy cattle but also with the enlargement of arable land under management. In 1965, for example, each dairy farm kept 5.7 head of dairy cattle and 1.6 hectares of arable land. In 1982, the number of dairy cattle amounted to 25.5 head per dairy farm, more than quadrupling that in 1965, and the acreage of arable land also increased to 2.2 hectares. Such enlargement of dairy farming scale differed from the case of Motoshinshimakaitaku in alluvial lowlands. According to Table 4 which shows agricultural management of 73 farm households in Shinseikaitaku of 1982, viable dairy farms increased to 17, accounting for 47.2 percent of all dairy farms. In addition, viable dairy farms were divided into those

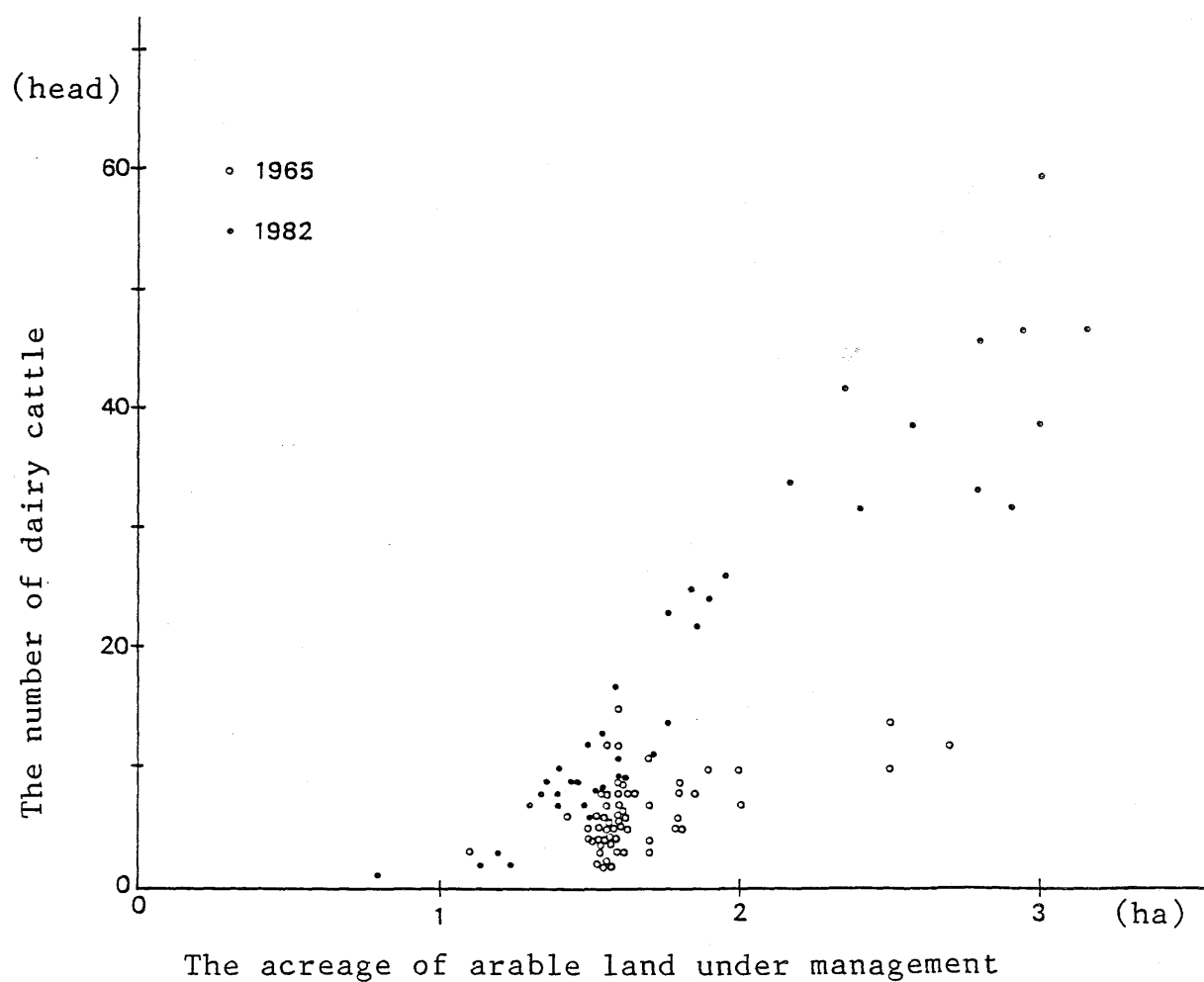


Figure 17 Changes of the Scale of Dairy Farming in Shinseikaitaku of Dejima Village, Ibaraki Prefecture
(Data sources: Movement statistics of dairy cattle, data from Dejima village office and hearing survey)

belonging to the specialized stage and others which remained at the mixed farming stage.

Viable dairy farms at the specialized stage amounted to 12, each of which kept 50 head of dairy cattle and managed three hectares of arable land. Four of them had already practiced viable dairy farming at the mixed farming stage in 1965, which proceeded to the mixed farming stage in 1971, and then to the specialized stage in 1975. These dairy farms enlarged all elements of dairy farming, i.e. the number of dairy cattle and arable land under management, agricultural family labor force, and dairy facilities and equipments, and promoted enlargement and specialization of dairy farming. Remaining eight dairy farms on the other hand, maintained the mixed farming in which rice played the leading role with dairy as a subsidiary section until about 1965, so that viable dairy farming had not yet been developed. By 1971 these farms developed viable dairy farming by increasing dairy cattle. This type of viable dairy farming, belonging to the mixed farming stage, continued by about 1975,⁶⁸ and then changed into that at the specialized stage. At that time, the dairy farms enlarged dairy facilities and equipments utilizing any kinds of subsidies and loans, and increased dairy cattle including "Hitohara shibori cows".

As mentioned above, viable dairy farms enlarged not only the number of dairy cattle and arable land but also agricultural family labor force. Although the family members engaged in agriculture were formerly a householder and his wife, they expanded to two generations including a farming successor and his wife. As the number of dairy cattle increased, furthermore, the self-supplied ratio of feed decreased. In 1982, viable dairy farms at the specialized stage depend on purchased formula feed which accounted for more than 60

percent of all feed required, so that the ratio of feeding cost to the value of sold milk increased to 60 percent.

Viable dairy farms which remained at the mixed farming stage amounted to five households, whose dairy cattle and arable land under management were 25 head and 1.8 hectares per farm respectively. These dairy farms managed the mixed farming where rice growing was the leading section with dairy as subsidiary until about 1965.⁶⁹ These dairy farms developed viable dairy farming since about 1975, and their farm income combination in 1982 was the "milk (70 percent) + rice (30 percent)" type. Enlarging the number of dairy cattle was one of direct conditions for the establishment of their viable dairy farming, in addition to the increase of arable land and farming successors. In this case, 20 head were the minimum requirement for viable dairy farming. The ratio of purchased feed to all feed was 40 percent and that of feeding cost to the value of sold milk was 30 percent, both of which were lower than those of viable dairy farms at the specialized stage. This was due to that production bases of feed were enlarged following the rice production adjustment, and that dairy farms avoided excessively enlarging the dairy farming scale.

On the other hand, 19 dairy farms did not develop viable dairy farming, all of them practicing mixed farming of dairy and rice. Twelve of them changed from the mixed farming with emphasis on rice to that with dairy as the major activity. But the enlargement of their dairy farming scale was restricted, for successors of household engaged in white-collar employment and householders were also temporarily employed in the Kandatsu Industrial Complex during the farmers' leisure season (Figure 16-c). This suggests the stagnation of dairy farming; the number of dairy cattle remained 10 to

18 head per dairy farm. The remaining seven households managed mixed farming in which rice was the leading section and dairy as subsidiary. Their dairy cattle, arable land, and agricultural family labor force unchanged since 1960. It was common that the successors were employed in white-collar jobs and householders engaged in temporary works, thus decreasing agricultural family labor force. Regarding feed utilization, the ratio of purchased feed to all was as well as 30 percent and that of feeding cost to the value of sold milk, 20 percent, remaining the level of 1965.

As agricultural family labor force decreased further and successors as well as householders became engaged in white-collar employment, many farms stopped keeping dairy cattle. Those gave up dairy cattle from 1965 to 1982 amounted to 26 households. In these farms, arable land under management and family members engaged in agriculture decreased, and non-agricultural income accounted for 50 percent of the entire farm income. Discontinuance of dairy farming was mainly caused by the decrease of agricultural family labor force and the lack of farming successors, but it was also due to their being unskilled dairy business and unsuccessful in enlarging operations by subsidies.

In the period of keeping large dairy herds the farms were divided into three types: viable dairy farms, the dairy farms without conducting viable dairy farming, and the farms which gave up dairy cattle. Viable dairy farms were further divided into those at the specialized stage and those at the mixed farming stage. Such differentiation of dairy farming was defined by the number of dairy cattle, arable land under management, dairy facilities and equipments, and family agricultural labor force. Especially family agricultural labor force was important. Dairy farms could develop viable dairy

farming with the increase of family labor, while they were forced to stop dairy family labor force decreased. In all cases, viable dairy farms played the central part in forming the dairy region.

2. Changes of landscape with the development of dairy farming

i) Settlement and road patterns

Road patterns changed with the development of dairy farming, but settlement patterns remained almost unchanged since the beginning of land reclamation in Shinseikaitaku (Figure 18). The road village pattern was clearly found where reclamation farms were built along the trunk road. It made a clear contrast to that of the reclamation settlements on volcanic slopes which presented the agglomerated settlement form at the beginning of land reclamation to provide facilities for constructing roads and electrical equipments, and gradually changed into the dispersed pattern.⁷⁰ Reclamation settlements on diluvial uplands such as Shinseikaitaku as well as those on alluvial lowlands such as Motoshinshimakaitaku did not have to form the dispersed patterns, but the reclamation farms were linearly arranged along the main roads from the beginning of land reclamation, as it was easy to construct and adjust roads and to supply electricity.

It is significant that settlement patterns have been almost unchanged. Although Shinseikaitaku has good socio-economic conditions for urbanization and industrialization, the expansion of housing and industrial developments has been restricted in this settlement where dairy region has been formed by viable dairy farms. It thus differs from other reclamation settlements situated in suburban areas of large cities which have been encroached by urban land use. The

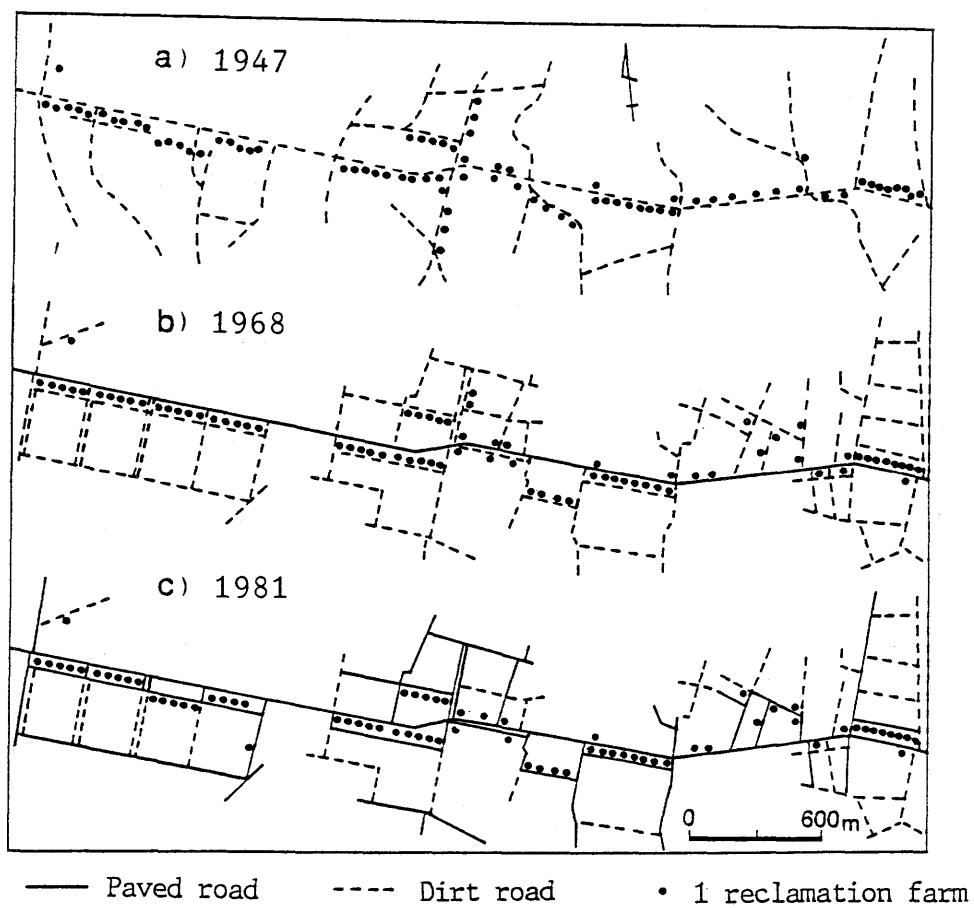


Figure 18 Changes of Settlement and Road Patterns in
Shinseikaitaku of Dejima Village,
Ibaraki Prefecture
(Data sources: Aerial photographs and field survey)

development of dairy farming has contributed to the persistence of the original settlement pattern in Shinseikaitaku.

Concerning the road pattern, the trunk road from the Kandatsu Station on Joban Line to Kashiwazaki settlement in the eastern end of Dejima Peninsula had already been constructed in the introduction stage of dairy farming. In the same period, narrow paths were mainly used for agricultural works while secondary roads were constructed with the progress of land clearing and the expansion period of dairy farming, the present road pattern of rectangular land division was built with the progress of secondary road constructions after the completion of land clearing and adjustment (Figure 18-b). This means that the road networks not only joined this settlement with other areas but connected one farm with others and the farm house with its arable land. Thus the completion of such road patterns facilitated agricultural efficiency.

From the expansion period of dairy farming to the period of keeping large dairy herds, milk yield increased and large-scale lorries were used for milk gathering and transportation. The trunk road was paved to provide good access for milk lorries and to prevent milk from churning and decay. In the period of keeping large dairy herds, furthermore, milk gathering systems changed into the individual operation by way of small-scale tank lorries,⁷¹ and secondary roads linking one farm to another were paved to facilitate individual milk gathering (Figure 18-c). Such improvement in road conditions promoted milk production not only in quality but in quantity, for the paved road prevented milk from churning and decay. Mechanization of agriculture was also promoted with the improvement of road and viable dairy farms began utilizing large-scale farm tractors.

Therefore, the improvement in road conditions was an important factor to support viable dairy farming.

ii) Landholding patterns

Landholding patterns and their changes are examined here in terms of the size, form and arrangement of arable land based. 1.5 hectares of arable land and 0.2 hectares of housing lot were provided to each reclamation farm at the beginning of settlement, farmland was consolidated to blocks based on a unit of "group (Kumi)" for practicing cooperative cultivation. Farmland blocks were surrounded with windbreak forests of chestnuts and red pines to preserve arable land from soil erosion of northwesterly monsoon, representing the landscape unique to this reclamation settlement. As arable land and secondary road patterns were improved, landholding patterns showed in Figure 19-a was formed since about 1950 when the land reclamation was completed and cooperative cultivation was discontinued.

Looking at the landholding patterns of Shinseikaitaku in 1965, farmland was divided into many rectangular strips along the trunk road. Each reclamation farm held one strip, whose frontage and depth were 50 meters and 340 meters respectively. Most reclamation farms used 0.2 hectares, facing the trunk road, for their housing and used the adjoining 1.5 hectares for farming. As the arable land was connected to the farmhouse, farming activities were largely facilitated. The acreage of arable land was uniform among reclamation farms. Such a homogeneous landholding pattern was maintained throughout the introduction period as well as the expansion period of dairy farming, though some reclamation farms enlarged their arable land by 0.3 hectares by clearing the adjoining forest.

In the period of keeping large dairy herds, the hierarchical differentiation of dairy farming was

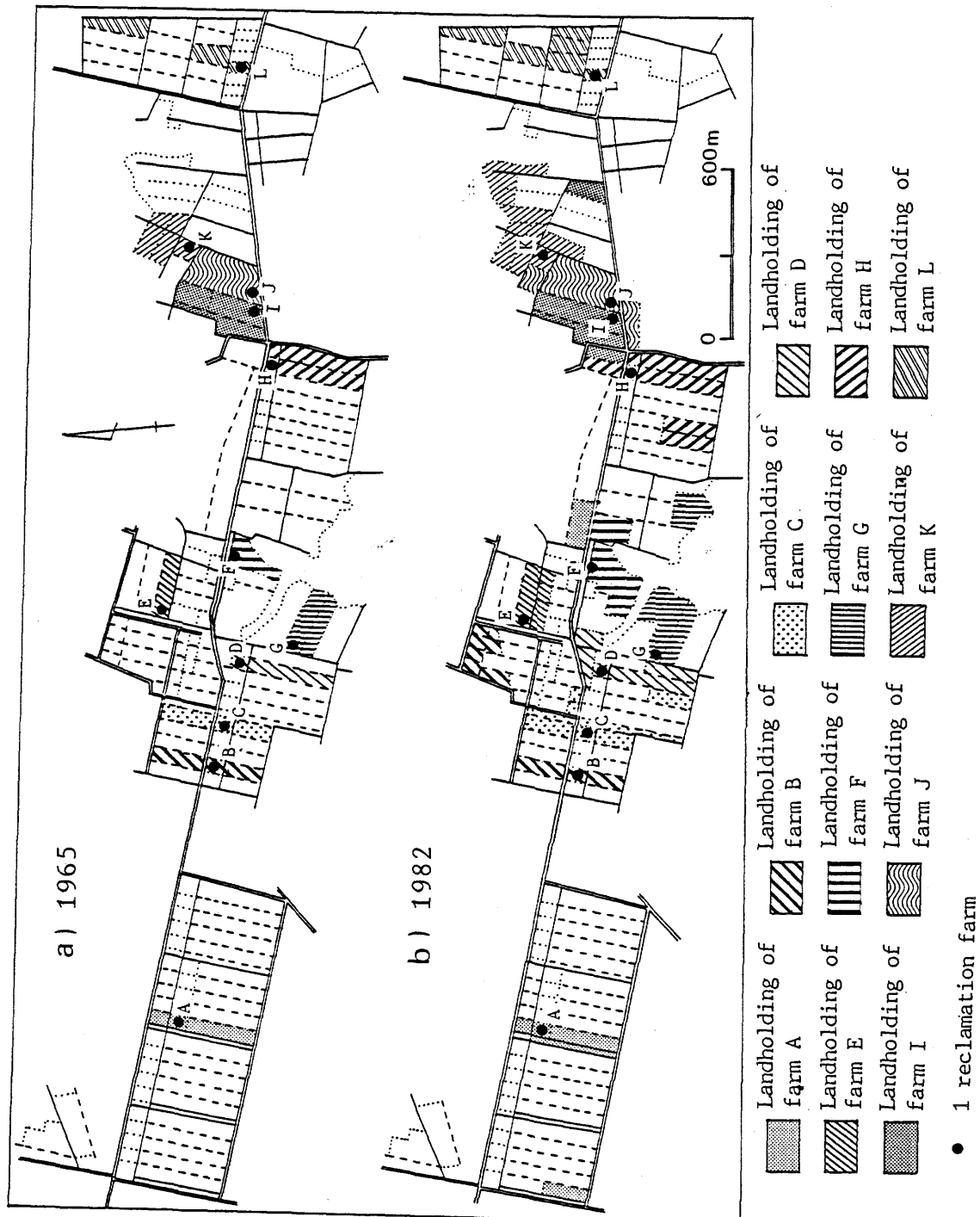


Figure 19 Changes of Landholding Patterns in Shinseikaitaku of Dejima Village, Ibaraki Prefecture
(Data sources: Cadastral maps, cadaster and hearing survey)

reflected in landholding patterns. According to Figure 19-b which shows landholding patterns of Shinseikaitaku in 1982, viable dairy farms at the specialized stage accumulated and enlarged their arable land under management with increasing specialization in dairy farming. Viable dairy farms at the mixed farming stage and the dairy farms without viable dairy farming, however, maintained the original landholding patterns. Therefore they managed 1.5 to 1.8 hectares of owned arable land.

On the other hand, the farms which stopped keeping dairy cattle, with the decrease of family agricultural labor, lent out a part of their arable land to viable dairy farms at the specialized stage, and their farmland was reduced. In leasing land viable dairy farms belonging to the same "group (Kumi)" were preferred most, and then nearer viable dairy farms were welcomed. Therefore viable dairy farms at the specialized stage could enlarge their arable land without fragmenting parcels, which rented 0.8 hectares on the average from two part-time farms. For land rent these viable dairy farms generally undertook plowing in paddy fields, rice transplanting and harvesting.

As mentioned above, changes of landholding patterns could be understood as an adaptation process of viable dairy farms in the dry field farming regions of outer suburbs of large cities. Since it was difficult to purchase and enlarge arable land, land leasing was a common practice. With the increase of dairy cattle and the specialization in dairy farming, viable dairy farms in Shinseikaitaku enlarged their arable land by leasing land from part-time farms. Viable dairy farms in these areas were thus supported with the existence of part-time farms. In the reclamation settlements such as Shinseikaitaku, could easily lease land because of the

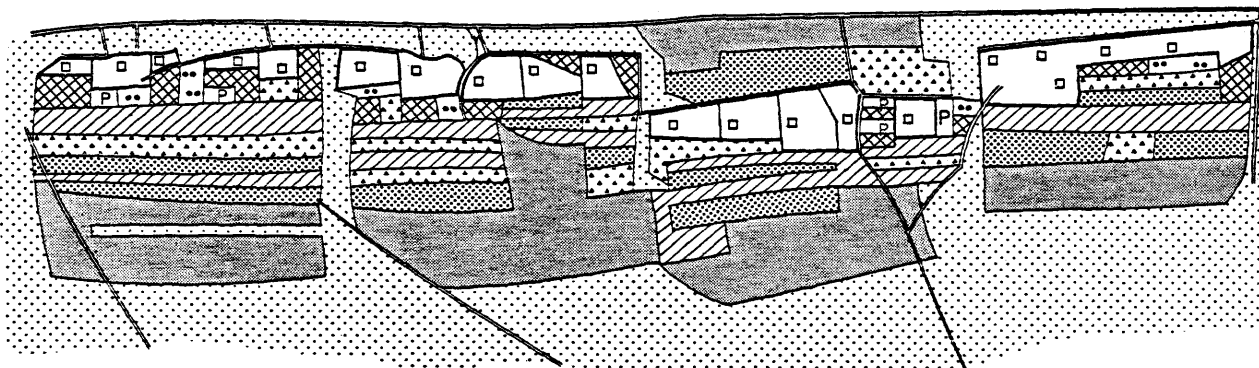
strong regional unity among farmers and of the aggregated farmland.

iii) Land use patterns

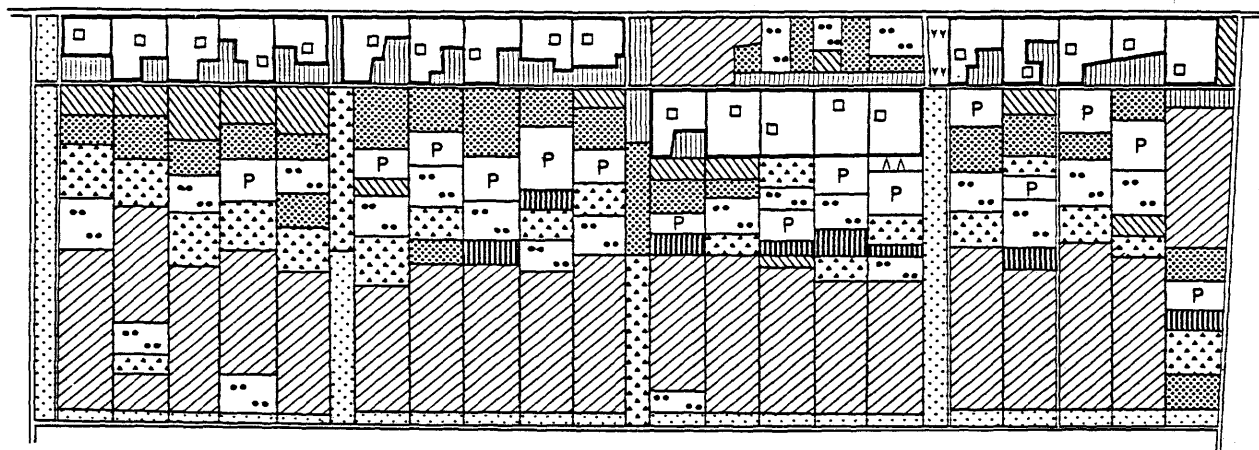
Land use is an important landscape element and reflects man's activities on the earth surface. Figure 20 indicates land use patterns of Shinseikaitaku in June of 1947, 1955 and 1968, which were restored by aerial photographs and interviews. The 1947 land use (Figure 20-a), just after the settling, shows that each reclaimed land existed in a unit of "group (Kumi)" and was surrounded with coppices. The reclamation farms began clearing trees around their houses and proceeded further in land, so that farm land, land under clearing, and forests were successively arranged with the distance from the housing lots. The arable land owned by each reclamation farm was agglomerated into a block based on a unit of "group (Kumi)", where upland rice, corn, and sweet potatoes were consecutively cultivated in strips disregarding landholding boundaries. This was due to the cooperative cultivation by a "group (Kumi)" to the "through cropping (Toshi kosaku)" which formed ridges of each owned arable land in lateral lines. Such crops and crop rotation systems were beforehand decided among farms at the reclamation association and cooperative groups, land use patterns in this reclamation settlement was uniform.

As land clearing was completed, arable land became used in a farm unit. According to Figure 20-b which shows the land use of June, 1955, such subsistence crops as upland rice, corn, and sweet potatoes were mainly cultivated in each reclamation farm as in the past, but most farms began cultivating cash crops such as peanuts and potatoes. Forage crops, hardly cultivated in the spring and summer, amounted to only 0.4 hectares per farm. This was due to that forage crops were mainly

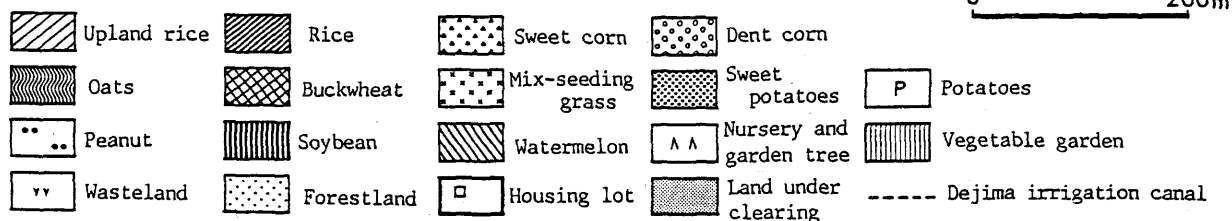
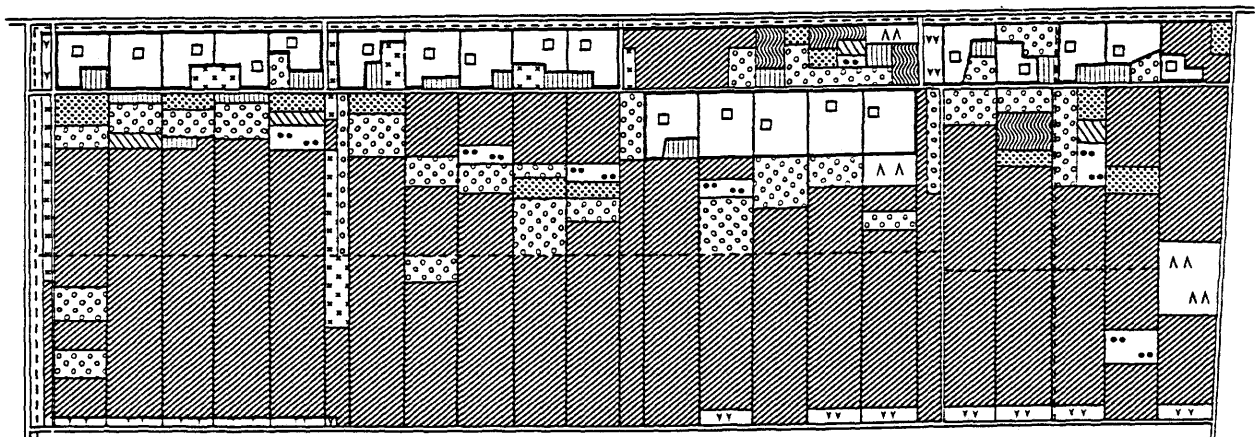
a) June, 1947



b) June, 1955



c) June, 1968



0 200m

Figure 20 Changes of Land Use Patterns in Shinseikaitaku of Dejima village, Ibaraki Prefecture
(Data sources: Aerial photographs, ledgers of reclamation farming and hearing survey)

cultivated in the fall and winter as in the case of wheat and barley, and that self-supplied feed for two to three dairy cattle were sufficiently supplied with the small-scale cultivation of roughage, wild grass, and residual farm products. Although the "through cropping (Toshi kosaku)" landscape disappeared with the discontinuance of cooperative cultivation, cultivated crops and cropping systems, were relatively uniform among the reclamation farms, because they were beforehand consulted at the Shinsei Reclamation Agricultural Cooperative Association and at each group. Therefore, the homogeneous pattern of land remained in Shinseikaitaku.

The homogeneous land use pattern mentioned above changed completely with the completion of the Dejima Irrigation Canal in 1958, when rice began to play the central role in forming the new land use pattern. According to Figure 20-c showing the land use in June, 1968, rice occupied about 80 percent of all arable land. The rest of arable land was planted in forage crops such as dent corn and oats. In other words, as water supply conditions improved, a variety of cash crops formerly cultivated were replaced by rice. This was due to that rice was an competitive cash crop in terms of production techniques as well as producers' prices. Five head of dairy cattle raised at each dairy farm demanded concentrate, so that dent corn and oats increased in the dry field. But rice straw, mix-seeding grass in the drained paddy field, and winter cropping Swedish turnip provided the major self-supplied feed. Thus the land use pattern in the expansion period of dairy farming was determined by the crop rotation system of rice and forage crops.

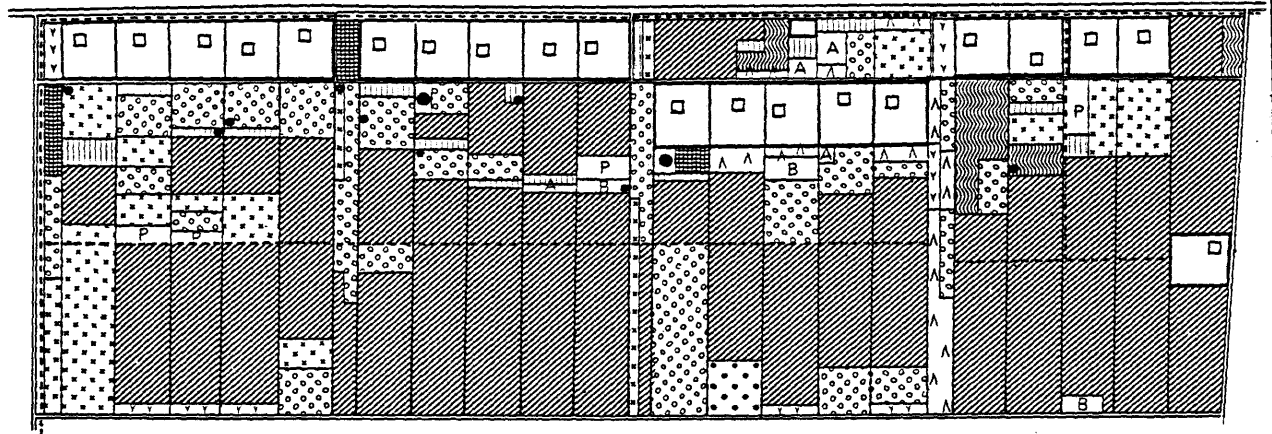
In the period of keeping large dairy herds, the rice production adjustment and the hierarchical

differentiation in agricultural management and landholding promoted the differentiation of land use among farms (Figure 21). Namely, viable dairy farms at the specialized stage reduced or discontinued rice growing, while enlarging forage crop acreage by renting parcels from part-time farmers. Although such farmland was generally leased throughout the year, some viable dairy farms seasonally rented the paddy field after harvest from October to April to grow winter forage crops. Similarly, viable dairy farms at the mixed farming stage tended to reduce rice areas and enlarged forage crops. On the other hand, dairy farms which did not yet develop viable dairy farming reduced rice and enlarged forage crop acreage within the quota of rice production adjustment. Former dairy farms discontinued forage crop cultivation and were specialized in rice and home-consuming vegetables. These farms rented out more than half of their arable land to viable dairy farms, which was utilized for the forage crop cultivation.

On the whole, the land use pattern in the period of keeping large dairy herds was characterized by the reduction of rice growing and the enlargement of forage crop cultivation. Especially in the autumn and winter forage crops predominated in land use presenting a uniform landscape (Figure 21-b), while in the spring and summer rice fields remained widely in spite of the growing forage crops. This was due to that rice was maintained by labor saving management utilizing agricultural machineries and contract farming and that only 12 viable dairy farms, accounting for 16.4 percent of all the reclamation farms, discontinued rice cultivation. Therefore non-agricultural land use could not encroach upon the land use of Shinseikaitaku.

- iv) Arrangement patterns of dairy facilities and equipments

a) May, 1981



b) December, 1981

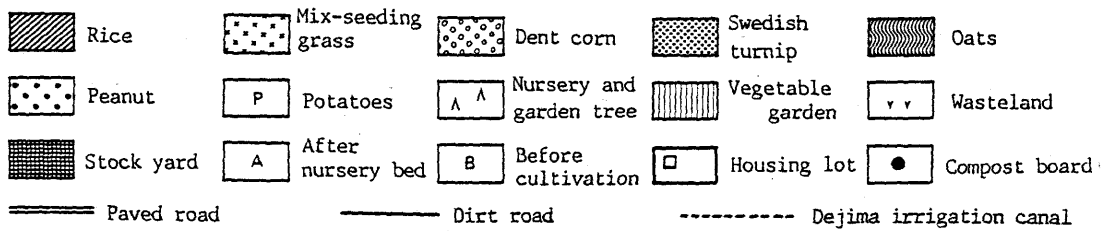
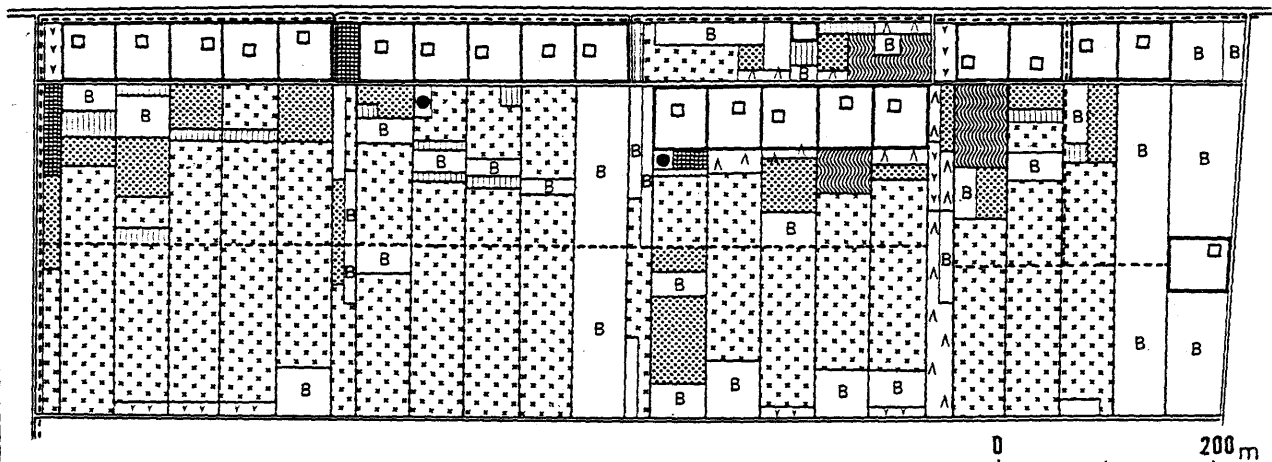


Figure 21 Recent Land Use Patterns in Shinseikaitaku of
Dejima Village, Ibaraki Prefecture
(Data source: Field survey)

Table 5 Introduction of Dairy Facilities, Equipments and Cattle in the Sample Farms of Shinseikaitaku, Dejima Village of Ibaraki Prefecture

Stage of management	The specialized stage					The mixed farming stage		
Sample farms Year	Viable dairy farms					Non-Viable dairy farms		
	A	B	C	D	E	F	G	H
Before 1964	B.S.T.C.	B.S.T.C	B.S.T.C	B.S.T.C	B.S.T.C	B. S. T	B. S. T	B. S. T
1965	—	—	—	1	—	1	—	—
1966	B' 2	M	1	—	M	—	—	—
1967	UC.M 2	UC. 2	UC.M	UC.M	UC. 1	UC.M	UC.M 3	UC.M 2
1968	—	B'.....3	—	3	2	1	1	—
1969	T 1	1	—	—	—	1	—	—
1970	—	—	B' 2	—	—	—	—	2
1971	—	T 3	—	B' 1	1	S	—	—
1972	S 3	2	1	2	S 2	1	S 1	2
1973	R 4	5	.....3	1	Ⓢ 2	—	B' 1	B' 2
1974	BC.S 3	R 4	2	S	T	B'	—	S 1
1975	Ⓢ P.N.2	ⓈP.BC.N	R.S. 4	BC. 1	S. 1	1	—	—
1976	2	2	ⓈT.N.10	2	1	—	2	—
1977	—	S 3	3	T.....3	.....2	—	—	—
1978	S 2	S 2	BC.P.S.1	2	BC.P. 3	2	—	2
1979	—	2	S 3	—	N 1	—	1	—
1980	3	2	7	1	—	—	—	—

Note: B. Cow shed, B'. Extension of cow shed, Ⓢ. Rebuilding of cow shed, T. Compost shed and board, S. Silo, C. Power cutter, R. Farm tractor, UC. Unit cooler, M. Bucket milker, P. Pipeline milker, BC. Bulk milk cooler, N. Barn cleaner, the figure shows the number of introduced dairy cattles, and a broken line shows the year when viable dairy farming was established.
(Data sources: Movement statistics of dairy cattles and hearing survey)

Table 5 indicates the years of introduction of dairy facilities, equipments, and cattle in sample farms of Shinseikaitaku. It is clear that cow sheds, silos, and compost sheds were uniformly arranged in each dairy farms from the introduction period of dairy farming to the first half of the expansion period. A standard dairy farm owned a cow shed for keeping five to fifteen dairy cows and two to three small-scale pit silos. Compost sheds, constructed all at once in the housing lot of each dairy farm utilizing reclamation farming funds around 1955, played an important part in improving soil fertility. Furthermore, the power cutter was one of the dairy equipments which diffused to dairy farms in this period. Large-scale farm tractors owned by the Shinsei Reclamation Agricultural Cooperative Association were communally utilized.

In the latter half of the expansion period of dairy farming, with the increase of dairy cattle, bucket milkers and unit coolers were established within the cow shed in order to save milking labor. These dairy equipments were all together established utilizing the agricultural modernization funds provided to the Shinsei Reclamation Agricultural Cooperative Association for improving the milk quality. Although this partly reflected the powerful leadership of directors in Shinseikaitaku, it was also important for the establishment of dairy facilities and equipments that this reclamation settlement was influential in the Tsuchiura Dairy Cooperative Association as its core member and had better opportunity to take many kinds of subsidies and loans. The arrangement patterns of dairy facilities and equipments were homogeneous until the end of the expansion period of dairy farming, differences among the farms being minimal. Some dairy farms, however, extended cow shed and newly constructed compost

boards while increasing dairy cattle. Such farms played a leading role in promoting viable dairy farming.

The homogeneous arrangement pattern of dairy facilities and equipments mentioned above completely disappeared in the following period. Viable dairy farms increased cows since 1971, promoting specialization of dairy farming. Consequently, the arrangement of dairy facilities and equipments considerably changed together with the landholding and land use patterns. In viable dairy farms at the specialized stage, cow sheds were rebuilt into stanchion stall barns accommodating 50 to 80 dairy cows, where barn cleaners, pipeline milkers, and bulk milk coolers were furnished. In addition, large-scale farm tractors were introduced and nine to twelve large-scale silos were constructed within the housing lot of each viable dairy farm. Enlargement of dairy facilities and equipments, a condition of specialization in viable dairy farming, was realized by subsidies and laws such as agricultural modernization funds. Such financial support was utilized from 1972 to 1975 when farming successors were ensured in dairy farms.

Viable dairy farms at the mixed farming stage were relatively behind in expanding dairy facilities and equipments, because dairy cattle increased slowly. Although these dairy farms purchased many dairy cattle and newly equipped bulk milk coolers and compost boards with the development of viable dairy farming, the expansion of dairy facilities and equipments remained minimized and only a few dairy farms rebuilt cow sheds and introduced pipeline milkers and barn cleaners. In other dairy farms without conducting viable dairy farming, the number of dairy cattle hardly enlarged even in the period of keeping large dairy herds, and they purchased dairy cattle only for the renewal of milking

cows. Therefore the arrangement pattern of dairy facilities and equipments was unchanged from that in the expansion period of dairy farming, though a part of these dairy farms extended the cow sheds.

As mentioned above, the progress of viable dairy farming requires the expansion of dairy facilities and equipments together with the increase of dairy cattle. Especially, cow sheds needed to be rebuilt and extended and milking equipments be introduced. Furthermore, for the specialization of viable dairy farming dairy facilities and equipments were to be enlarged with the increase of dairy cows. For example, cow sheds were rebuilt to stall barns accommodating more than 50 dairy cows and milkers were changed from the bucket type into the pipeline type.

3. Conditions of viable dairy farming and their regional characteristics

Two types of viable dairy farming were found in Shinseikaitaku: one is at the mixed farming stage and the other at the specialized stage. It was also confirmed that viable dairy farming developed from the mixed farming stage to the specialized stage. The author examined such elements as farm household, dairy cattle, land, and dairy facilities and equipments as spatial organized in the development process. In other words, the establishment and development bases of viable dairy farming were analyzed by examining changes of the spatial organization of dairy farming systems.

Figure 22 indicates the of change of arrangement of agricultural facilities, arable land, and its land use in a sample viable dairy farm at the mixed farming stage. The agricultural management of this farm changed from mixed farming in 1968 where rice was the primary section and dairy farming a subsidiary, into viable

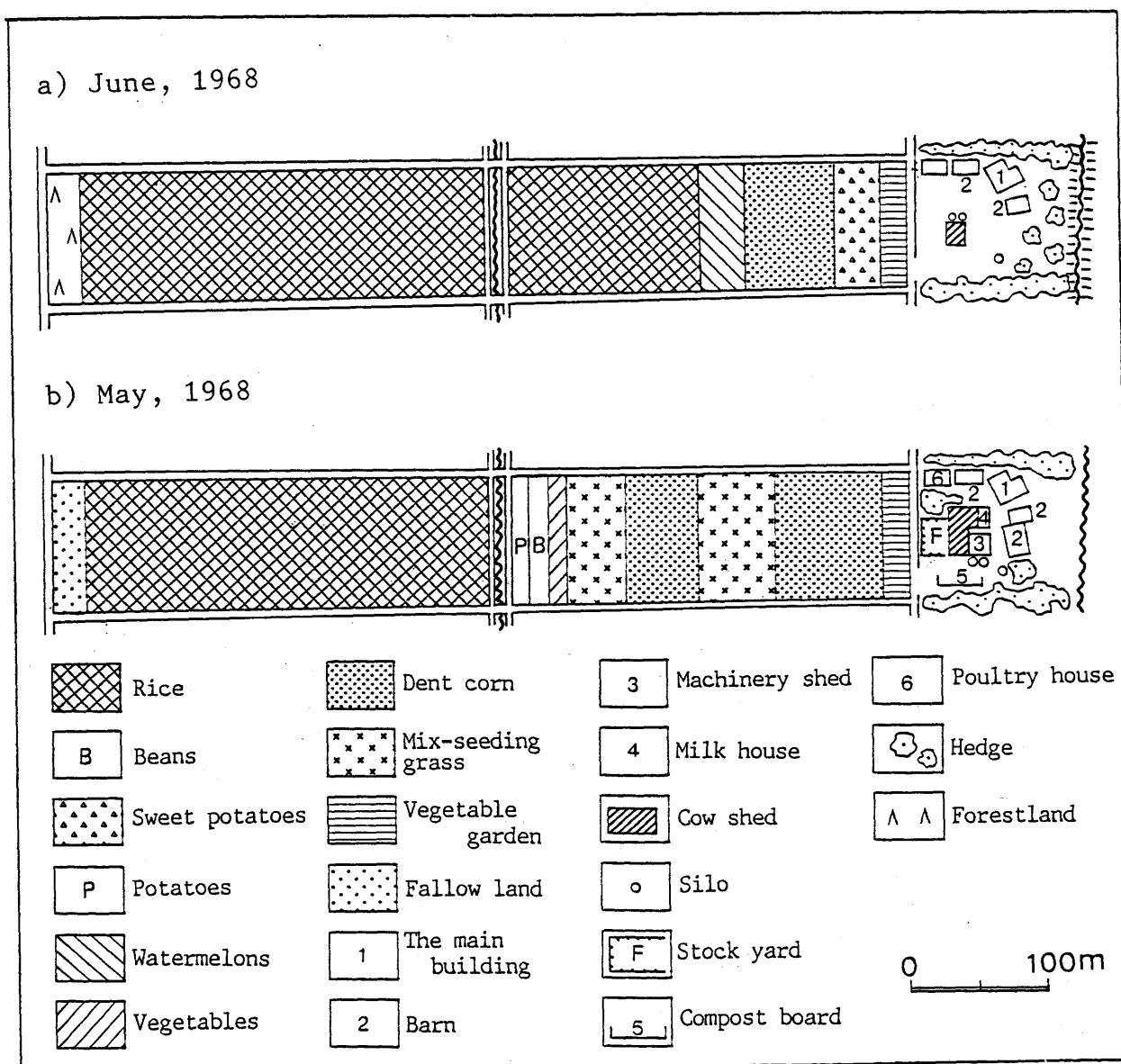


Figure 22 Changes of Arrangement of Agricultural Facilities, Arable Land and its Land Use in a Sample Viable Dairy Farm at the Mixed Farming Stage in Shinseikaitaku of Dejima Village, Ibaraki Prefecture (Data sources: Aerial photographs and field survey)

dairy farming in 1981. In this case, the increase of dairy cattle was the key factor for the establishment of viable dairy farming, which required the expansion of dairy facilities and equipments, especially the extension of cow sheds. But this expansion was limited within the housing lot so that the dairy farms avoided overinvestment in dairy facilities and equipments. Feed production bases were also enlarged in three ways: the enlargement of grassland by the land clearing and leasing the intensification of land use by adjusting cropping system and by consolidating farmland, and the increased dependency on purchased feed. These ways reflected locational conditions of dairy farming.

In Shinseikaitaku, dairy farms, each owning agglomerated parcels, had difficulty in enlarging the arable land because of their location in dry field farming regions of outer suburbs metropolitan Tokyo. In addition, the dairy farms depended substantially on purchased feed which was not cheaply available, and thus the increase of dairy cattle was limited. The feed production bases had to be enlarged by intensifying arable land use. Rice and forage crops became dominant in the rotation system and forage crops cropped double and tripple a year. These forage crops and rice straw as self-supplied feed for keeping dairy cattle.

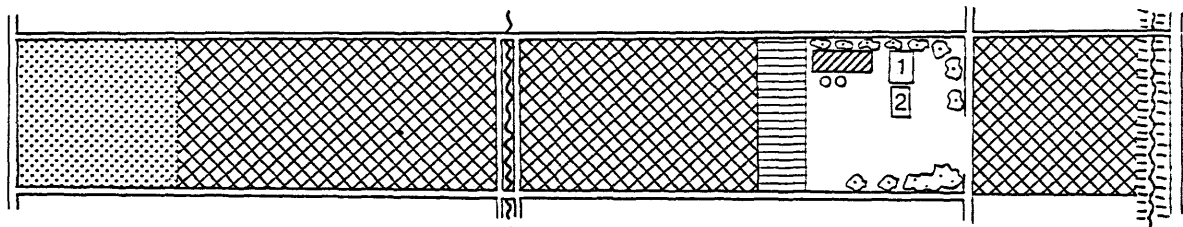
In viable dairy farms at the mixed farming stage, the increase of dairy cattle, the minimum expansion of dairy facilities and equipments, and the enlargement of feed production by way of arable land consolidation and intensification, functioning together as a system, formed the development basis of the viable dairy farming. Dairy cattle tended to reduce with the decline of family agricultural labor, while it increased with the expansion of family labor. But viable dairy farming at the mixed farming stage was established when family

agricultural labor of a householder and his wife was ensured.

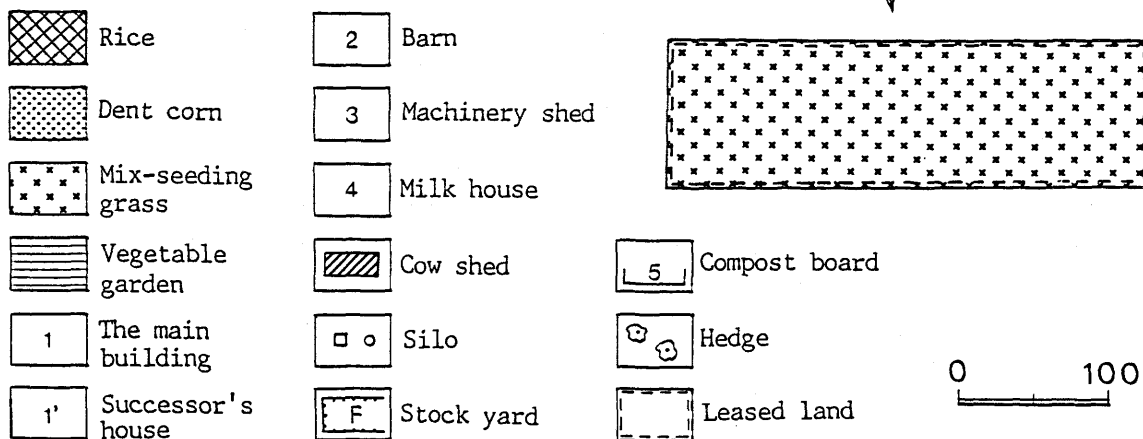
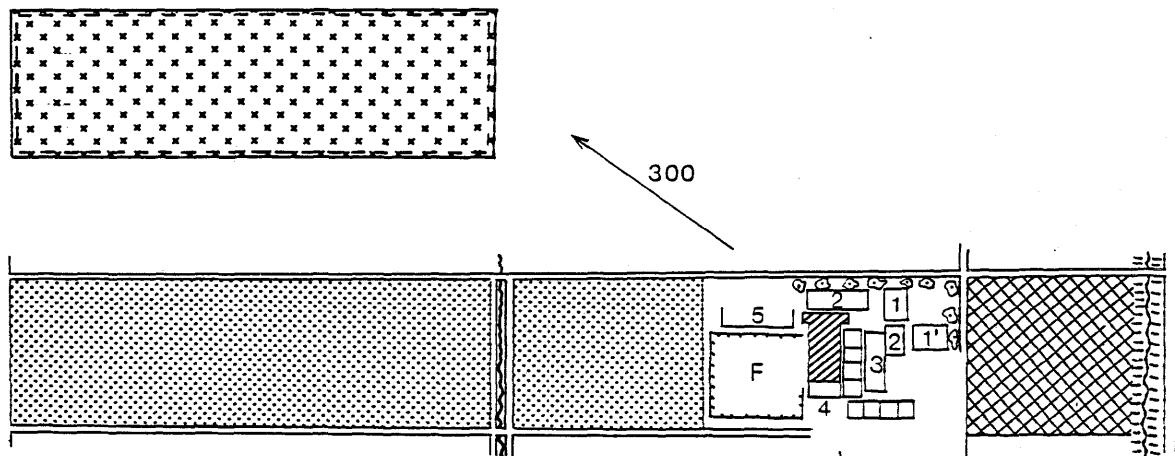
On the other hand, Figure 23 indicates the change of agricultural facilities, arable land, and its land use in a sample viable dairy farm at the specialized stage. This farm became specialized in viable dairy farming from 1968 to 1981 by further enlarging the bases of viable dairy farming. Viable dairy farms increased dairy cattle with the enlargement of family agricultural labor over two generations including farming successors. At the same time, as dairy cows increased, usual dairy facilities and equipments were replaced by larger ones, and the housing lot of each dairy farm expanded into arable land in order to accommodate them. As a matter of course, the enlargement of dairy facilities and equipments was related with the increase of family labor, for the existence of farming successors provided better access to many kinds of subsidies and loans. Furthermore, the feed production bases had to be enlarged by intensification of arable land use as well as the advancement of lease farming. Large-scale farm tractors were utilized to save labor, and large-scale silos were constructed in each housing lot.

In viable dairy farms at the specialized stage, therefore, development bases of viable dairy farming was established by family agricultural labor including the successor and his wife, the increase of dairy cattle, the expansion of dairy facilities and equipments, and the enlargement of arable land by lease farming, all of which functioned together forming a system. These development bases were organized within the enlarged spatial framework as contrasted to that at the mixed farming stage confined to the arable land and housing lot. This differs from the viable dairy farming in alluvial lowlands where the specialization of viable

a) June, 1968



b) May, 1981



0 100 m

Figure 23 Changes of Arrangement of Agricultural Facilities, Arable Land and its Land Use in a Sample Viable Dairy Farm at the Specialized Stage in Shinseikaitaku of Dejima Village, Ibaraki Prefecture

Note: The figure attached to arrows shows distance(meters) the housing lot to each arable land.

(Data sources: Aerial photographs and field survey)

dairy farming proceeded depending on cheaply purchased feed as viable dairy farms maintained usual spatial framework of arable land and housing lot.

The development process of viable dairy farming in Shinseikaitaku is summarized in Figure 24. Agricultural management of viable dairy farms developed from non-viable dairy farming to viable dairy farming at the mixed farming stage, by intensifying the spatial organization of farm households, dairy cattle, land, dairy facilities and equipments while maintaining the original framework of landholding. This was also reflected in the feed production. In keeping 10 to 15 dairy cattle, self-supplied feed accounted for about 80 percent of all the feed required. As viable dairy farming proceeded to the specialized stage, the spatial framework indigenous to the original reclamation settlement disappeared and the spatial organization of farm households, dairy cattle, land, dairy facilities and equipments was expanded and intensified. This was enabled by the existence of part-time farms. After all, as it was difficult for viable dairy farms to expansion their owned land, the area under cultivation was enlarged by leasing parcels from part-time farms.

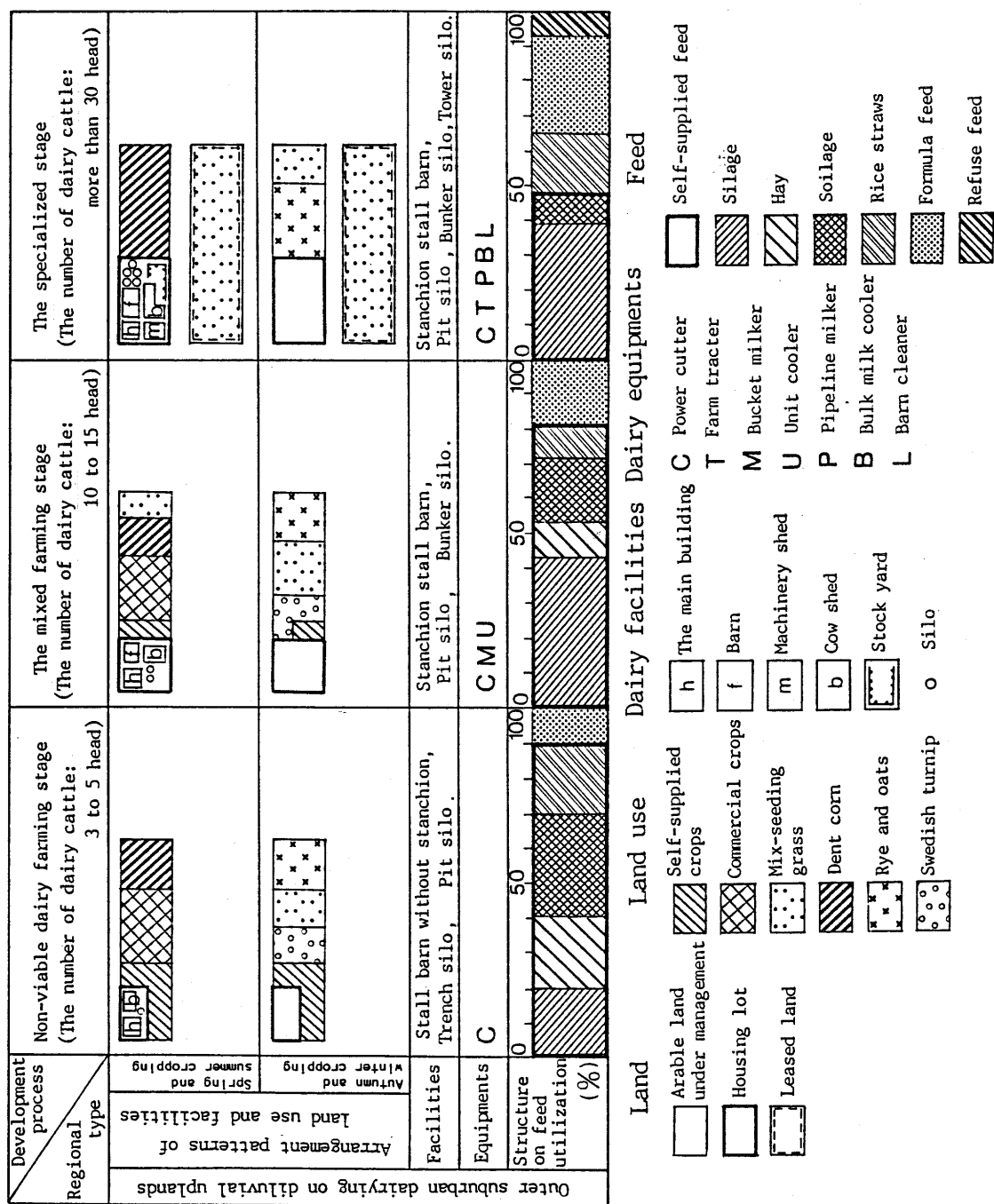


Figure 24 The Development Process of Viable Dairy Farming in Shinseikaitaku of Dejima Village, Ibaraki Prefecture

CHAPTER V

DEVELOPMENT OF VIABLE DAIRY FARMING IN REMOTE AREAS OF TOKYO METROPOLIS

1. Changes of agricultural management with the development of dairy farming

This chapter attempts to examine the change of agricultural management with the development of dairy farming in Oyaharakaitakuchi, Naganohara town of Gunma prefecture. Figure 25 shows the transition of dairy cattle and dairy farms and the acreage of cultivated land by main crops under the control of the Kita-Karuizawa Reclamation Agricultural Cooperative Association (the present-day Kita-Karuizawa Agricultural Cooperative Association). The Kita-Karuizawa Reclamation Agricultural Cooperative Association was the organization integrating six reclamation settlements of Oyaharakaitakuchi, Kanra, Gunmakogen, Hairon, Kosuge and Asamakogen, situated in the Kita-Karuizawa area on the northern volcanic slopes of Mt. Asama. According to Figure 25, the development process of dairy farming is divided into four periods. The first period is from 1947 to 1954 when land settling and reclamation started and subsistence farming was the leading economic activity. Second is from 1955 to 1963 when dairy farming spread into all reclamation farms and the mixed farming combining dairy with vegetables was practiced at large. Third is the expansion period of dairy farming from 1964 to 1972 when the number of dairy farms decreased and that of dairy cattle and the acreage of forage crops increased rapidly. Then followed is the period of keeping large dairy herds after 1973 when dairy cattle and the forage crop acreage continued to increase but the number of dairy farms became stable.

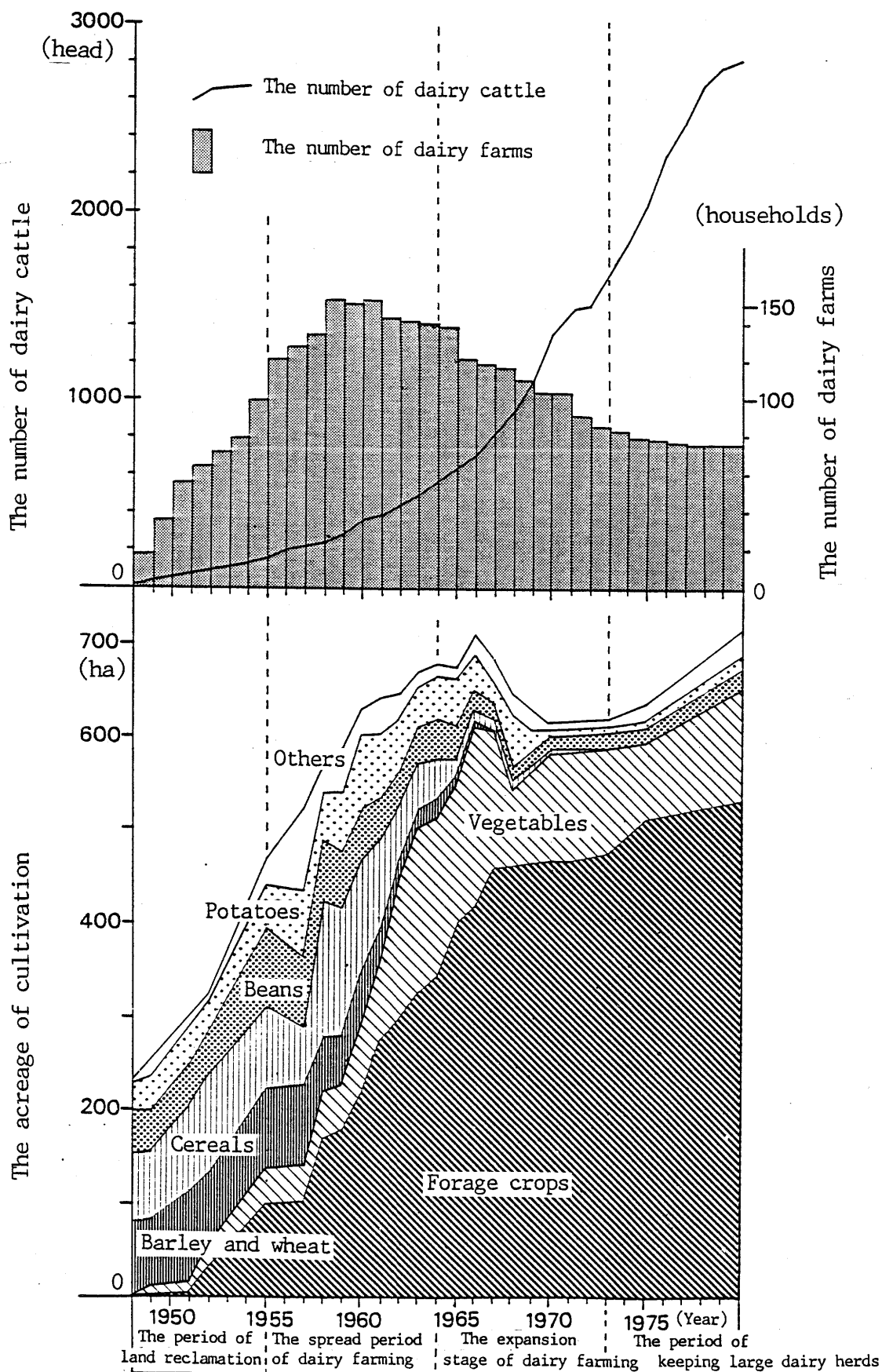


Figure 25 Changes of the Number of Dairy Cattle and Dairy Farms, and the Acreage of Cultivation by Main Crops in the Kita-Karuzawa Reclamation Agricultural Cooperative Association of Naganohara Town, Gunma Prefecture
(Data sources: Investigation of reclamation farming results, agricultural censuses and movement statistics of dairy cattle)

Oyaharakaitakuchi is the center of dairy farming in the Kita-Karuizawa area.

i) The period of land reclamation (1947~1954)

Twenty-three farms of the Oyahara Reclamation Farming Association settled in the Kita-Karuizawa area on the northern volcanic slopes of Mt. Asama in March, 1947, and started clearing forests of larch and sasa albo-marginata. Oyaharakaitakuchi, where Prince Kitashirakawa managed "pasture of prince (Miyasama bokujo)" in the middle of the Meiji era,⁷² is located at the altitude of 1,000 to 1,200 meters on Mt. Asama. The settled farmers were repatriates from Manchuria's Ekibakaitaku, who originally came from the Kise village of Gunma prefecture (the present-day Kise area of Maebashi city, Gunma prefecture).⁷³ The number of farms in Oyaharakaitakuchi increased to 47 by 1948. These farms held 13 hectares per farm and raised such livestock as horses, dairy cattle, sheep and pigs in Manchuria. Therefore, they intended to practice livestock farming in Oyaharakaitakuchi, though their main works by around 1950 were the cultivation of subsistence crops and charcoal making with land clearing.

In Oyaharakaitakuchi, 3.7 hectares were distributed to each settled farm, which were individually cleared with plough and hoe, while a horse was also distributed to every four farms for clearing land cooperatively. The farmland cleared by 1950 was 630 hectares, which accounted for 40.7 percent of the planned farmland, showing good progress in land clearing. In the arable land, subsistence crops such as wheat, barnyard millet, soybeans, azuki beans, and potatoes were cultivated. The yields per 10 ares of wheat, soybeans and potatoes were 76.7 kilograms, 84.9 kilograms, and 705 kilograms respectively, which corresponded to less than 50 percent

of the yields in lowland villages.⁷⁴ This was partly due to the infertile land of Oyaharakaitakuchi consisting are of volcanic sand and lapilli soils,⁷⁵ and also due to the cool climate similar to that of Sapporo city in Hokkaido; the annual highest and lowest temperatures being 30 °C and -20 °C respectively and the frostless period lasting only 100 days. The settled farms obtained cash incomes from the clearing subsidy of 3,000 yen per 10 ares, charcoal making, and temporary employment in engineering works, because their farming was devoted to subsistence crops.

The commercial farming in Oyaharakaitakuchi started in about 1948 when seed potato and radish were cultivated as cash crops. Especially seed potatoes were cultivated widely by the reclamation farms of the Kita-Karuizawa area since the establishment of the Potato Foundation Stock Seed Farm in Tsumagoi village of Gunma prefecture. The Potato Foundation Stock Seed Farm provided seed potatoes and technical assistance with the reclamation farms. Dairy farming in Oyaharakaitakuchi also started in 1948. The establishment of the Kita-Karuizawa Reclamation Agricultural Cooperative Association being a turning point, 17 dairy cattle were purchased from Hokkaido and Chiba prefectures utilizing reclamation farming funds to improve land fertility and increase commercial productivity with stable manure. After that, dairy cattle were purchased utilizing the financial supports to found diversified farming with livestock. In 1952 the number of dairy cattle amounted to 47 in Oyaharakaitakuchi and to 107 in the Kita-karuizawa area as a whole. The number of dairy farms in the Kita-Karuizawa area, however, amounted to only 80 in the same year, accounting for some 50 percent of all the reclamation farms. This was because dairy farming in the early period was practiced by those which had experience

in dairy farming in the Manchuria reclamation.⁷⁶

Although dairy farming did not diffuse throughout the Kita-Karuizawa area, cash crop cultivation spread to every farm in the reclamation settlements. Regarding the acreage of cultivated land by crops in the Kita-Karuizawa area, radish and seed potatoes covered were 24.0 hectares and 28.1 hectares respectively, and that per farm was 15 ares and 17 ares respectively. The acreage of beans amounted to 91.8 hectares in the Kita-Karuizawa area, a half of which was planted in such cash crops as soybeans and azuki beans. Each farm applied 40 ares for bean cultivation. The reclamation farm cleared 2.2 hectares for arable land and one third of it was used for cash crops. The remaining two third of the entire arable land was for such subsistence crops as wheat, cereals, and potatoes. Thus subsistence farming was the major part of dry field farming. Moreover, although dairy farms grew forage crops in addition to subsistence and cash crops, forage crops occupied only 40 ares per dairy farm. In this period, agriculture in the Kita-Karuizawa area including Oyaharakaitakuchi was characterized by subsistence farming.

ii) The spread period of dairy farming (1955~1963)

The reclamation farms were considerably damaged from nation-wide cold weather in 1953 and 1954, because agriculture in the Kita-Karuizawa area including Oyaharakaitakuchi depended largely on the cultivation of dry field crops. There were no yields of wheat, cereals, and beans and the harvest of both potatoes and vegetables was both less than 30 percent of that in the normal year. These cold weather damages being a turning point, agricultural management policies of the Kita-Karuizawa Reclamation Agricultural Cooperative Association changed from dry field farming to grassland farming, encouraging all the reclamation farms in the

Kita-Karuizawa area to practice dairy farming. Furthermore, the Kita-Karuizawa area was designated in 1955 as an intensive dairy region, so that dairy farming largely spread into this area.⁷⁷ Utilizing reclamation farming funds and subsidies after being designated as intensive dairy region, the number of dairy cattle increased in the Kita-Karuizawa area, amounting to 209 in 1956, which doubled that in 1952. As dairy cattle increased, dairy farms in the Kita-Karuizawa area increased rapidly to 135 in 1956, which accounted for 82.3 percent of all the reclamation farms. From 1958 to 1960 the number of dairy farms reached the peak of 153. Moreover, the income from sold milk in 1956 increased to five million yen, tripling that in 1952.

With the progress of land clearing in Oyaharakaitakuchi, the acreage of arable land amounted to 120.2 hectares in 1960, which accounted for 80 percent of the planned farmland. Although the average farmland per farm was 2.8 hectares, the area under cultivation varied from 2.2 to 4.2 hectares among the reclamation farms reflecting the progress of land clearing. A standard reclamation farm held 3.2 hectares of arable land where subsistence crops such as wheat, cereals, and potatoes (0.6 hectares), cash crops such as seed potatoes, sweet corn, and radishes (1.2 hectares), and forage crops (1.4 hectares) were cultivated (Figure 26-a). Especially, the forage crop fields in 1960 were 3.5 times as much as that in 1952, for dairy farming, encouraged by the Kita-Karuizawa Reclamation Agricultural Cooperative Association, became undertaken in most of the reclamation farms. This increase was related to the enlargement of dairy cattle in Oyaharakaitakuchi. In 1960 141 head were counted, which were three times as many as those in 1952. Dairy cattle per farm varied from one to eight, the average being 3.3

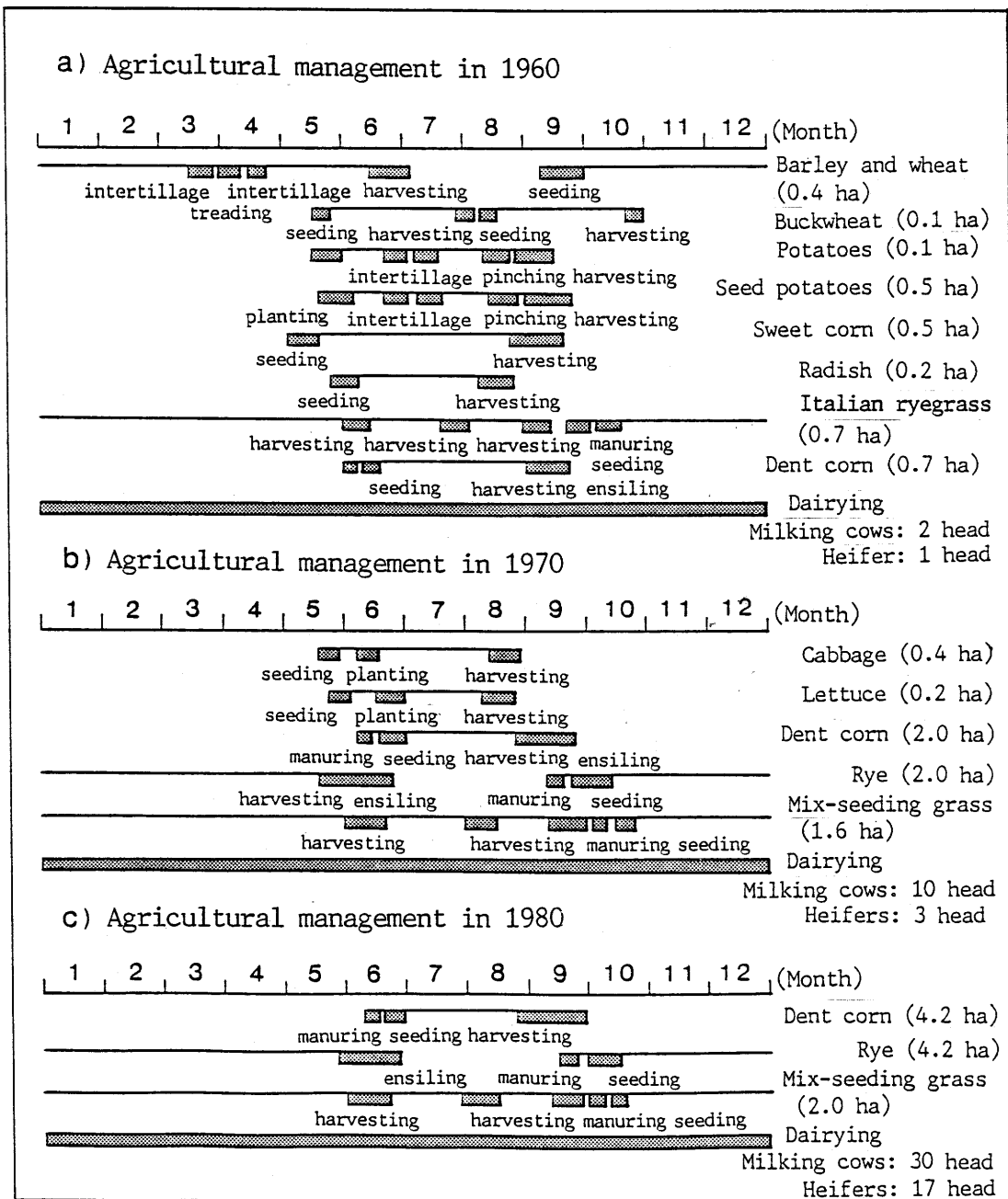


Figure 26 Transitions of Agricultural Management on a Standard Dairy Farm of Oyaharakaitakuchi in Naganohara Town of Gunma Prefecture (Data source: Hearing survey)

head in 1960.

Dairy farming at a standard reclamation farm about 1960 was practiced by the householder and his wife in the thirties or forties. Two milking cows and a heifer were kept in the simple shed for five cows, which was constructed with logs and bamboo grass in the housing lot. They fed and milked cows with by their hand three times a day; five to seven in the morning, noon to two in the afternoon, and six to eight in the evening. Fluid milk was packed into 20 kilogram cans and was carried to the milk gathering places within the reclamation settlement.⁷⁸ Then it was gathered by milk gathering lorries of the Agatsuma County Dairy Cooperative Association and sold to the Kantoseiraku Dairy Products Company in Maebashi city of Gunma prefecture. Soilage and hay feed of Italian ryegrass were mainly used, sharing 45 percent of all the feed required, and such purchased feed as rice straws and formula feed accounted for only about 20 percent. This indicates that the ratio of feeding cost to the value of sold milk was less than 20 percent in about 1960.

Examining each agricultural management of 46 reclamation farms of Oyaharakaitakuchi in 1960 (Table 6), dairy farming at the specialized stage and that at the mixed farming stage were indentified. Two farms belonged to the specialized stage, which kept eight head of dairy cattle and managed four hectares of arable land. In these farms, the householder and his wife engaged in dairy farming, and milk was their only source of income. Therefore, these dairy farms had already developed viable dairy farming at the specialized stage. This reflected that these dairy farms made good use of their experience in dairy farming in Manchuria's Ekibakaitaku and fist started dairy farming in Oyaharakaitakuchi. They became leaders of dairy farming

Table 6 Changes of Agricultural Management in Oyaharakaitakuchi of Naganohara town, Gunma Prefecture. (1960, 1970, 1980)

Year	1960				1970				1980			
Contents of management	Households				Households				Households			
Stage of management	The average number of dairy cattle (head)				The average number of dairy cattle (head)				The average number of dairy cattle (head)			
	The average acreage of arable land (hectares)				The average acreage of arable land (hectares)				The average acreage of arable land (hectares)			
	Family members engaged in agriculture				Family members engaged in agriculture				Family members engaged in agriculture			
	Farm income combinations				Farm income combinations				Farm income combinations			
Stage of management	Households				Households				Households			
The specialized stage	H(100)				H(100)				H(100)			
The mixed farming stage	H(90)+C(10)	5	3.8	11	H(90)+V(10)	4	16	4.7	H(90)+A(10)	5	36	5.8
	H(80)+C(10)+V(10)	4	3.5	11	H(80)+V(20)	4	15	4.3	H(90)+C(10)	1	35	5.5
	H(70)+C(20)+P(10)	1	4.3	11	H(80)+V(10)+K(10)	3	10	4.0	H(90)+V(10)	3	35	5.5
	H(80)+C(10)+P(10)	8	3.5	11	H(80)+V(20)	5	15	4.7	H(90)+K(10)	2	26	5.0
	H(70)+C(20)+V(10)	3	3.0	11	H(70)+V(30)+K(10)	3	10	3.8	H(60)+A(30)+O(10)	1	17	3.8
The dry field farming stage (former-dairy farms)	H(70)+C(20)+V(10)	2	3.3	11	H(70)+V(20)+K(10)	2	8	3.5	H(60)+V(30)+O(10)	1	12	3.8
	H(60)+C(20)+P(10)+V(10)	6	3.3	11								
	H(30)+O(30)+C(20)+V(20)	1	2.2	7								
	H(60)+C(20)+O(20)	1	2.2	5								
	H(60)+C(20)+P(10)+V(10)	1	3.2	8								
The dry field farming stage (former-dairy farms)	H(60)+P(10)+C(10)+O(10)	2	3.2	7	H(60)+O(30)+V(10)	1	8	3.8	V(90)+O(10)	1	2	5
	H(60)+C(20)+V(10)+O(10)	2	3.2	8	H(60)+V(30)+P(10)	2	10	4.2	V(80)+O(10)+C(10)	3	3	5
	H(50)+C(40)+O(10)	2	3.2	8	V(50)+H(30)+P(10)+O(10)	1	13	4.2	V(60)+A(40)	3	3	5
	H(50)+P(30)+V(10)+O(10)	1	3.2	8					A(50)+V(40)+O(10)	1	3	0
	C(70)+H(20)+O(10)	1	1.2	4	V(60)+P(20)+K(10)+O(10)	2	3	2				

Note: H. Milk, C. Sweet corn, P. Seed potatoes, K. Beans, V. Vegetables, A. Apples.

O. Non-agricultural income, H. A householder, W. His wife, S. His successor.

B. His daughter-in-law, and the figure in parentheses shows percentage.

(Data sources: Investigation of reclamation farming result, data from Kita-Karuizawa Agricultural Cooperative Association and Naganohara town office, and hearing survey)

in the Kita-Karuizawa area, expanding their operation taking advantage of many kinds of subsidies and loans. Consequently the development and the specialization of viable dairy farming was achieved.

On the other hand, there were 40 dairy farms at the mixed farming stage, which combined dairy farming with sweet corn, seed potatoes, and vegetables. Twenty-nine of them had developed viable dairy farming, keeping more than three head of dairy cattle and cultivating more than three hectares of farmland per farm. Regarding farm income combination of these viable dairy farms, the "milk (80 percent) + sweet corn (10 percent) + seed potato (10 percent)" type was the largest in all types, numbering eight. The "milk (60 percent) + sweet corn (20 percent) + seed potato (10 percent) + vegetable (10 percent)" type counted six farms, and the "milk (80 percent) + sweet potato (10 percent) + vegetable (10 percent)" type, four. In viable dairy farms at the mixed farming stage, dairy farming was the major part of economy and dry field farming of more than two crops was a subsidiary section. Other dairy farms at the mixed farming stage numbered eleven, each of which kept less than three head of dairy cattle and operated the arable land of 2.8 hectares or less. In their farm income combination, milk constituted less than 60 percent and non-agricultural income accounted for 10 to 20 percent.

As mentioned above, in Oyaharakaitakuchi which was representative of the reclamation settlements in the Kita-Karuizawa area, dairy farming became conducted by all reclamation farms after the cold weather damages in 1953 and 1954 and to the designation as an intensive dairy region at the foot of Mt. Asama in 1955. This reflected the shift of agricultural management policies of the Kita-Karuizawa Reclamation Agricultural Cooperative Association from dry field farming to

grassland farming, and it was successfully carried out by farmers under the strong leadership of settlement leaders. By the middle of this period, viable dairy farming, in which dairy farming was the leading part and dry field farming subsidiary, had been established in more than half of all dairy farms. Some dairy farms had already developed viable dairy farming at the specialized stage. The early establishment of viable dairy farming in this period was due to that dairy farmers actively purchased many dairy cattle utilizing various subsidies and that most of them had experience in dairy farming in Manchuria. It was also important that dairy farming was profitable than any other commercial farming at the foot of Mt. Asama where three croppings in two years was generally practiced on the volcanic sand and lapilli soils.

iii) The expansion period of dairy farming
(1964~1972)

In the expansion period of dairy farming, the number of dairy farms in the Kita-Karuizawa area decreased from the peak of 153 households in 1960 and to 104 households in 1970, experiencing 32 percent decrease during the decade. But the number of dairy cattle kept in the Kita-Karuizawa area continued to increase at the ratio of 15 to 20 percent a year, counting 1,362 head in 1970, which were 3.7 times as many as that in 1960. As the number of cattle increased, income from milk increased rapidly. It amounted to 180 million yen in 1970, being 8.6 times as many as that in 1960. Furthermore, the ratio of milk in all agricultural income increased from 42 percent in 1960 to 61 percent in 1970. On the other hand, the shares of sold vegetables and potatoes decreased from 30 and 10 percent respectively in 1960 to 25 and 7 percent ten years later. Although agriculture in the Kita-Karuizawa area

was still mixed farming combining dairy farming with dry field farming, the importance of dairy farming increased considerably. The Kita-Karuizawa Reclamation Agricultural Cooperative Association was awarded the Asahi agricultural prize in 1967,⁷⁹ for the development of dairy farming in reclamation settlements of highlands.

In Oyaharakaitakuchi, clearing in plan was completed by 1970, and the acreage of arable land per farm amounted to 3.7 hectares in 1970. Farmland managed by reclamation farms varied from 3.2 to 4.2 hectares in 1970, the differences having been reduced compared with those in 1960. This was due to that some dairy farms cleared accessory forests to create arable land with the increase of dairy cattle, though the size of arable land per farm became standardized with the completion of clearing. In 1970, a standard reclamation farm held 4.2 hectares of arable land. Vegetables such as cabbages and lettuce for sale were cultivated in 0.6 hectares, and the rest of the arable land was planted in such forage crops as dent corn and rye (2.0 hectares) and mix-seeding grass (1.6 hectares). Thus the distribution of agricultural labor throughout a year became centered on the forage crop cultivation, whose acreage in 1970 was about three times as much as that in 1960. Rye, seeded in the last ten days of September, was harvested in late May and early June. After being manured and fertilized, dent corn was seeded in the middle part of June, and was harvested in early September. Mix-seeding grass was harvested in the first ten days of June and August, and toward the end of September. Therefore the peaks of agricultural labor and works were formed in June and September when the harvest of mix-seeding grass and ensiling of rye and dent corn overlapped (Figure 26-b).

The number of dairy cattle increased to 507 head in

1970, which were 3.6 times as many as that in 1960. The average number of dairy cattle per farm also increased to 12.7 head in 1970, 3.8 times as many as that in 1960. But it varied from 6 to 28 head among the farms. Such differences in 1970 were larger than those in 1960, indicating that the hierarchical differentiation of dairy farming progressed. Dairy farming at a standard reclamation farm in 1970 was practiced by a householder and his wife in their forties and fifties and by their successor in the twenties. They kept ten milking cows and three heifers in the shed of mansard roof type for 20 cows newly built within the housing lot. They fed and milked cows with bucket milkers twice a day; from five to seven in the morning and six to eight in the evening. Self-supplied feed included soilage and hay feed of mix-seeding grass and Swedish turnip (accounting for 28 percent of all the feed required) and silage of dent corn and rye (46 percent). Purchased feed such as rice straws and formula feed accounted for only 26 percent of all the feed used. Because these dairy farms could enlarge production bases of self-supplied feed according to the number of dairy cattle, its ratio to all the feed required was high and the ratio of feeding cost to the value of sold milk remained less than 30 percent.

Examining the agricultural management of reclamation farms in 1970 (Table 6), they were divided into dairy farms and dry field farming farms. Dairy farms were further divided into those at the specialized stage and those at the mixed farming stage. The dairy farms at the specialized stage counted ten, which raised twenty dairy cattle and management 4.8 hectares of arable land on the average. The householder, his wife, and a successor engaged in viable dairy farming, and all farm income was gained from sold milk. Eight viable dairy farms at the specialized stage, which had already

farms at the specialized stage, which had already developed viable dairy farming at the mixed farming stage by 1960, enlarged the production bases of self-supplied feed by converting accessory forests to arable land by 1970 and made efforts to purchase dairy cattle utilizing subsidies for agricultural structure improvement projects. Such development was promoted by the existence of farming successors who learned large scale dairy farming at the Kiyosato Agricultural Training School (Kiyosato Nogakuryo).

The number of dairy farms at the mixed farming stage decreased to 30, but 28 of them conducted viable dairy farming. As in the case of viable dairy farms at the specialized stage, the householder, his wife, and a successor engaged in agriculture. The average number of dairy cattle was twelve and the average arable land was four hectares, both being smaller than those of viable dairy farms at the specialized stage. But the number of dairy cattle and the area in self-supplied feed at the mixed farming stage more than doubled from 1970 to 1960. Regarding the farm income combinations, the "milk (80 percent) + vegetable (20 percent)" type counted 9 households, the largest in all types. Four farms belonged to the "milk (90 percent) + vegetable (10 percent)" type. Such farm income combination, depending mainly on dairy farming with supplementary vegetable growing, became simplified compared to that in 1960.

In the farm without operating viable dairy farming, eight head of dairy cattle were raised and 3.8 hectares were cultivated. These dairy farms lagged behind viable dairy farms in the enlargement of dairy farming, because family agricultural labor was not large enough to expand the dairy management. Two farms, losing farming labor, stopped keeping dairy cattle and changed to dry field farming, where householder's wife and a successor

engaged in the cultivation of vegetables, potatoes and kidney beans. Their farm income combination was the "vegetable (60 percent) + potatoes (20 percent) + kidney beans (10 percent) + non-agricultural income (10 percent)" type, being similar to that of full-time farms.

In this period viable dairy farming was established by enlarging the number of dairy cattle, the acreage of arable land, and family agricultural labor, which were closely connected with each other. Furthermore, the hierarchical differentiation of dairy farming was caused by the difference of the number of cattle, arable land, and family agricultural labor.

iv) The period of keeping large dairy herds (after 1973)

The number of dairy cattle per farm in the Kita-Karuizawa area amounted to 20.3 in 1972, marking the beginning of the period of keeping large dairy herds. The number of dairy farms in this period hardly changed, because small-scale dairy farms had already discontinued keeping cattle by 1972. The number of dairy farms in 1980 was 77, a half of that in the peak period. On the other hand, the number of dairy cattle increased at the rate of about 10 percent annually and amounted to 2,813 head in 1980, doubling that in 1970. The number of dairy cattle per farm also increased from 13.1 head in 1970 to 36.5 head in 1980. This increase in dairy cattle has stagnated since the milk production adjustment in 1979, and the annual rate of increase has been only three percent since 1980.

Milk production adjustment influenced the milk marketing. The income from milk in the Kita-Karuizawa area increased at the rate of more than 20 percent every year amounting to 1,023 million yen in 1980, but after that it stagnated. On the other hand, the ratio of milk

to all agricultural income increased, amounting to 78.4 percent in 1980 and to 80.0 percent in 1982. Sales of such vegetables as cabbages and lettuce which came after milk have been decreasing. In 1980 vegetable sales were 220 million yen, which accounted for only 17.0 percent of all agricultural income. These facts suggest that the mixed farming combining dairy farming with vegetables gradually declined and the reclamation farms were differentiated into specialized dairy farms and specialized vegetable growers.

In 1980, the farmland in Oyaharakaitakuchi amounted to 204.9 hectares, 50 hectares more than the original plan. This was due to that remaining forests and small woods were cleared into arable land. The farmland under managed by reclamation farms varied from 2.5 hectares to 8.0 hectares, while the average was 4.9 hectares. Dairy farms tended to enlarge their arable land with the increase of keeping large dairy herds, while vegetable growers rarely enlarged average. There were only eight vegetable growers in Oyaharakaitakuchi in 1980, and dairy farms amounted to 34. Thus the arable land in Oyaharakaitakuchi expanded as a whole.

Dairy cattle numbered 1,328 in 1980 and the average per farm was 39. Differentiation among dairy farms was observed, whose dairy cattle ranged from 12 to 55. According to Figure 27, the enlargement of dairy farming from 1960 to 1970 was mainly achieved by the increased number of dairy cattle, while that from 1970 to 1980 was brought about by the increase of both dairy cattle arable land. Thus the hierarchical differentiation progressed both in the size of dairy cattle and arable land.

In the period of keeping large dairy herds, Oyaharakaitakuchi's economy consisted of viable dairy farming and dry field farming (Table 6). There were 32

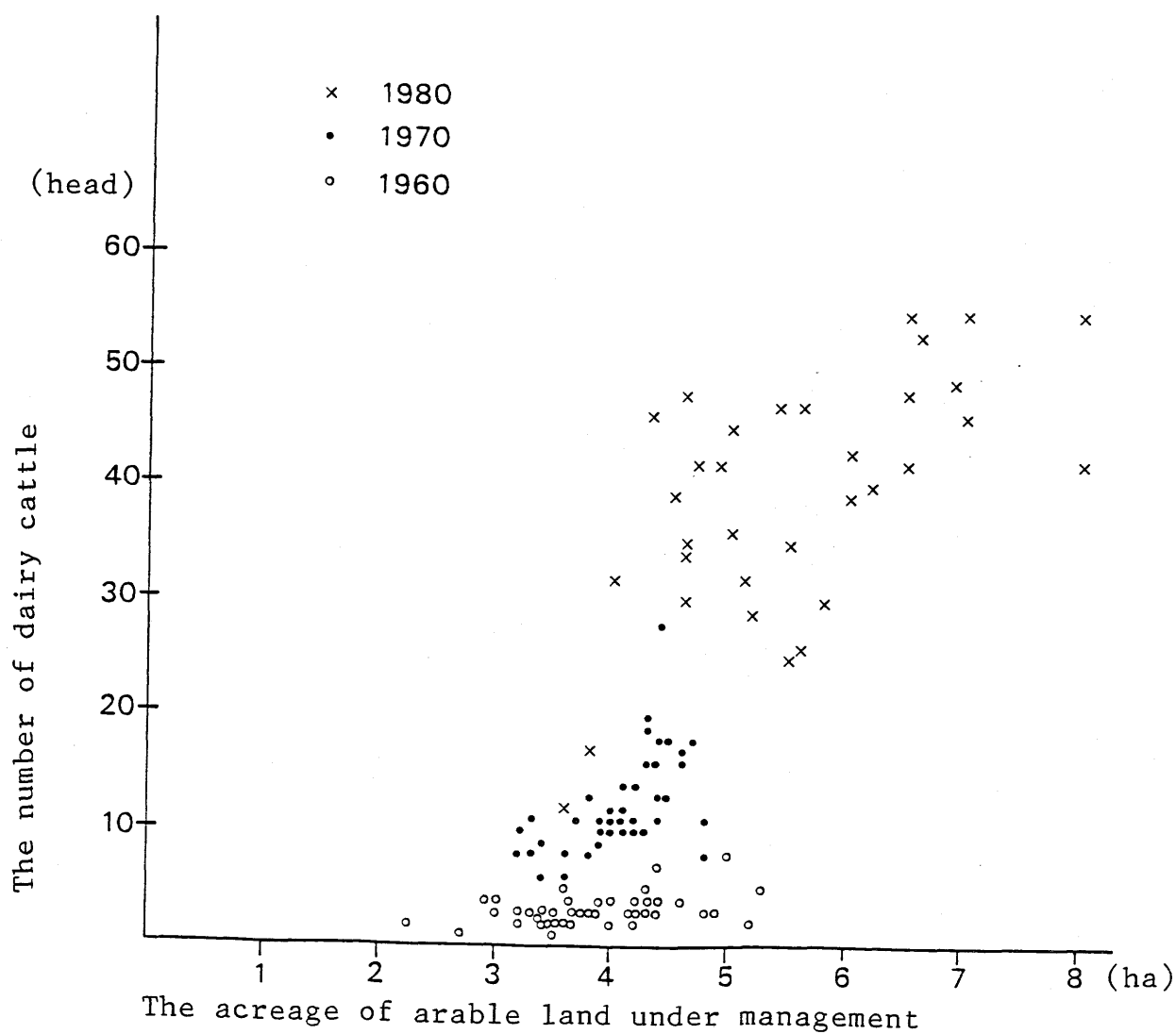


Figure 27 Changes of the Scale of Dairy Farming in Oyaharakaitakuchi of Naganohara Town, Gunma Prefecture
(Data sources: Movement statistics of dairy cattle, data from the Kita-Karuizawa Agricultural Cooperative Association and hearing survey)

viable dairy farms in 1980, 21 of which were those at the specialized stage. In a viable dairy farm at the specialized stage, two couples over two generations engaged in dairy farming, keeping 45 head of dairy cattle and managing 6.5 hectares of farmland. Among these viable dairy farms, eleven developed from the mixed farming stage to the specialized stage from 1970 to 1980. In this process dairy cattle were purchased with many subsidies and increased by raising highly graded registered cows, and cultivated acreage expanded by converting accessory forests to arable land and by leasing land from former dairy farms. At the same time, family agricultural labor was enlarged.

A typical viable dairy farm at the specialized stage in 1980 kept 30 milking cows and 17 heifers, whose the ratio of heifers to all dairy cattle was relatively high. This was due to that most of milking cows were highly graded registered cows, which were used to breed and raise high lactation cows in the farm.⁸⁰ The acreage of arable land amounting to 6.2 hectares, 4.2 hectares was used for cultivating dent corn and rye in rotation and the rest was used for of mix-seeding grass (Figure 26-c). This increase of dent corn and rye was due to that the silage feeding system became predominant throughout the year. Silage and hay feed accounted for only 7 percent of all the feed required, while the ratio of silage increased to 58 percent. Purchased feed including rice straws and formula feed also increased to more than 30 percent, so that the feeding cost to increased to 50 percent of milk sales.

There were eleven viable dairy farms at the mixed farming stage, showing a decreasing tendency. The average number of their dairy cattle was 34 and the average arable land, 5.5 hectares, managing smaller scale dairy farming than that at the specialized stage.

But three family members engaged in agriculture and milk sales accounted for more than 90 percent of all farm income. Therefore this dairy farming was similar to that at the specialized stage. As regard the farm income combination, the "milk (90 percent) + apple (10 percent)" type was the largest in all types, to which five farms belonged. Next to this type, the "milk (90 percent) + vegetables (10 percent)" type numbered three. Apple and vegetable growing was subsidiary to dairy farming, for they were highly productive competing with dairy farming for agricultural labor. In some viable dairy farms, the householder and his wife both in their sixties grew apples and vegetables, and the successor and his wife in their twenties or thirties engaged in dairy farming.

Only two dairy farms did not yet develop viable dairy farming. They kept 15 head of dairy cattle managing 3.8 hectares of arable land in 1980, which were almost unchanged since 1970. Family agricultural labor decreased. These dairy farms are considered to be at the transitional stage to dry field farming. There were eight reclamation farms at the dry field farming stage in 1980, and six of which formerly operated dairy farms but changed to dry field farming between 1970 and 1980. The discontinuance of dairy farming in these farms was due to that family agricultural labor declined into less than two persons, that disease caused the death of many cattle, and that debt from agricultural loans were accumulated.

As mentioned above, in the period of keeping large dairy herds, viable dairy farms at the specialized stage and those at the mixed farming stage played the central role in forming the dairy region. They constituted the major part of the dairy farms and the reclamation farms in Oyaharakaitakuchi. This differs from the dairy

regions in outer suburban areas of Tokyo metropolis where only a part of dairy farms or reclamation farms developed viable dairy farming. Although viable dairy farming in remote areas from large cities had restrictions in terms of the number of dairy cattle, arable land, family agricultural labor, and dairy facilities and equipments as in the case of outer suburban areas of large cities, there existed peculiar conditions favorable for the development of dairy farming on the volcanic slopes.

2. Changes of landscape with the development of dairy farming

i) Settlement and road patterns

The settlement pattern and the road pattern in Oyaharakaitakuchi, as shown in Figure 28, changed with the development of dairy farming. When the repatriates from Manchuria's Ekibakaitaku settled here, they constructed three communities: the first Oyahara community (Dai-ichi), the second Oyahara community (Dai-ni), and the third Oyahara community (Dai-san). The first Oyahara community, consisting of 12 reclamation farms, had the compact village pattern. The second Oyahara community, constituted by 16 reclamation farms, had the road village form in which farms were lined up along the main road. On the other hand, the third Oyahara community, to which 14 farms belonged, was a loosely compact village. In all cases, these communities had agglomerated settlement patterns to provide facilities for the road construction, water and electricity supply, and the cooperative clearing of forest (Figure 28-a). This is common to many reclamation settlement on volcanic slopes, having close connection with the landholding pattern to be mentioned later.⁸¹

The agglomerated settlement pattern of

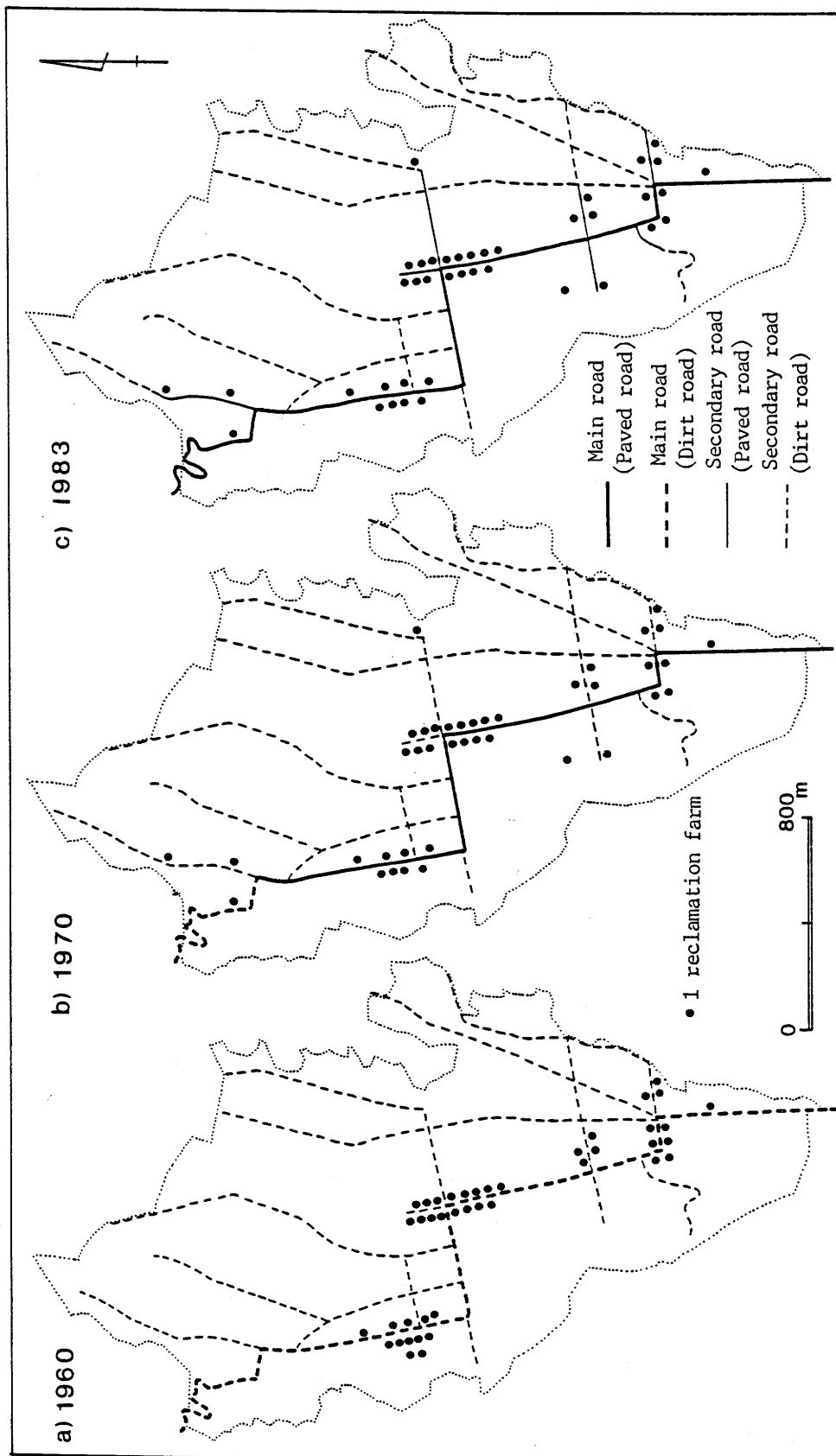


Figure 28 Changes of Settlement and Road Patterns in
Oyaharakaitakuchi of Naganohara Town,
Gunma Prefecture
(Data sources: Aerial photographs and field survey)

Oyaharakaitakuchi was maintained from the period of land reclamation to the end of the spread period of dairy farming, while in the expansion period of dairy farming dispersion of farms was planned and took place. As further reclamation was conducted, the supply of water and electricity was completed, and the road network was improved, farms did to have to be agglomerated. The agglomerated settlement pattern was rather inconvenient for the efficiency of agricultural works because of the scattered arable land. Therefore this reclamation settlement changed from the agglomerated settlement pattern to the dispersed one with the development of dairy farming, especially with the increase of dairy cattle. The first agricultural structure improvement project in 1968 accelerated this. Three reclamation farms of the first Oyahara community, one farm of the second Oyahara community, and two farms of the third Oyahara community moved out to the surrounding arable land. With the settlement dispersion, modeled after Oyakaitakuchi at the foot of Mt. Nasu and Nobeyamakaitaku at the foot of Mt. Yatsugatake, arable land became consolidated. The dispersed settlement pattern was maintained from the latter half of the expansion period of dairy farming (Figure 28-b, c), and contributed to the development of dairy farming in Oyaharakaitakuchi.

As regard the road pattern, the main road and the secondary roads had already been completed by 1960 in the spread period of dairy farming (Figure 28-a). The main road, running from the center of the Kita-Karuizawa area through Oyaharakaitakuchi to Route 146 which connected Karuizawa to Naganohara towns, played an important part in joining this reclamation settlement with other areas. The main road was constructed immediately after the beginning of land reclamation. The

secondary roads linking farm houses to arable land and clearing land were gradually constructed with the advancement of land reclamation. They extended substantially throughout the period of land reclamation and the spread period of dairy farming, reflecting the dispersed landholding patterns. With the improvement of road patterns, land reclamation advanced rapidly and the area under cultivation accounted for 80 percent of all the land planned for reclamation.

In the expansion period of dairy farming and the period of keeping large dairy herds, the road patterns remained unchanged, but they were improved qualitatively. For example, some roads were paved in these periods. In the expansion period of dairy farming when the Kita-Karuizawa Reclamation Agricultural Cooperative Association purchased large milk gathering lorries, a part of the main road was paved from 1965 to 1967 (Figure 28-b). It facilitated milk gathering, which in turn prevented milk from deterioration and churning. Furthermore, the entire main road and a part of the secondary roads linking the reclamation farms to the main road were paved to provide facilities for milk gathering and to advance milk quality, when the milk became individually gathered by large tank lorries since 1971. The secondary roads linking the farm houses to their arable land, which were wide enough for farm machinery's, remained unpaved.

ii) Landholding patterns

Landholding patterns in Oyaharakaitakuchi are closely related with the settlement pattern mentioned above. Both in the period of land reclamation and the spread period of dairy farming, the agglomerated form of settlement made reclamation farms to own arable land in dispersed locations. This is shown in Figure 29-a, which indicates the landholding patterns of Oyaharakaitakuchi

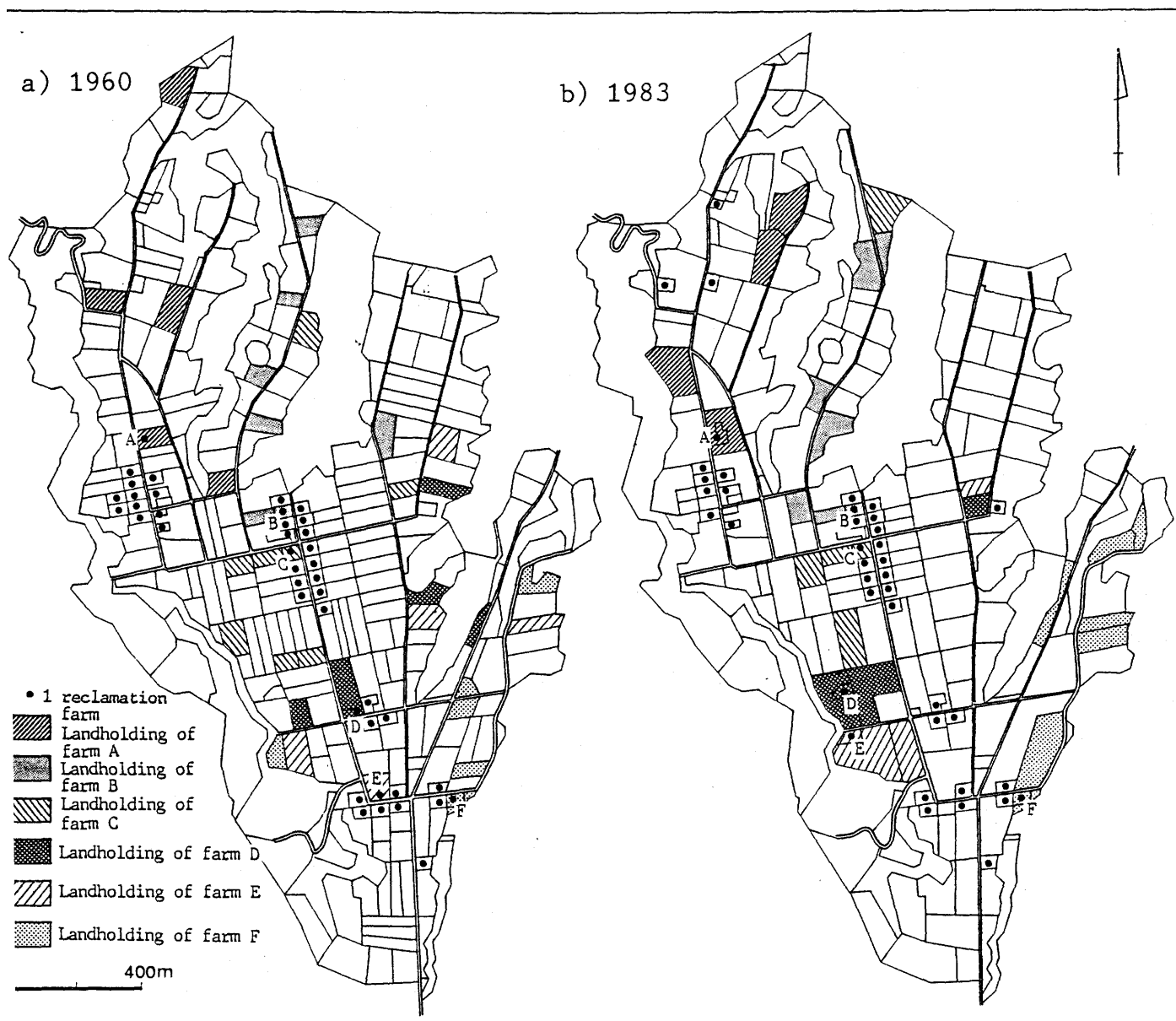


Figure 29 Changes of Landholding Patterns in Oyaharakaitakuchi of Nagano-hara Town, Gunma Prefecture
 (Data sources: Cadastral maps, cadaster and hearing survey)

in 1960. The land originally distributed to each farm amounted to 3.7 hectares, but it consisted of five to seven parcels in different locations, each of which was 0.5 to one hectare. Parcels generally had irregular square farm. Such a landholding pattern was due to the effort to equalize the land distributed to farms in consideration of the agglomerated settlement form and such conditions as topography, soils, and sunshine.

According to Figure 29-a, a standard reclamation farm held about 0.5 hectares of arable land adjacent to the housing lot and the rest in four locations. The distance between parcels and the farmhouse varied from 200 to 900 meters. Since the reclamation farms began clearing forest around their houses and proceeded inland, the most distant house were still under clearing. During harvested in distant forage crop fields and was transported to the cow sheds located in the housing lots every day. In the autumn dent corn, harvested in their forage crop fields, had to be carried to silos in the housing lots to be stored for the winter. These works were heavy burden to the reclamation farms with insufficient family agricultural labor and obstructed to the increase of dairy cattle. Therefore, it was planned to consolidate the parcels owned by each farm and to disperse the settlement pattern in order to increase the farming efficiency.

The consolidation of landholdings proceeded in parallel with the dispersion of the settlement pattern since the first agricultural structure improvement project started in 1968. Thus the reclamation farm became to possess 1.5 to 2.0 hectares of farmland around the house and the rest of the arable land in a few locations within the 900 meter radius from the farmhouse. Although such a landholding pattern remained unchanged from the original form, each parcel expanded

to 1.0 to 1.5 hectares and the arable land under management became consolidated as much as possible. Therefore, the efficiency of farming increased. This consolidation of landholdings, however, remained insufficient as compared with that in Nobeyamakaitaku at the foot of Mt. Yatsugatake and in Oyakaitakuchi at the foot of Mt. Nasu. This was due to that only six reclamation farms, or 14.3 percent of all the reclamation farms, actually moved out and that the time required from the farmhouse to arable land was halved with the improvement of roads and the mechanization of agriculture.

As is evident in Figure 29-b, typical reclamation farms maintained parcels in three different locations throughout the expansion period of dairy farming and the period of keeping large dairy herds. Such parcels, although being irregular squares, were collected around the farmhouse, and each parcel was enlarged, so that large-scale farm tractors could be utilized. The production bases of feed was enlarged with the increase of dairy cattle, and feed production became efficient and labor saving with the utilization of machineries. In the period of keeping large dairy herds, the size of arable land was enlarged in viable dairy farms at the specialized stage. In this case, accessory forests adjacent to the arable land were cleared into arable land and the acreage of each parcel was enlarged, although the landholding pattern in three locations was almost unchanged. When viable dairy farms at the specialized stage further enlarged the size of arable land, their landholding pattern changed to encompass parcels in five locations by newly converting woods and forests into arable land and by leasing fields from former dairy farms.

Generally speaking, the landholdings in the

reclamation settlements at the foot of Mt. Asama were consolidated with the increase of dairy cattle and with the settlement dispersion. More recently, however, the landholding pattern of viable dairy farms at the specialized stage tended to disperse due to the grassland establishment of woods and forests and to arable land leasing.

iii) Land use patterns

In the period of land reclamation, wheat and barley, cereals, and potatoes were predominant occupying two thirds of the entire arable land. Since the land distributed to each reclamation farm was dispersed in five locations, it influenced the land use patterns. For instance, in the parcel of 0.5 hectares around the farmhouse A, cash crops such as radishes and seed potatoes were cultivated in 0.3 hectares, exceeding the acreage of subsistence crops. In a parcel of 0.8 hectares 200 meters away from the farmhouse, the acreage of cash crops decreased to 0.1 hectare and subsistence crops predominated. Furthermore, 1.0 hectare parcel about 500 meters distant from the farmhouse was hardly planted in cash crops, but was mostly covered with subsistence crops as well as forage crops (0.4 hectares). The most distant field more than 600 meters away from the farmhouse was under clearing or was not yet cleared.

The land use pattern mentioned above was common to many reclamation farms in Oyaharakaitakuchi, where cash crop fields, subsistence crop fields, forage crop fields, and land under clearing or uncleared forests were successively arranged as distance from the farmhouse. Thus the land use as a whole had the concentric zonal structure. Such a land use pattern was fundamentally sustained in the spread period of dairy farming. According to Figure 30 which shows the land use

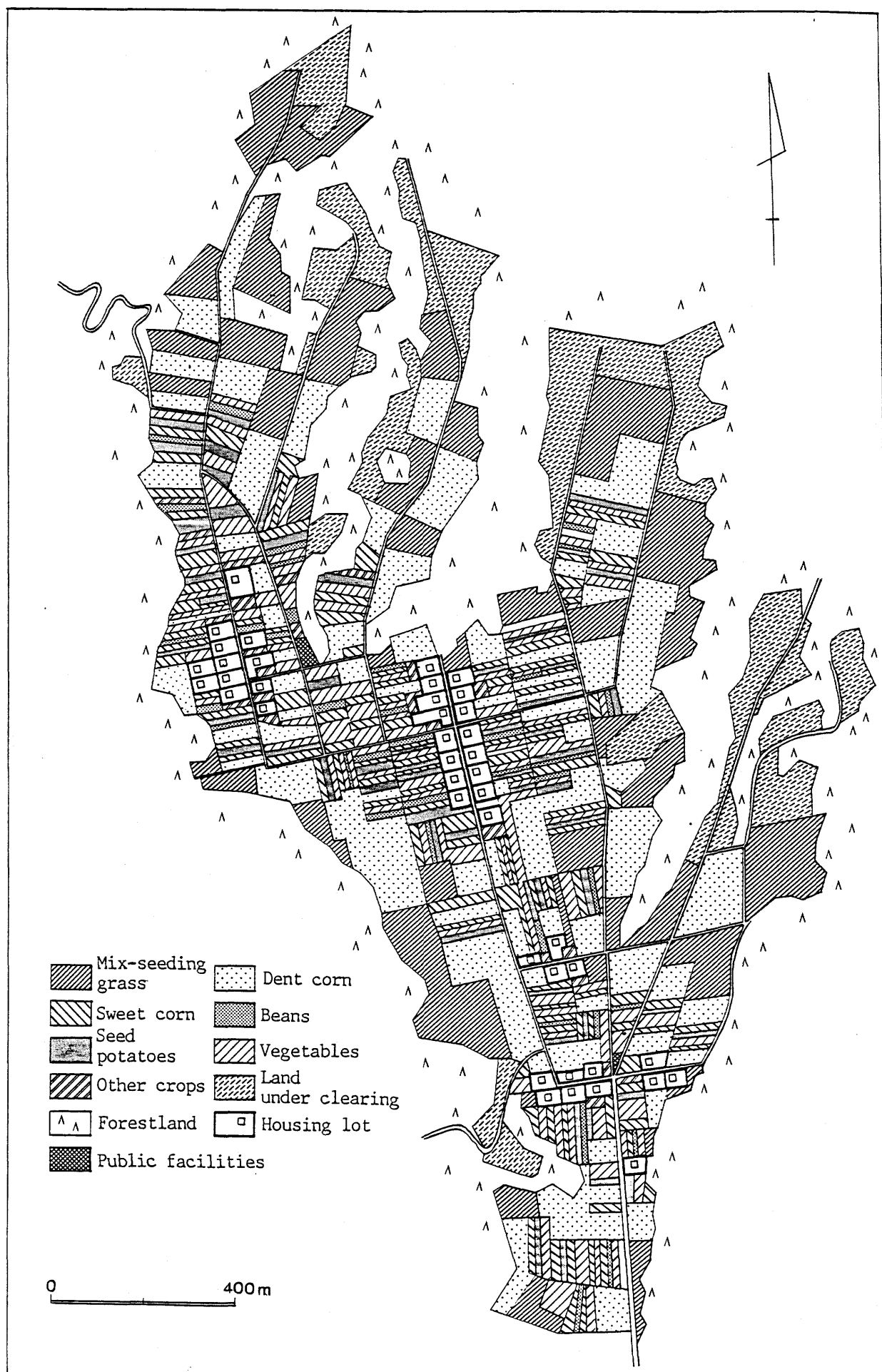


Figure 30 Land Use Pattern at the Spread Period of Dairy Farming in Oyaharakaitakuchi of Naganohara Town, Gunma Prefecture (July, 1960)
(Data sources: Ledgers of reclamation farming and hearing survey)

patterns of Oyaharakaitakuchi in 1960, cash crops were predominant in the field around farmhouses, while forage crops predominated over the distant arable land. With the development of commercial farming, the decline of subsistence farming, and the spread of dairy farming, cash crop and forage crop acreages experienced a threefold increase from the period of land reclamation. In addition, uncleared forest and the land under clearing were reduced, only remaining either in the outermost areas or in the steep hillsides. The arrangement pattern of land uses as a whole in the spread period of dairy farming had the concentric zonal structure, in which cash crop fields, forage crop field, and the land under clearing and forests were successively arranged as distance from farmhouses was increased.

Examining the land use patterns in the spread period of dairy farming in terms of land use intensity, cash crops were intensively cultivated around the farmhouse, while forage crops were extensively cultivated in the parcels away from the farmhouses. Thus the land use intensity declined toward the periphery. The cash crop field was divided into four strips where radishes, sweet corn, kidney beans, and seed potatoes were cultivated. This was to consider soil and climatic conditions, and to diversify risks of the meteorological disaster and the damage of repeated cultivation. Therefore the land use around farmhouses became the mosaic pattern. On the other hand, in the forage crop fields, dent corn was grown closer to the farmhouse, while mix-seeding grass was planted most distant. This was due to that dent corn was an annual crops and mix-seeding grass was perennial, and that the weight and volume of dent corn were larger than those of mix-seeding grass. The fields of both dent corn and mix-

seeding grass were uniform and large enough to provide facilities for agricultural machineries such as farm tractors.

After the expansion period of dairy farming, land use patterns changed with the consolidation of landholdings and the increase of dairy cattle. In other words, the land use became further simplified as cash crop decreased in number and acreage, and the crop rotation system with the emphasis on forage crops was established. According to Figure 31 which shows the land use pattern of Oyaharakaitakuchi in 1982, cash crop field where vegetables, kidney beans, sweet corn and apple were grown remained around the farmhouses, but forage crop fields were predominant. Especially the acreage of dent corn, suitable for silage, expanded because the feeding system at dairy farms changed to the yearround silage feeding. Rye, has suitable for silage and included in the crop rotation system with dent corn.

Yields of mix-seeding grass, dent corn and per ten ares were six tons, six tons and 3.5 tons respectively, which were less than those in lowland villages where ten tons of mix-grass, eight tons of dent corn and six tons of rye were produced per ten ares. Therefore the dairy farms in Oyaharakaitakuchi used yearround silaged feed in order to utilize roughage effectively.⁸² The land use pattern also changed to that mainly consisted of dent corn and rye fields. On the ground with more than 15 degrees of gradient, however, mix-seeding grass was mainly cultivated for soilage and hay feed, for it was difficult to utilize large machineries such as farm tractors and corn harvesters. Forage crops such as dent corn, rye and mix-seeding grass were cultivated in the consolidated parcels depending heavily on the mechanized system of farming, so that the land use pattern also became collective and uniform regardless of the spatial

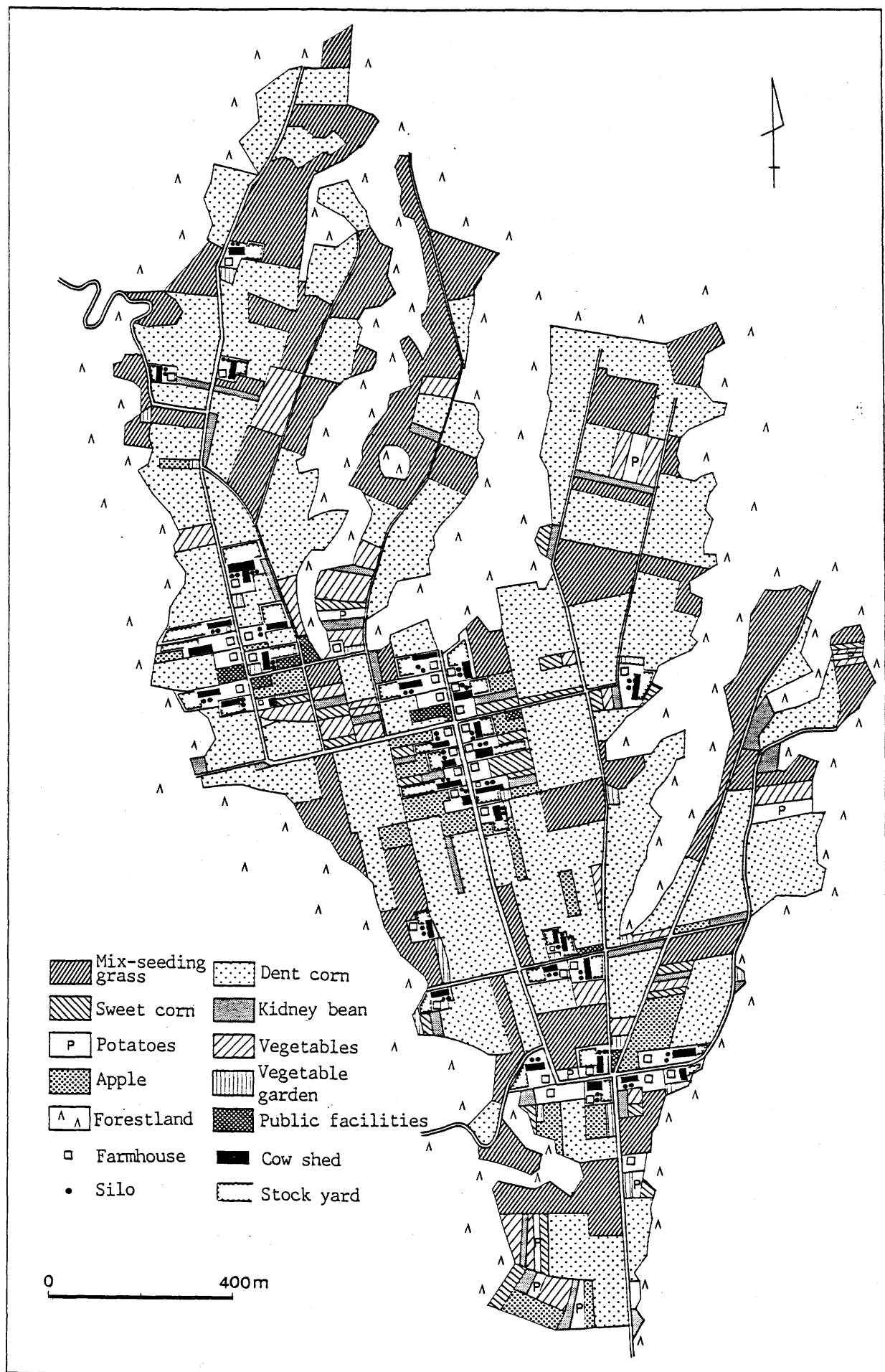


Figure 31 Recent Land Use Pattern in Oyaharakaitakuchi of Naganohara Town, Gunma Prefecture (July, 1982)
(Data source: Field survey)

arrangement of landownerships. As a whole, the land use pattern became collective and simplified with the development of dairy farming, the changes of landholding patterns, and the progress of mechanization.

iv) Arrangement patterns of dairy facilities and equipments

Table 7 indicates the year of introduction and installation of dairy facilities, equipments, and cattle in the sample farms of Oyaharakaitakuchi. Cow sheds, fences and banker silos, and power cutters had been installed in the standard reclamation farms by 1960. Cow sheds were small and simple stall barns without stanchion only to accommodate five cows. As banker silos were suitable for well draining volcanic ash soils and were cheaply constructed, they spread to most reclamation farms. Some dairy farms operating viable dairy farming at the specialized stage communally owned and utilized large-scale farm tractors. These tractors were introduced in 1960 when the first Oyahara community was designated as an experiment settlement of agricultural mechanization.⁸³ Most reclamation farms used farm tractors in common which were introduced to the Kita-Karuizawa Reclamation Agricultural Cooperative Association in 1957 by dry field farming development projects in cold areas. These tractors were used not only for farming but also for the clearing and preparation of fields.

As the land reclamation was completed and farmland was enlarged, large-scale farm tractors began to increase. In the first half of the expansion period of dairy farming when there was little accumulation of capital in the reclamation farms, about four farms made a group to purchase a farm tractor utilizing agricultural modernization funds. Bucket milkers and unit coolers were also installed within the cow sheds in

Table 7 Introduction of Dairy Facilities, Equipments and Cattle in the Sample Farms of Oyaharakaitakuchi, Naganohara Town of Gunma Prefecture

Stage of management	The specialized stage				The mixed farming and dry field farming stage		
Sample farms	Viable dairy farms				Non-viable dairy farms and former-dairy farms		
Year	A	B	C	G	H	I	J
Before 1960	B. B. S. C. R' 2	B. S. C	B. S. C	B. S. C	B. S. C	B. S. C	B. S
1961	3	2	1	1	1	1	1
1962	B'. M 3	B'. M. UC 1	S 2	1	—	1	—
1963	UC 2	R' 1	1	1	1	—	—
1964	1	S 2	B'. R'	B'. R'	S. R'	S. R'	—
1965	S 2	—	M. UC	M. UC	1	—	—
1966	1	2	2	1	Ⓟ. UC 1	B' 1	—
1967	R 1	Ⓟ. S	1	B' 2	M 1	UC. M	—
1968	S 2	S. R 1	2	S 1	R 1	1	—
1969	1	3	Ⓟ. S. R 1	2	—	—	—
1970	S 2	2	2	R 1	S	S 1	—
1971	Ⓟ. N 3	1	B'. S. BC 1	2	1	—	—
1972	R 3	2	R 1	2	B'	1	—
1973	2	T 1	2	Ⓟ. S 1	—	—	—
1974	2	B'. BC. P	2	2	—	—	—
1975	BC. P. 3	4	S 4	S 3	2	R	—
1976	S 3	Ⓟ. S. N 3	S. R 1	2	1	—	—
1977	R 2	2	3	R 1	—	—	R
1978	Ⓟ. N 2	2	Ⓟ. P. N 2	B'. P. BC	R'	—	—
1979	1	S. R	2	2	1	—	—
1980	1	2	2	2	BC 1	—	—

Note: B. Cow shed, B'. Extension of cow shed, Ⓟ. Rebuilding of cow shed, S. Silo, C. Power cutter, R. Farm tractor, R'. Farm tractor for cooperative use, UC. Unit cooler, M. Bucket milker, P. Pipeline milker, BC. Bulk milk cooler, N. Barn cleaner, the figure shows the number of introduced dairy cattles, and a broken line shows the year when viable dairy farming was established.
(Data sources: Investigation of reclamation farming results, movement statistics of dairy cattles and hearing survey)

order to save labor to milk increased number of cows. These equipments, also introduced using agricultural modernization funds, played an important role in increasing milk quality and quantity. In all cases, these dairy facilities and equipments were introduced to all reclamation farms by the first half of the expansion period of dairy farming, representing homogeneous arrangement patterns among farms.

In the second half of the period as production bases of self-supplied feed were enlarged and the crop rotation centering on dent corn became widely practiced. Large-scale farm tractors were purchased individually. Simultaneously large-scale tower silos replaced the usual simple silos, for the annual silage feeding was adopted by many farms. The reclamation farms actively extended their cow sheds with the increase of dairy cattle, and some viable dairy farms rebuilt the cow shed. New cow sheds were two-story stall barns with mansard roofs and stachions. This type of cow sheds spread widely in the Kita-Karuizawa area, a heavy snow region, for soilage, hay and rice straws could be stored on the second floor and it was conveniently structured to raise dairy cattle as well as to keep warmth. These dairy facilities and equipments were established utilizing such subsidies as agricultural modernization funds, and the availability of such fund depended on the number of dairy cattle and family agricultural labor. Therefore, the homogeneous arrangement pattern of dairy facilities and equipments disappeared and the agricultural management became differentiation.

In the period of keeping large dairy herds, dairy facilities and equipments tended to expand in viable dairy farms, while those in the non-viable farms remained unchanged or even decreased. In viable dairy farms, large-scale tower silos and air-tight silos were

installed with further increase of cows, and pipeline milkers and bulk milk coolers were newly introduced to save milking labor. Two large-scale farm tractors were individually owned by most viable dairy farms with enlarged production of feed. Furthermore, the second, large cow shed was newly built, thoroughly equipped with barn cleaners and pipeline milkers, for milking. On the other hand, the old medium-scale cow shed was used for raising cattle. Generally speaking, while the use and arrangement of dairy facilities and equipments became differentiated between viable dairy farms and non-viable dairy farms, viable dairy farms, with the increase of cows and the specialization in viable dairy farming, shared the uniform pattern of dairy facilities and equipment.

3. Conditions of viable dairy farming and their regional characteristics

The viable dairy farming established in Oyaharakaitakuchi was that of the mixed farming stage, which developed into the specialized stage. This development process of viable dairy farming was common to that in other dairy regions, but it was characteristic to Oyaharakaitakuchi that viable dairy farming was established relatively early after the introduction of dairy farming and that some dairy farms had developed viable dairy farming at the specialized stage by 1960. Therefore viable dairy farms in Oyaharakaitakuchi were broadly divided into three categories in terms of the degree of development: those remained at the mixed farming stage, those developed into the specialized stage in the period of keeping large dairy herds, and those developed into the specialized stage by the expansion period of dairy farming.

By the end of spread period of dairy farming, most the dairy farms in Oyaharakaitakuchi had developed viable dairy farming at the mixed farming stage. It was realized by the socio-economic conditions that there existed few opportunities for non-agricultural dairy employment and that dairy farming, requiring yearround occupation, prevented farmers to take seasonal employment outside. Figure 32 indicates the changes of the arrangement patterns of agricultural facilities and farmland and the land use in the sample viable dairy farm at the mixed farming stage. It indicates that viable dairy farming in this stage was established with the production of sweet corn, vegetables, beans, and seed potatoes as a supplementary section of farming in order to be adapted to the natural and socio-economic conditions of Oyaharakaitakuchi. The sample farm kept three to five dairy cattle in 1960, whose dairy facilities and equipments were small and simple. But more than two family members engaged in agriculture, and the forage crop fields was more than twice as large as that of dairy farms in lowland villages. The spatial organization of dairy farming, in which farmhouses, dairy cattle, land, and dairy facilities and equipments were functionally arranged, changed to enlarge the family agricultural labor and to enlarge and improve arable land, in order to be adapted to natural and socio-economic conditions.

Since the expansion period of dairy farming, the number of dairy cattle increased to maintain viable dairy farming at the mixed farming stage, and the spatial organization changed greatly. With the increase of dairy cattle, successors began to engage in dairy farming, expanding the family agricultural labor. Additionally, as Figure 32 shows, forage crops became the center of the crop rotation system and the dispersed

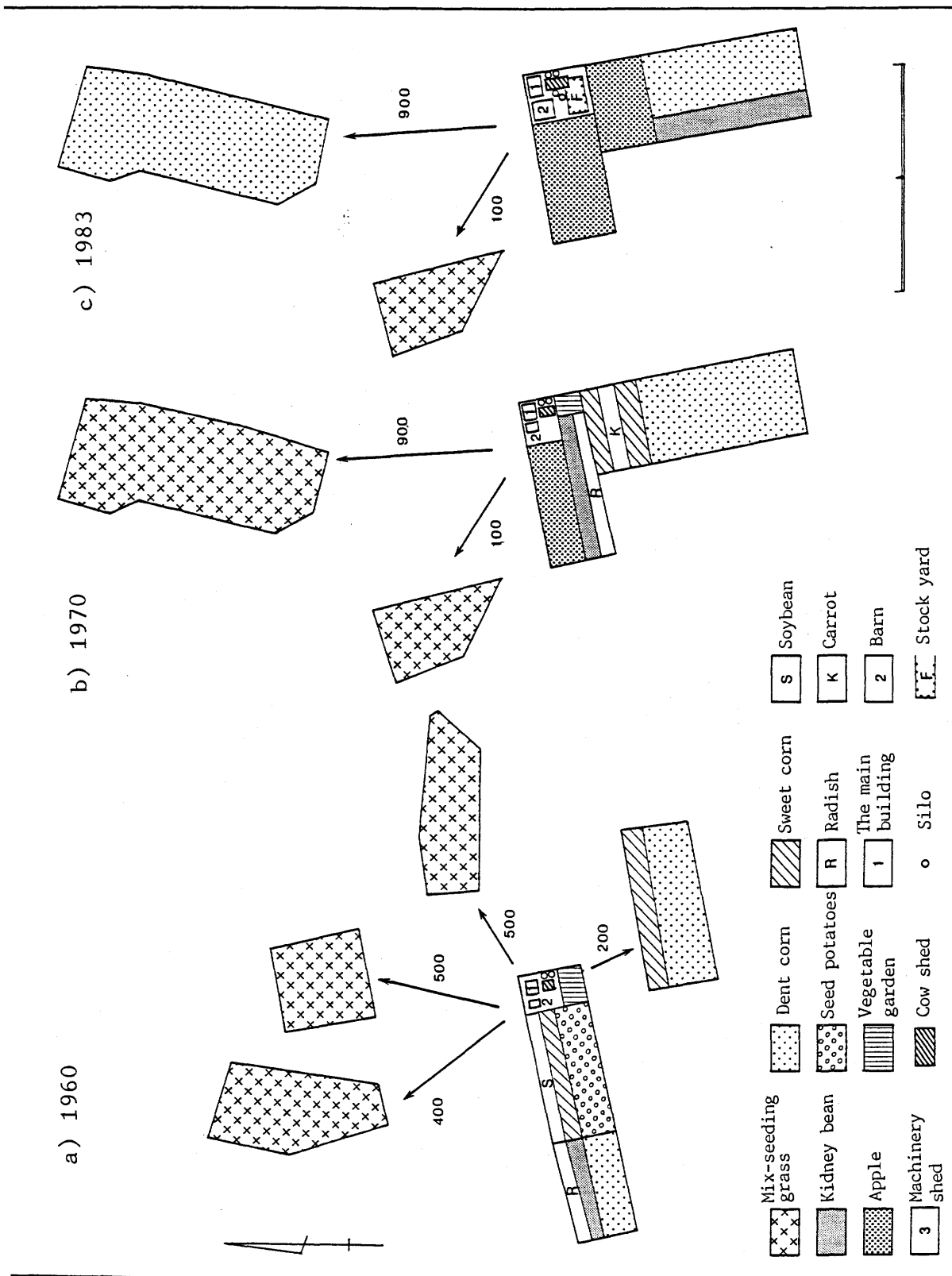


Figure 32 Changes of Arrangement of Agricultural Facilities, Arable Land and its Land Use in a Sample Viable Dairy Farm at the Mixed Farming Stage in Oyaharakaitakuchi of Nagano-hara Town, Gunma Prefecture

Note: The figure attached to arrows shows distance (meters) the housing lot to each arable land.

(Data sources: Ledgers of reclamation farming and field survey)

landholdings became consolidated. But the expansion of dairy facilities and equipments remained minimal and the intensification and enlargement of spatial organization depended on the accumulation of capital, the ability of raising capital, and the attitude of dairy farms. In the period of keeping large dairy herds, therefore, viable dairy farms at the mixed farming stage increased the number of cows to more than 30 head per farm by reducing cash crops, intensifying forage crop cultivation, and hardly expanding dairy facilities and equipments, while maintaining the original spatial organization of dairy farming. In other words, viable dairy farming at the mixed farming stage highly intensified the spatial organization but maintained the original spatial framework.

On the other hand, the viable dairy farms which well accumulated or raised capital changed from the mixed farming stage into the specialized stage. Figure 33 indicates the changes of arrangement patterns of agricultural facilities, arable land, and land use in the sample viable dairy farm which reached the specialized period in the stage of keeping large dairy herds. According to this figure, viable dairy farming at the mixed farming stage was maintained by highly intensifying the land use with forage crops by increasing the family agricultural labor as well as the number of dairy cattle, and by expanding dairy facilities and equipments, by the end of the expansion period of dairy farming. In the following period, however, married couples of two generations, including the householder and his son, engaged in dairy farming with the increase of cows, while dairy facilities and equipments were improved by using agricultural loans. Furthermore, the production bases of self-supplied feed were enlarged not only by intensifying land use but also

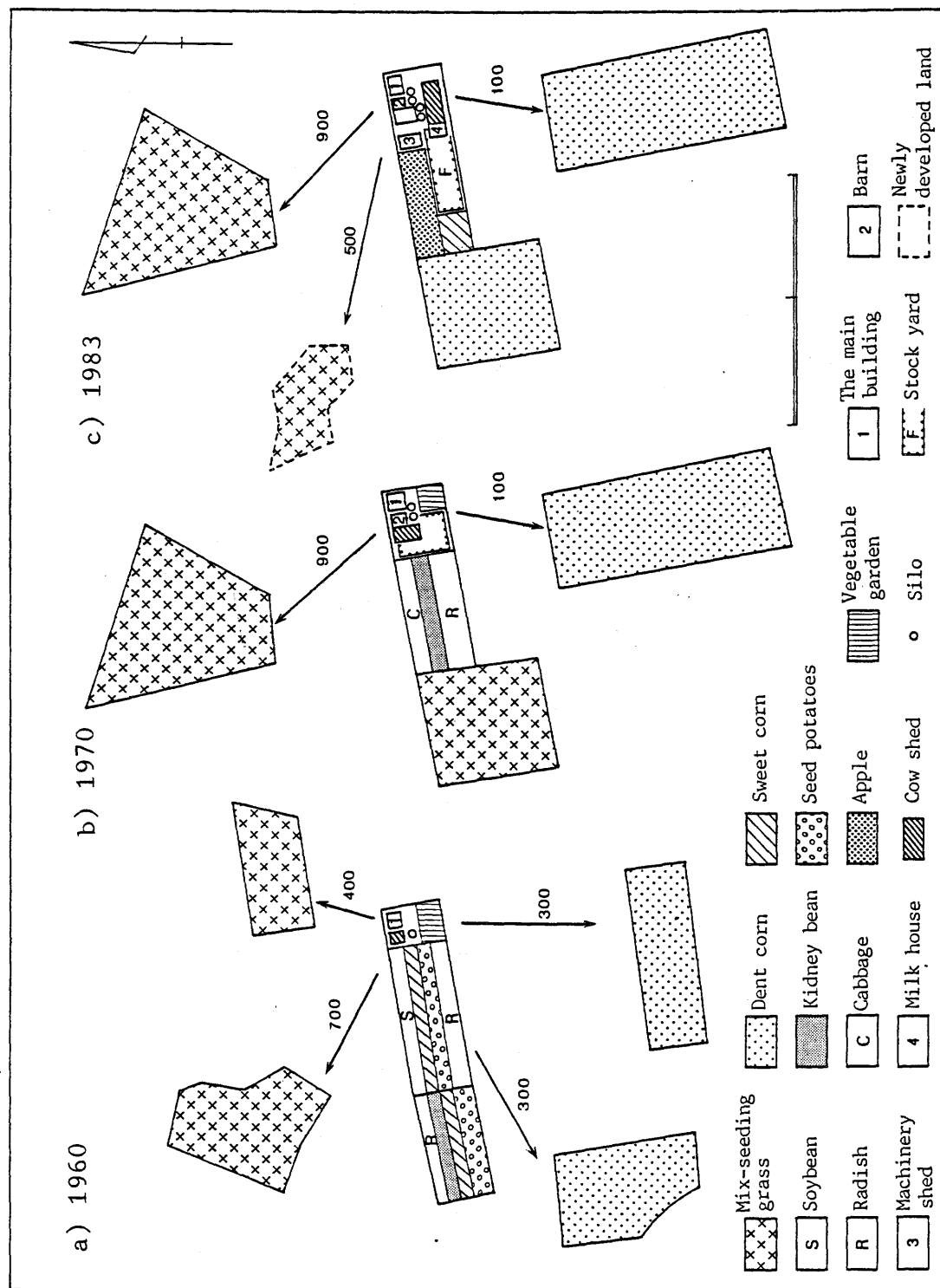


Figure 33 Changes of Arrangement of Agricultural Facilities, Arable Land and its Land Use in a Sample Viable Dairy Farm at the Specialized Stage in Oyaharakaitakuchi of Nagano-hara Town, Gunma Prefecture

Note: This farm has developed to the specialized stage of viable dairy farming in the period of keeping dairy herds. The figure attached to arrows shows distance (meters) the housing lot to each arable land.

(Data sources: Ledgers of reclamation farming and field survey)

by clearing accessory forests into farmland and establishing grassland in surrounding woods and forests. The reclamation settlements located far away from large cities such as Oyaharakaitakuchi on volcanic slopes had better possibilities of expanding cultivated acreage compared with those in outer suburban areas of large cities. This promoted the specialization of dairy farming.

The analyses of other viable dairy farms which attained the specialized stage by the end of the expansion period of dairy farming also support the above. Figure 34 indicates the changes of arrangement of agricultural facilities and arable land, and the land use in the sample viable dairy farm which developed to the specialized stage shortly after the beginning of dairy farming. It shows that this viable dairy farm already completed land clearing in the spread period of dairy farming, and with the increase of dairy cattle, established the crop rotation system centered on forage crops on the dispersed landholdings. Then agricultural machineries were utilized in the forage crop field in order to supplement the scarce family agricultural labor. Furthermore new tower silos were added and cow sheds were expanded. Therefore the spatial organization of dairy farming constituted from farm households, dairy cattle, land, and dairy facilities and equipments changed to provide the development bases of viable dairy farming by increasing of dairy cattle and forage crop cultivation and expanding dairy facilities and equipments in spite of the limited farming labor and arable land and of the insufficient capital.

Following the expansion period of dairy farming, viable dairy farms intensified and enlarged the spatial organization of dairy farming systems in order to maintain viable dairy farming at the specialized stage.

Especially as the landholdings were consolidated, family agricultural labor, dairy cattle, arable land and dairy facilities and equipments were enlarged. Additionally, the housing lot was enlarged to accommodated the expanded dairy facilities and equipments, and new parcels of farmland were added. Therefore the spatial framework of housing lot and arable land was reshaped with the expansion of the spatial organization as a whole. This enlargement of spatial framework was enabled by conditions unique to the volcanic slopes remote from large cities where arable land was easily expanded.

The above-mentioned development process of viable dairy farming in Oyaharakaitakuchi is summarized in Figure 35. Early viable dairy farming, keeping three to five dairy cows, reflected the socio-economic conditions remote from large cities and the natural conditions of volcanic slopes. This viable dairy farming developed to the mixed farming stage by intensifying the spatial organization of farm households, dairy cattle, land, and dairy facilities and equipments while maintaining the original framework. As viable dairy farming developed to the specialized stage, the spatial framework indigenous to dairy farms became enlarged, where the spatial organization of farm households, dairy cattle, land, dairy facilities and equipments were further expanded as well as highly intensified. This depended on the availability of land suitable for farming, which provided the bases of viable dairy farming in the remote areas of large cities.

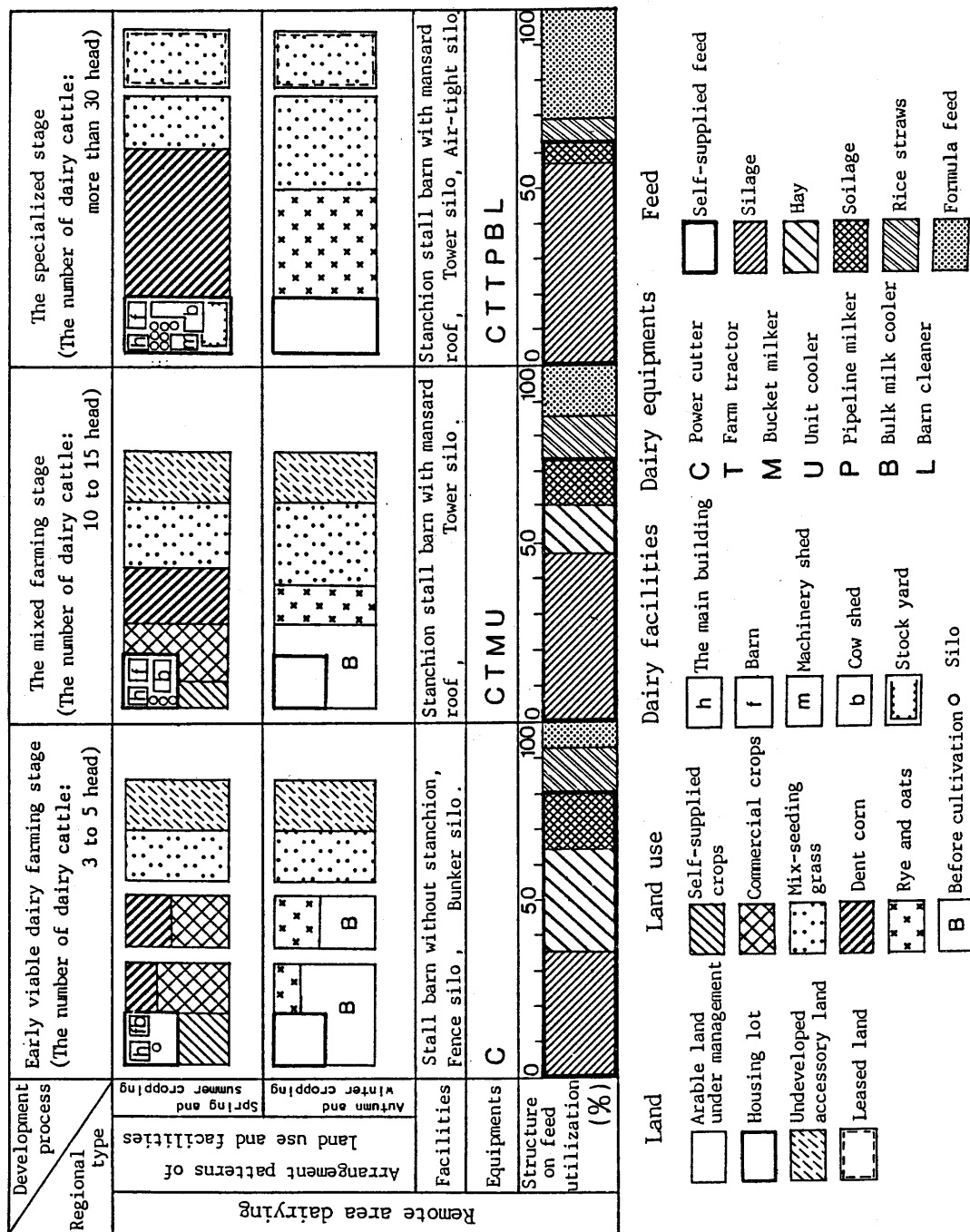


Figure 35 The Development Process of Viable Dairy Farming in Oyaharakaitakuchi of Naganohara Town, Gunma Prefecture

CHAPTER VI

THE BASES OF DEVELOPMENT OF VIABLE DAIRY FARMING

Comparing the bases of development of viable dairy farming examined in the previous chapters by each management element, we can find the distinct areal similarities and differences in the bases of development (Table 8). The similarities are as follows. On the farm households, they try to extend family agricultural labors to the second generation with diverse farming with livestock, promote keeping large dairy herds and specialize in the dairy farming. In terms of the management element of dairy cattle, the similarity is shown in keeping large dairy herds, and in terms of the management element of arable land the similarity is shown in the integration of landholding patterns, intensiveness and monopolization of land use patterns and enlargement of feed bases. Furthermore, in terms of dairy facilities and equipments, to enlarge and expand these facilities and equipments is the common bases of development of viable dairy farming. On the other hand, areal differences in the bases of development of viable dairy farming are found in the ratio of feeding cost to the value of sold milk, kinds of dairy cattle, the number of dairy cattle, the structure on feed utilization, the size of arable land under management and possibility of enlarging the size of arable land.

The structure on feed utilization is closely interrelated with the ratio of feeding cost to the value of sold milk, kinds of dairy cattle and potentiality of the enlargement of arable land size. Figure 36-a shows the fact that the ratio of purchased feed to all feed required lowers with the distance from the metropolitan center, if the structure on feed utilization is divided

Table 8 Areal Differences on the Bases of Development of Viable Dairy Farming

Elements of dairy farming Area	Farm households	Dairy cattle	Land	Dairy facilities and equipments
Outer suburban areas of large cities	Hotoshinshimakitaku, Azuma Village of Ibaraki Prefecture.	the advancement of keeping large dairy herds average size : 80 head delivered cows : 56 head milking cows of a few lactation : 16 head bull cattle : 8 head	road settlement patterns, integration of landholding patterns, intensiveness and monopolization of land use patterns, size of arable land under management (average : 1.4 ha), possibility of the enlargement of arable land size : very low, structure on feed utilization (mainly refuse feed, formula feed, silage, rice straws	enlargement and expansion of dairy facilities and equipments, stall barn, milk house silo for refuse compost board midam-sized tractor pipeline milker bulk milk cooler barn cleaner
	Shinseikaitaku, Dejima Village of Ibaraki Prefecture.	the advancement of keeping large dairy herds average size : 50 head delivered cows : 35 head milking cows of a few lactation : 5 head bull cattle : 6 head raising heifers : 4 head	road settlement patterns, integration of landholding patterns, intensiveness and monopolization of land use patterns, size of arable land under management (average : 3.0 ha), possibility of lease farming, possibility of the enlargement of arable land size, structure on feed utilization (silage, silage, hay, rice straws, formula feed, refuse feed)	enlargement and expansion of dairy facilities and equipments, stall barn, milk house bunker silo, tower silo compost board large-sized tractor pipeline milker bulk milk cooler barn cleaner
Remote areas of large cities	Oyoharakaitakuchi, Naganohara town of Gunma Prefecture.	the advancement of keeping large dairy herds average size : 45 head delivered cows : 33 head raising heifers : 12 head	dispersed settlement patterns, integration of landholding patterns, intensiveness and monopolization of land use patterns, size of arable land under management (average : 6.5 ha) possibility of grassland establishment, newly reclaiming land and the enlargement of arable land size, structure on feed utilization (mainly silage, silage, hay, rice straws, formula feed)	enlargement and expansion of dairy facilities and equipments, stall barns, milk house tower silo, air-tight silo compost board large-sized tractor pipeline milker bulk milk cooler barn cleaner

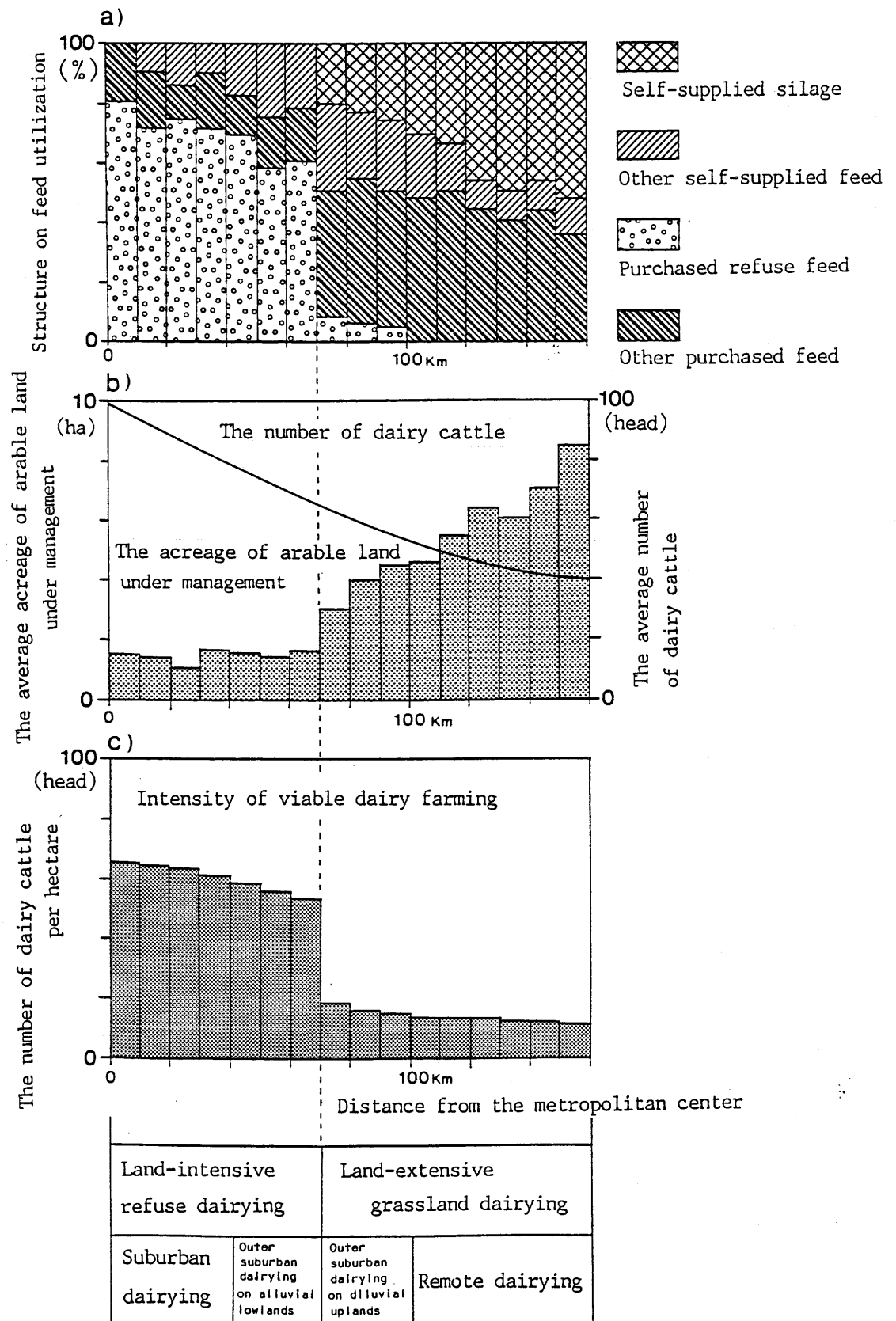


Figure 36 Areal Differences of the Structure on Feed Utilization, the Scale and Intensity of Viable Dairy Farming
(Data sources: Data from dairy cooperative associations, agricultural cooperative associations and reclamation agricultural cooperative associations. Agricultural censuses. Field survey.)

into the purchased and self-supplied feed. Especially the ratio of purchased feed to all feed required lowers rapidly over the point of 70 kilometers from the metropolitan center. This phenomenon is also prominent in the ratio of purchased refuse feed to all. Namely, purchased refuse feed is widely used in the viable dairy farming located within 70 kilometers from the metropolitan center and its ratio to all is 60 percent. In the viable dairy farming located in the area over 70 kilometers from the metropolitan center, is little used, but formula feed in the purchased feed and silage feed in the self-supplied feed are widely used. The ratio of silage feed accounts for 20 to 30 percent of all feed required in outer suburban areas of large cities, and accounts for 30 to 50 percent in remote areas of large cities.

The areal difference of the structure on feed utilization is also related with kinds of dairy cattle. Viable dairy farming using much of refuse feed conducted the dairy cattle keeping of much delivered cows and milking cows of a few lactation. Viable dairy farming using much of silage feed conducted the dairy cattle keeping of delivered cows and raising cattle with advanced registration. These areal differences of the structure on feed utilization are reflected on the possibility of land size enlargement. In the area within 70 kilometers from the metropolitan center, the agricultural land use is competed with the non-agricultural land use such as factories and residential lands, thus there is little possibility to enlarge arable land under management. Therefore production bases of self-supplied feed were very unstable. But the refuse feed is provided from the beer breweries and bean-curd factories located in the outer suburban areas and suburbs of the metropolitan center. Thus the high

accessibility to the cheap refuse feed supplements the low possibility to enlarge the size of arable land. On the other hand, the lease farming on diluvial uplands in outer suburban areas of large cities and new land development such as grassland establishment and converting woods and forests into arable land have the large potentialities. Therefore, viable dairy farming depends on the production bases of self-supplied feed such as silage. Totally, with the distance from the metropolitan center, the possibility to enlarge the size of arable land under management in viable dairy farming becomes high, and on the contrary the ratio of the purchased feed and the ratio of feeding cost to the value of sold milk becomes low.

Next, an attempt is made to examine the areal differences between the scale and intensiveness on the viable dairy farming. The scale of viable dairy farming is expressed by average size of arable land under management and the average size of dairy cattle keeping (Figure 36-b). The average size of arable land under management tends to enlarge with the distance from the metropolitan center. Especially, average arable land under management is 1.5 hectares in the areas within 70 kilometers from the metropolitan center, but it is 3.0 hectares in the areas over 70 kilometers from the metropolitan center. This is because the possibility to enlarge the size of arable land under management is low in the areas within 70 kilometers from the metropolitan center, but the possibility becomes high rapidly in the areas over 70 kilometers. While, the average size of dairy cattle keeping tends to reduce with the distance from the metropolitan center. In the areas within 70 kilometers from the metropolitan center using much of refuse feed, i.e., refuse dairying region, the average number of dairy cattle of viable farming is over 60

head, and dairy cattle keeping is not related with the land use of self-supplied feed production. On the other hand, the areas using much of silage over 70 kilometers from the metropolitan center, i.e., grassland dairying region, as the dairy cattle keeping is related with the land use of self-supplied feed production, the average number of dairy cattle of the viable dairy farming is only from 40 to 50 head. The intensiveness of viable dairy farming is expressed by the size of arable land under management and dairy cattle keeping (Figure 36-c). The intensiveness of dairy farming tends to lower with the distance from the metropolitan center. Especially, the intensiveness of viable dairy farming lowers steadily by the point of 70 kilometers from the metropolitan center, but it lowers rapidly from 70 kilometers to 80 kilometers, and over 80 kilometers, it lowers gently again. In other words, at the point of 70 kilometers from the metropolitan center, the viable dairy farming is divided into the intensive dairying and the extensive one. In the areas within 70 kilometers from the metropolitan center, the viable dairy farming is intensive, and the number of dairy cattle per hectare was over 50 head. This indicates that viable dairy farms in this area have promoted keeping large dairy herds by using much of cheap refuse feed and by conducting the land use effectively. This base of viable dairy farming shows the regional characteristics of refuse dairying with the effective use of arable land. On the contrary, in the areas over 70 kilometers from the metropolitan center, the viable dairy farming is more extensive, and the number of dairy cattle per hectare is less than 20 head. This shows that the viable dairy farms in this area have promoted keeping large dairy herds with the production of self-supplied feed on the background of high possibility to enlarge the size

of arable land under management. In other words, the bases of development of viable dairy farming have the regional characteristics with the land use type of grassland dairying.

Totally speaking, viable dairy farming has been promoted by the enlargement of agricultural family labors and arable land under management, the increase of the number of keeping dairy cattle, enlargement feed bases upon the usage of cheap refuse feed and holding acreage, integration of landholding patterns, intensiveness and monopolization of land use patterns, enlargement and expansion of dairy facilities and equipments and so on. But the bases of development of viable dairy farming are being separated into two types, i.e., land-intensive refuse dairying and land-extensive grassland dairying, due to areal differences of possibility to enlarge the farming acreage and accessibility to the refuse feed. Land-intensive refuse dairying type corresponds to "suburban dairying" and "outer suburban dairying on alluvial lowlands". On the other hand, land-extensive grassland dairying corresponds to the "outer suburban dairying on diluvial uplands" and "remote dairying". In the "suburban dairying" and "outer suburban dairying on alluvial lowland", the low possibility to enlarge the size of arable land under management was supplemented by refuse feed and the high accessibility to markets and intensiveness of dairy farming. "Outer suburban dairying on diluvial uplands" was supported by the high possibility to enlarge the size of arable land under management through the lease farming, while "remote dairying" was formed by the high possibility to enlarge the size of arable land under management.

By the way, on the bases of development of viable dairy farming, preference to diverse farming with

livestocks was also a common element. This preference was the common characteristics in many reclamation settlements after World War II. The reclamation after World War II was promoted through "Emergent Reclamation Projects" whose purpose was the production increase of food, rescue of unemployed workers, solution of social uncertainty and introduction of diverse farming with livestock. This was the work that reclamation of 1,550,000 hectares' land, inuring of 100,000 hectares' land and improvement of 2,100,000 hectares' land were practiced by 1950, and the rice, barley and wheat production increase of 1,500,000 tons (2,100,000 tons if including cereals) was pushed forward.⁸⁴ The postwar reclamation was practiced mainly in the uplands and volcanic slopes and cool highlands and cold areas unused for a long time as the margin of cultivation because of naturally bad conditions.⁸⁵ And then, so called "Postwar reclamation settlements" were established in many areas in Japan. The distribution of reclamation settlements after World War II in the Kanto district and its outskirts is shown in Figure 37. This figure shows that the postwar reclamation settlements are concentrically distributed in diluvial uplands and hilly land in outer suburban areas of the metropolitan area, and volcanic slopes in the outer margin on the Kanto district.

Densely distributed areas of reclamation settlements after World War II on diluvial uplands and hilly land in the Kanto district, are formed mainly in the southwestern parts of Shimofusa upland and surrounding areas of Lake Kasumigaura, and in the areas from Sayama hill to Hiki hill. Parts of these diluvial uplands and hilly land were developed for the military use in early the Showa era, but most of them were left alone as flat woodlands consisted of red oaks and narra, and mountainous wastelands. At that time, flat

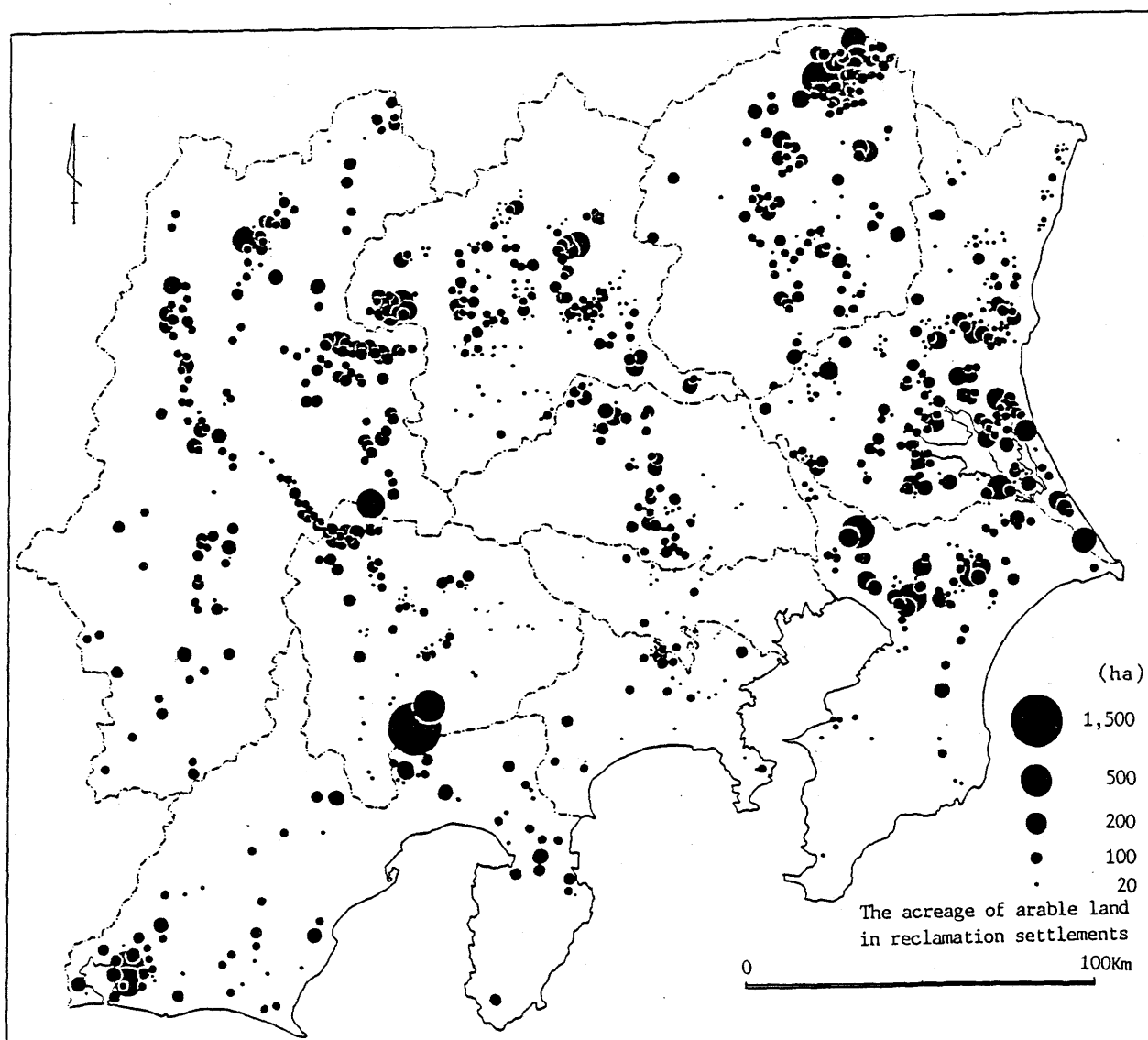


Figure 37 Distribution of Postwar Reclamation Settlements
in and around the Kanto District (1970)
(Data source: Investigation of reclamation farming results)

woodlands and mountainous wastelands were used only as the land for collecting grass and fallen leaves or fuelwood forest. Thus these lands were reclaimed with the lands of military use after World War II. Particularly, in Ibaraki prefecture since the postwar period, the reclamation settlements located in the diluvial uplands of Kanto loam have occupied 130 areas including from small areas with about 10 hectares to the large with about 200 hectares, and the total acreage of arable land amounts to 9,600 hectares. The number of areas and the total acreage of arable land correspond to 81.3 percent and 84.0 percent of the sum of the reclamation settlements after World War II in Ibaraki prefecture, respectively.

In the other hand, densely distributed areas of the reclamation settlements after World War II are mainly at the foots of Mt. Nasu, Mt. Akagi, Mt. Haruna, Mt. Asama, Mt. Yatsugatake and Mt. Fuji. These volcanic slopes were in the natural margin of cultivation before World War II, and these areas were used only as the grasslands and pasture for cows and horses in the agricultural point of view. For example, reservations of military horses supplement and pasture of the Imperial Forest Agency (Teishitsu rinya kyoku) were extended at the foot of Mt. Nasu, and its surrounding areas were known as the production places of military horses and farm horses at the beginning of Showa era. After World War II, the grasslands and pasture in the volcanic slopes were reclaimed by the repatriates from Manchuria, and diverse farming with livestocks was introduced to maintain and improve the soil fertility.

In the postwar reclamation settlements in the Kanto district, so called "reclamation crops" such as barley, wheat, cereals, potatoes and beans were the main crops from 1948 to 1958. Reclamation crops were planted in the

areas of about 70 percent of total cultivated acreage, but most of them were for subsistence but for commercial purpose. This type of farming is very inactive due to the cold weather damage and frost damage because it is so called "farming for taking seed". This peculiarity was one of the causes of cold weather damage in 1953 and 1954. With this as a turning point, there appeared many reclamation settlements transferred from "farming for taking seed" to "grassland farming". Thus agricultural management changed from the one mainly taking seed to the dairy farming. Furthermore, dairy farming was encouraged in the first promotion programs for reclamation agricultural management and then introduction of dairy cattle into the postwar reclamation settlements was promoted. In the reclamation settlements after World War II, main reason why the advancement of viable farming was positively promoted by dairy farming, was based upon the possibility to enlarge the size of agricultural management by diverse farming with livestock, mainly by dairy farming. As a result, the postwar reclamation settlements in the Kanto district were developed as dairy regions. This is evident by the fact that densely distributed regions of the postwar reclamation settlements (see Figure 37) correspond almost to most viable dairy farming regions (Figure 1-b).

Generally speaking, in the postwar reclamation settlements in the Kanto district, traditional bases of agricultural production such as rice growing was very inactive and thus possibility to enlarge the size of arable land was very high. Therefore diverse farming with livestock such as dairy farming was easy to introduce. Especially, this is the important forming factor of land-extensive grassland dairying type. Furthermore, as shown by repatriates from Manchuria, the

reclamation farms had the high knowledge of diverse farming with livestock such as dairy farming and also possessed the power of unity practicing the dairy farming cooperatively. This organizational power of unity was very profitable for introduction of various subsidies and loans necessary for the enlargement of scale in dairy farming and establishment of viable dairy farming. In other words, viable dairy farming has been established in the regions that potential possibility, experiences and tradition of dairy farming were aggregated. In this sense, it is said that the postwar reclamation settlements have been contributed to the regional formation of viable dairy farming.

CHAPTER VII

CONCLUSIONS

In the Kanto district viable dairy farming has been developed with adapting oneself to natural and socio-economic conditions. It was the purpose of this study to elucidate the bases of development of viable dairy farming and its areal differences. To put it in the concrete, the author tried to clarify the forming processes of viable dairy farming by synthesizing many farming elements, that is, farm households, agricultural managements, dairy cattle, land use patterns, forms of settlement and landownerships, dairy facilities and equipments. Each change in these elements is systematically connected with the whole changes in dairy farming systems, these changes in dairy regions affect landscape that reflect dairy farming systems in land surfaces. Especially changes in landscape in terms of dairy farming systems are reflected in land use patterns, landholding patterns, settlement patterns and arrangement patterns of dairy facilities and equipments. For that reason, landscape analyses were an effective method in elucidating the existing conditions and regional characteristics of the viable dairy farming. In this study, therefore, the author regionally compared with landscape of viable dairy farming, and tried to examine the bases and regional characteristics of viable dairy farming with considering areal differences of landscape.

In the Kanto district and its outskirts, most of viable dairy farms in 1960, that is, dairy farms keeping more than five dairy cows, were distributed in suburban areas within a 40 kilometer radius from the center of Tokyo. Viable dairy farming regions, however, were not

still formed in outer suburban and remote areas of Tokyo metropolis. Because the milk price at producer near metropolitan markets was higher than that in distant places, and Japanese dairy farming lagged still behind in dairy technological innovations such as milk cooling, storing and transporting facilities dairy farms were in the suburbs of Tokyo. In 1980 viable dairy farming of the Kanto district and its outskirts, that is, dairy farms keeping more than fifteen dairy cows, have expanded outward and been distributed in more outer areas of the Tokyo metropolitan area. The region where viable dairy farms were concentrated have been formed in suburban, outer suburban and remote areas of Tokyo metropolis. Especially viable dairy farming in suburbs has tended to move further outward and to be located in outer suburban areas, since the agricultural land use of suburban areas has competed with non-agricultural land use. Therefore, viable dairy farming regions have been mostly formed on alluvial lowlands and diluvial uplands of outer suburban areas and on volcanic slopes of remote areas of Tokyo metropolis.

Viable dairy farming in the Kanto district and its outskirts were classified into four types by natural conditions (topographical conditions, land conditions and so on), socio-economic conditions (relation between markets and producers, transportation conditions, regional organization such as dairy of agricultural co-operatives and dairy products companies, and so on) and conditions of agricultural management (kinds of dairy cattle, structure on feed utilization, farm households in a dairy farming region and sources of farm income). These types of viable dairy farming were 1) suburban dairying, 2) outer suburban dairying on alluvial lowlands, 3) outer suburban dairying on diluvial uplands, and 4) remote area dairying. Distribution of

the regional types illustrates a concentric structure centering on the center of Tokyo. The structure consists of arrangements of "suburban dairying", "outer suburban dairying on alluvial lowlands", "outer suburban dairying on diluvial uplands" and "remote area dairying" successively from the center to the margin. After 1960 viable dairy farming in the Kanto district moved outward and expanded to outer suburban and remote areas of Tokyo metropolis. Viable dairy farming has been developed as outer suburban dairying and remote area dairying. Thus, the author selected cases from "outer suburban dairying on alluvial lowlands", "outer suburban dairying on diluvial uplands" and "remote area dairying" in order to elucidate development conditions and regional characteristics of viable dairy farming.

In alluvial lowlands of outer suburban areas of Tokyo metropolis, farms practiced the mixed farming combining dairy farming with rice growing until the late 1970's, so that in outer suburban areas dairy farming with keeping large dairy herds was less developed than in suburban and remote areas of Tokyo metropolis. Mixed farming, however, has been turned into viable dairy farming since the late 1970's because dairy farms have increased family members engaged in agriculture and the number of keeping dairy cows, and have cultivated forage crops intensively. Simultaneously part-time farm households have increased as many opportunities of employment were given to farm labors, so that farm types of this dairy region have differentiated into viable dairy farms and part-time farmers. Therefore, the ratio of viable dairy farms is about 20 percent of all farm households, and it is not too much to say that the dairy farming region on alluvial lowlands of outer suburban areas has been formed by a small number of viable dairy farms. The average number of dairy cows is 80 head per

viable dairy farm. In keeping dairy cattle, viable dairy farms have preferred to increase milk yield. Accordingly, with regard to kinds of dairy cattle, milking cows account for about 90 percent of the total dairy cattle per viable dairy farm, and milking cows of a few lactation and much delivered cows account for about 20 and 60 percent of the total dairy cattle per viable dairy farm respectively.

In alluvial lowlands of outer suburban areas, viable dairy farming has been developed with keeping large dairy herds but it has not enlarged arable lands under management. The reason is that dairy farms are not able to enlarge the size of arable land under management owing to the restriction of natural conditions and the advancement of suburbanization. Furthermore it has been inactive that dairy farms have enlarged the production bases of self-supplied feed with lease farming because part-time farmers have maintained to grow rice as subsistence crop or main cash crop. As regards structure on feed utilization, purchased feed account for about 80 percent and self-supplied feed accounts for only 20 percent of all feed. This structure affects income and expenditure of farms, so that the ratio of feeding cost to the value of sold milk is 60 percent to 70 percent and the ratio of net income to gross income is 20 percent to 25 percent. Moreover, availability of cheap refuse feed, that is, tofu dregs, beer draff, strained lees of soy and vegetable refuse, has made up for low potentiality of enlarging arable land under management, and supported viable dairy farming.

Generally speaking, viable dairy farming on alluvial lowlands of outer suburban areas has been developed with dairy farming, increasing family members engaged in agriculture, using arable land with intensive cultivation of forage crops, giving a great deal of

cheap refuse feed to dairy cattle, expanding dairy facilities and equipments. This farming is characterized by keeping large dairy herds, feeding purchased feed and using arable land intensively. The characteristics of "outer suburban dairying on alluvial lowlands" are similar to those of "suburban dairying".

On the other hand, dairy farms on diluvial uplands of outer suburban areas have long practiced the mixed farming combining dairy farming with dry field farming or rice growing at reclaimed lands for paddy fields, so that dairy regions of diluvial uplands lagged behind ones of alluvial lowlands in specializing dairy farming with keeping large dairy herds. Dairy farms have gradually reduced the number of cultivating crops, cultivated forage crops intensively, simplified land use patterns and increased family members engaged in agriculture, so that they have developed viable dairy farming with keeping large dairy herds. Viable dairy farms merely account for about 30 percent of all farm households in a dairy region because part-time farm households increases as many opportunities for non-agricultural employment are given to farm labors in outer suburbs of diluvial uplands. These viable dairy farms keep 50 dairy cows on an average and give priority to increase milk yield and to retrench production cost in keeping dairy cattles. Although milking cows account for about 80 percent of all dairy cattle per viable dairy farm, milking cows of a few lactation and much delivered cows account for only 10 percent of all dairy cattle per viable dairy farm respectively. Calves and heifers raised for renewal of milking cows account for about 10 percent of all dairy cattle per viable dairy farm.

On diluvial uplands of outer suburban areas, it is characteristic that viable dairy farming has been

developed with both keeping large dairy herds and enlarging arable land under management. Originally dairy farms are not able to enlarge the size of arable land because of competition with non-agricultural land uses such as lots for housing and factory, but can enlarge acreage of arable land under management with leasing arable land from part-time farmers for all practical purposes. As regards a structure on feed utilization, self-supplied feed accounts for 40 to 50 percent of all feed required per viable dairy farm, and viable dairy farms produce self-supplied concentrate such as rye and dent corn. This structure is also reflected in income and expenditure of farms, so that the ratio of feeding cost to the value of sold milk decreases to about 50 percent. Although the figure is low, the ratio of net income to gross income merely rises to 30 percent, because of the increase in payment to dairy buildings, facilities and equipments. This payment in viable dairy farming on diluvial uplands increases more than alluvial lowlands. Examining the structure of feed utilization, the degree of dependency on purchased feed decreases in viable dairy farming on diluvial uplands compared with one on alluvial lowlands. Viable dairy farms, however, depend upon purchased feed such as formula feed and rice straws. Its degree is about 50 percent of all feed required per viable dairy farm.

Generally speaking, viable dairy farming on diluvial uplands of outer suburban areas has established and been developed with specializing in dairy farming, increasing family members engaged in agriculture, keeping large dairy herds, raising calves and heifers, enlarging arable land under management by lease farming, cultivating forage crops intensively, simplifying land use patterns, expanding dairy facilities and equipments. Although this farming is characterized by keeping large

dairy herds, enlarging acreage of arable land under management and utilizing lease farming, the degree of intensiveness in viable dairy farming is lower on diluvial uplands than on alluvial lowlands.

In remote areas of Tokyo metropolis there were few opportunities of non-agricultural employment for farm family members, and there were traditionally many seasonal workers and side businesses. Viable farming in this region has tended to specialize in commercial farmings such as dairy and vegetable growing. These commercial farmings have usually been high productivity, so that agricultural regions has alternatively been divided into dairy farming regions and vegetable growing regions according to areal differences of land conditions. Therefore, dairy farming regions in remote areas of Tokyo metropolis has already been formed since the early 1960's. Viable dairy farming in remote areas of Tokyo metropolis has been developed more quickly than one of outer suburban areas, next to suburbs. In remote areas of Tokyo metropolis, it is more distinctive that viable dairy farming is concentrated with higher density than other areas, because viable dairy farms account for about 70 percent of all farm households in this region. Viable dairy farmers have increased family members engaged in agriculture, enlarged cultivating acreage of forage crops, utilized large scale dairy buildings, facilities and equipments, and kept large dairy herds with large scale arable land under management. These viable dairy farms keep 45 dairy cows on an average and has attached much importance to saving expenditure and to increase milk quality in keeping dairy cattles. Milking cows account for only about 70 percent of all dairy cattle per viable dairy farm, the rest are calves and heifers for renewal of milking cows. Though the ratio of much delivered cows to all milking ones are

only 10 percent, advanced registration cows account for about 80 percent of all milking ones.

Land consolidation and enlargement of arable lands have been promoted with the advancement of keeping large dairy herds in remote areas of Tokyo metropolis. Through these changes viable dairy farms have possessed their farmland around their houses. The acreage of arable land under management has been enlarged by land reclamation and conversion of forestland to arable land. Because there is much forestland and woodland in remote areas of Tokyo metropolis, the potentiality of enlarging arable lands is higher in these areas than in suburban and outer suburban areas of Tokyo metropolis. This viable dairy farming is based on arable land for producing self-supplied feed, and land is predominantly used for forage crops. As regards a structure on feed utilization, self-supplied feed accounts for about 60 percent of all feed required per viable dairy farm, and especially the ratio of silage feed to all self-supplied feed is about 80 percent. As compared with self-supplied feed, purchased feed such as straws and formula feed accounts for about 40 percent of all feed required per viable dairy farm. Although viable dairy farming in all dairy regions is characterized by dependency on purchased feed in greater or lesser degree, viable dairy farms in remote areas of Tokyo metropolis give a greater deal of self-supplied feed to dairy cattle. Therefore, the ratio of feeding cost to the value of sold milk decreases to about 40 percent in these areas. But the ratio of net income to gross income still remains about 30 percent because the payment and the amortization for dairy buildings, facilities and equipments increase higher in viable dairy farming of remote areas than in outer suburban areas.

Generally speaking, viable dairy farming in remote

areas of Tokyo metropolis have been established and developed with specializing in dairy farming, increasing family members engaged in agriculture, keeping large dairy herds of advanced registration cows, collecting dairy farmers' arable land under management around their houses, cultivating forage crops intensively, simplifying land use patterns, giving a greater deal of silage feed to dairy cattle, expanding dairy facilities equipments. So to speak, this farming is characterized by keeping large dairy herds, enlarging acreage of arable land under management, utilizing the high possibility of enlarging arable land and giving a greater deal of silage feed to dairy cattle all the year round.

All things considered, viable dairy farming in the Kanto district have been developed and supported with increasing family members engaged in agriculture, enlarging the size of farm business and bases of feed utilization according to feeding cheap refuse or enlarging the acreage of arable land under management, keeping large dairy herds, collecting dairy farmers' arable land under management around their houses, changing into homogeneous and intensive land use patterns from mosaic land use patterns, expanding dairy facilities and equipments. But characteristics of viable dairy farming are divided into "land-intensive refuse dairying type" and "land-extensive grassland dairying type" according to areal conditions such as accessibility to refuse feed and possibility of enlarging arable land.

Furthermore, the inherent characteristics of the reclamation settlements after World War II are bases of development of viable dairy farming in the Kanto district. In reclamation settlements traditional farming of rice growing on paddy field is hardly established,

and there is high potentiality of enlarging arable land. Therefore it was easier for settlers to practice diverse farmings with livestock such as dairy farming. As typical settlers in reclamation settlements are repatriates from Manchuria, they are familiar with diverse farmings with livestock such as dairy farming and at the same time have co-operative spirit in practicing dairy farming. This co-operative spirit has been advantageous to obtain many kinds of subsidy and finance for expanding the scale of dairy farming and to develop viable dairy farming. Eventually, viable dairy farming has been developed in regions which accumulate tradition and experience in terms of dairy farming. In these regions there is high potentiality of expanding the scale of dairy farming and dairy farms are united under the powerful leadership. In this sense, it is not too much to say that characteristics of the reclamation settlements have contributed to develop viable dairy farming regions.

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farming. Nihon no Nogyo, 81, 3~79.
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- 49) This is defined by the ratio (%) of feeding cost to
the value of sold milk. As viable dairy farms
get income mainly from sold milk, the ratio is
nearly same as the ratio of feeding cost to gross
income.
- 50) It is necessary for the development process of dairy
farming to be grasped from the enlargement of
both keeping dairy cattle and feed bases.
Therefore the development process of dairy
farming was divided from changes of main
cultivating crops and raising livestock, and of
the number of dairy cattle and dairy farms
rationally. The author applied this method to
analyzing the development process of dairy
farming in the pioneer settlement at the foot of
Mt. Nasu and confirmed the availability of this
method.
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- 51) Celebration Approval Association, Ibraki Prefecture
(1957) : Motoshinshima kaitaku shunko kinenshi
(Essays in celebration of completion of
Motoshinshima reclaimed land) . Azuma village,
1~47.

Banks were first constructed with sand pump engineering in reclamation. The polder land was divided from Lake Kasumigaura with the outer bank, and its construction was completed in 1951. Construction of the inner bank, protection works of outer banks and drainage works of the polder land were begun after 1952. Then the reclamation settlement was established as a model village of double-crop system with the development of reclamation.

- 52) Soil horizons of sodium chloride, sulfate and ferrous chloride are formed by the groundwater level raising because of poor drainage. Growth of rice root is obstructed by hydrogen sulfide sprung from their soil horizons.
- 53) Falling the groundwater level into about 30 centimeters, Italian ryegrass can be cultivated because of its wet endurance. Because the groundwater level of Motoshinshimakaitaku, where is the polder land in marsh, is relatively high, Italian ryegrass is most suitable for cultivation in forage crops.
- 54) The system of composite facilities funds was established to grow viable farms in 1963. Objects of lending funds in this system were reclamation, improvement and acquisition of land, introduction of dairy cattle, machinaries and equipments, and construction of agricultural buildings and facilities. The debt of this system was limited to eight million yen per farm.

- 55) In terms of the acreage distribution of converting cultivation on paddy fields, the system of priority distribution is adapted in Azuma village of Ibaraki prefecture. According to this system, the acreage of converting cultivation on paddy fields was first distributed to dairy farms in Motoshinshimakaitaku, Hirasukaitaku and Daijyukaitaku for cultivation of forage crops, the rest was equally distributed among rice single-cropping farms. As to converting acreage per dairy farm more than the average acreage of converting cultivation of paddy fields in Azuma village, dairy farms recieved 6,500 yen per 10 ares as compensation besides 83,500 yen per 10 ares of incentive pay for conversion of crops.
- 56) Because a part of viable dairy farmers began to practice coitus, parturition, raising and milking in their farms consistently, the ratio of calves and heifers to all keeping dairy cattle raised 14 percent in 1975 to 36 percent in 1980.
- 57) Lewis, G., J. (1979): Rural communities. David and Charles, London, 95~117.
- 58) Land productivities of rice yield in superior (Joden), medium (Chuden) and inferior (Geden) paddy fields were 600, 480 and 360 kilograms per 10 ares respectively
- 59) Kikuchi, T. (1982): Ibid., 35).
- 60) Black locust can grow well in marsh, and the dairy farmers put its young leaves to use for feed and compost (Karishiki).
- 61) Saito, I. (1983): Ibid., 7).
- 62) Cholley, A. (1967): Ibid., 46).

- 63) Shinsei Reclamation Agricultural Cooperative Association (1976): Shinsei kaitaku sanjunen no michi (History of 30 years in Shinseikaitaku). Dejima village, 142~156.
- 64) Taguchi, M. (1958): Dry field farming of the reclamation settlement in the Kanto loam district, A case of Shinsei Reclamation Agricultural Cooperative Association, Ibaraki prefecture. Nogyo to Keizai, 24-4, 8~22.
- Yoshida, H. (1958): Cooperation and technology in the reclamation farming. Nogyo to Keizai, 24-12, 34~39.
- 65) Plowing acreage per day was about 40 ares with horses at most, but extended to about 250 ares with farm tractors. Furthermore plowings with horses and farm tractors were about 20 and 40 centimeters in deep respectively.
- 66) There were three milk gathering places in Shinseikaitaku. The first milk gathering place was between third and fourth groups (Kumi), the second milk gathering place was in front of Reclamation Agricultural Cooperative Association and the third milk gathering place was in fifteenth group. Milk gathering groups were organized with groups (Kumi). Therefore dairy farms in first to fourth groups, fifth to tenth and eleventh to fifteenth groups made use of the first, the second and the third milk gathering places respectively.

- 67) Roughage is scarce of digestible nutrient, but is rich in crude fiber. Its ratio of TDN (total digestible nutrients) is less than 50 percent. On the other hand, concentrate is rich in starch and digestible nutrient such as protein and fat, but is scarce of crude fiber. Its ratio of TDN is more than 50 percent.
- 68) Viable dairy farms at the mixed farming stage earned income of about five million yen per farm in 1975. Income of sold milk and rice accounted for 60 percent and 40 percent respectively.
- 69) These dairy farms earned income of about five million yen per farm in 1975. Income of sold milk and sold rice and non-agricultural employment accounted for 50 percent, 40 percent and 10 percent respectively.
- 70) Ogasawara, S. (1962): Dispersion movement of the settlement in Nobeyama. Jinbun chiri (The Human Geography), 14, 44~58.
Kikuchi, T. (1982): Ibid., 35).
- 71) Fluid milk from the dairy farms is gathered with smallscale tank lorries in and around Tsuchiura city of Ibaraki prefecture, because each housing lot of the dairy farms is small. About 55 percent of all fluid milk gathered from the dairy farms is sterilized and bottled in the plant of Tsuchiura Dairy Cooperative Association, and it is sold as city milk within Tokyo metropolis, Ibaraki, Chiba, Saitama and Gunma prefectures. The rest of fluid milk is sold for processing to Yukijirushi Dairy Products Company.

- 72) The Editorial Committee on History of 30 years in
Kita-Karuizawa Reclamation (1979): Kita-Karuizawa
kaitaku sanjunen (History of 30 years in Kita-
Karuizawa reclamation). Kita-Karuizawa
Agricultural Cooperative Association, Naganohara
town, 56~60.
- 73) According to the movement of economic revival in
early Showa era, establishing a branch village of
Kise village was planed by Mr. Tomoe Shimizu and
his group, who was the chief by Kise Village
Industrial Association, and was enforced in 1939.
Thus 23 households of the Manchuria reclamation
group of Kise village, in which the leader was
Mr. Kyube Shimizu's eldest son; Mr. Keitaro
Shimizu, settled Ekiba area of Banseki
prefecture, Kitsurin province. Finally the
settled farms in Manchuria Ekibakaitaku increased
to 163 households which came together from every
place of Gunma prefecture.
- 74) Agrarian Bureau in Ministry of Agriculture and
Forestry (1950): Kaitakuchi kumiaibetsu eino
jyokyo, Kanto-Hokuriku chiku (Agricultural
management by reclamation associations, Kanto and
Hokuriku districts). Tokyo, 58p.
- 75) Volcanic sand and lapilli soil is distributed in
Rokurigahara extending from the eastern of
Tsumagoi village to Naganohara town, and its
distribution corresponds with the controlled
sphere of Kita-Karuizawa Reclamation Agricultural
Cooperative Association. On the other hand,
volcanic ash humic soil is distinguished in
vegetables growing highland regions of Tsumagoi
village, so that soil conditions in Tsumagoi
village are difference from ones in Kita-
Karuizawa area.

- 76) In Kise village where is the mother village of Oyaharakaitakuchi, dairy farming has been developed, and many farms have been well versed in both technique and knowledge of dairy cattle keeping. Therefore, it was relatively smooth for the reclamation farms of Oyaharakaitakuchi to introduce dairy farming. Furthermore, the dairy farms in Kise village have been closely connected with Kantoseiraku Dairy Products Company which is one of local Dairy Products Companies. According to these connections, the dairy farms in Kita-Karuizawa area also have been closely connected with Kantoseiraku Dairy Products Company.
- 77) The Editorial Committee on History of 30 years in Kita-Karuizawa Reclamation (1979): Ibid., 72), 264~293.
- 78) Milk gathering places were established at 12 positions within Kita-Karuizawa area; milk gathering places were in the Reclamation Agricultural Cooperative Association, the first Oyahara community, the second Oyahara community, the third Oyahara community, HIRON, the first Kanra community, the second Kanra community, the first Gunmakogen community, the second Gunmakogen community, the third Gunmakogen community, the fifth Gunmakogen community and Asamakogen respectively.

- 79) As concerns reclamation agricultural cooperative associations, Nobeyama Reclamation Agricultural Cooperative Association at the foot of Mt. Yatsugatake in 1964, and Shonai Reclamation Agricultural Cooperative Association in Rokkasho village of Aomori prefecture and Kahogaoka Reclamation Agricultural Cooperative Association in Inba county of Chiba prefecture in 1964 received the Asahi Agricultural Prize. Next to these associations, Kita-Karuizawa Reclamation Agricultural Cooperative Association received the Asahi Agricultural Prize. After that, Keichozen Reclamation Agricultural Cooperative Association in Shioya county of Tochigi prefecture in 1969, Katori Reclamation Agricultural Cooperative Association in Seihaku county of Tottori prefecture and Chikumagaoka farms in Iwate county of Iwate prefecture in 1975 received the Asahi Agricultural Prize.
- 80) The dairy farms in Oyaharakaitakuchi trust pasture land of Hokkaido and the Asama pasture with yearlong grazing heifers of advanced registration cows in order to raise superior milking cows. The number of these heifers are about five head per dairy farm, and each dairy farm put three head and two head into pasture land of Hokkaido and the Asama pasture respectively. This granzing cost a year amounts to about one million yen per dairy farm.
- 81) Muraki, S. (1965): Ibid., 32).
Ogasawara, S. (1962): Ibid., 70).
Kikuchi, T. (1982): Ibid., 35).

- 82) The degree of dependency on silage feed for keeping dairy cattle has generally become to raise in dairy regions of both highland and cold land. In Oyaharakaitakuchi where is located at about 1,000 meters above the sea, silage feed accounts for more than 80 percent of all self-supplied feed required. In the reclamation settlements at the foot of Mt. Nasu, however, where are located at 500 to 700 meters above the sea, silage feed accounts for 40 to 60 percent of all self-supplied feed required.
- 83) Ministry of Agriculture and Forestry designated eleven reclamation settlements of the whole country as the experimental settlements of agricultural mechanization in order to examine results of agricultural mechanization, and lent them large scale farm tractors without compensation pay. In Kita-Karuizawa area, the first Oyahara community, Hairo and the fifth Gunmakogen community were designated as the experimental settlements of agricultural mechanization.
- 84) The Editorial Committee on History of the Postwar Reclamation (1977): Sengo kaitakushi (A history of the postwar reclamation). National Federation of Reclamation Agricultural Cooperative Association, Tokyo, 845 p.
- 85) Yamamoto, Sh., Asano, Y. and Saito, I. (1976): Geographical approaches to agriculture and agricultural region in Japan. Assoc., Japan Geogr., Spec. Pub., 2, 113~142.

菊地 俊夫

関東地方における自立酪農経営は、自然的条件と社会・経済的条件に適応しつつ成立し、酪農地域の中心になっている。そこで本研究は、関東地方における自立酪農経営の成立基盤とその地域的差異を解明することを目的とした。具体的には、酪農経営の発展過程、および自立酪農経営の形成過程のなかで、酪農経営を構成する諸要素、すなわち農家－乳牛－土地－酪農の施設装備の変化を明らかにした。これらの諸要素の変化は酪農経営の組織体全体の変化につながり、酪農経営組織体を地表に投影した景観も同時に変化する。特に、酪農経営組織体の景観の変化は、土地景観と酪農の施設装備の配置パターンに反映されるため、それらの景観分析が自立酪農経営の存立条件と地域的性格を解明するうえで有効な方法となった。したがって、本研究は酪農経営組織体の示す景観を地域的に比較し、それらの地域的差異を考察することにより、自立酪農経営の成立基盤とその地域的性格を解明した。

関東地方とその周辺地域における1960年の自立酪農経営、すなわち乳牛飼養規模5頭以上の酪農家は、主に大都市中心地から半径40km圏内の大都市近郊に集中的に分布していた。しかし、大都市近郊外縁部や大都市遠郊部では、自立酪農経営の明確な集積地域は形成されなかった。これは、生産者乳価が消費地に近接した地域で有利であったことと、牛乳の冷却・保存施設や輸送装備の技術革新が遅れていたことを反映していた。1980年になると、関東地方とその周辺地域における自立酪農経営の分布、すなわち乳牛飼養規模15頭以上の酪農家の分布は外延的に拡大し、その集積地域は大都市近郊、大都市近郊外縁部、大都市遠郊部に形成されるようになった。特に、大都市近郊では農業的土地利用と非農業的土地利用が競合するようになり、自立酪農経営の立地は外方移動する傾向にある。そのため、自立酪農経営の主要な集積地域は、大都市近郊外縁

部の沖積低地と洪積台地、大都市遠郊部の火山斜面に形成されている。

関東地方とその周辺地域における自立酪農経営は、自然的条件（地形条件、土地条件）、社会・経済的条件（市場との関係、交通条件、酪農業協同組合や乳業会社などの地域組織）、経営条件（乳牛構成、飼料構成、酪農地域の農家構成、農家の収入支出）から類型化され、「近郊酪農」、「沖積低地中郊酪農」、「洪積台地中郊酪農」、「遠郊酪農」の地域類型が設定された。さらに、関東地方とその周辺地域において、自立酪農経営の地域類型は大都市中心地を中心にして、「近郊酪農」－「沖積低地中郊酪農」－「洪積台地中郊酪農」－「遠郊酪農」の圏構造的に配列している。ところで、関東地方の自立酪農経営は1960年以降、大都市近郊から大都市近郊外縁部や大都市遠郊部に外方的に立地移動し、大都市近郊外縁部の「沖積低地中郊酪農」と「洪積台地中郊酪農」、大都市遠郊部の「遠郊酪農」として発展してきた。そこで本研究は、「沖積低地中郊酪農」、「洪積台地酪農」、「遠郊酪農」から事例地域を選定し、それぞれの自立酪農経営の存立条件とその地域的性格を解明した。

大都市近郊外縁部の沖積低地では、長く水稻作と酪農の複合経営が行われていたため、酪農経営の多頭育化と専門化は大都市近郊や大都市遠郊部よりも遅れていた。しかし、酪農家は家族農業労働力を強化し、飼料作物の集約的な栽培を行うことにより、経営の自立化を進めてきた。同時に、大都市近郊外縁部における雇用機会の増大により、兼業化が深化し、自立酪農経営農家と兼業農家との両極分化が促進された。したがって、酪農地域における自立酪農経営農家の割合は農家全体の20%程度であり、大都市近郊外縁部の沖積低地では少数の自立酪農経営が酪農地域を形成してきたといえる。自立酪農経営の平均乳牛飼養規模は80頭であり、乳牛飼養では乳量の増大が優先されてきた。そのため、乳牛構成では搾乳牛の割合が乳牛全体の90%程度であり、そのうちの調整牛と高経産牛の割合もそれぞれ搾乳牛全体の20%程度と60%程度であった。

大都市近郊外縁部の沖積低地における自立酪農経営では、乳牛飼養の多頭育化が経営耕地規模の拡大をともなっていない。これは、自然的な制約条件や宅

地化の進展により、経営耕地規模の拡大が不可能になっているためである。さらに、水稻作が兼業農家で自給用として、あるいは主要な商品生産部門として維持されているため、自給飼料の生産基盤を借地耕作で拡大することも低調であった。したがって、飼料構成では、購入飼料が80%程度であり、自給飼料は20%程度を占めるにすぎなくなっている。このことは農家の収入支出にも反映され、乳飼比は60%から70%であり、所得率は20%から25%である。また、購入飼料のなかで粕飼料が80%程度を占めており、低廉な粕飼料への近接性が低い耕地規模拡大の可能性を補完し、自立酪農経営を支えてきた。

総じていえば、大都市近郊外縁部の沖積低地における自立酪農経営は、酪農経営の専門化を指向し、家族農業労働力を強化し、乳牛飼養を調整牛と高経産牛で多頭育化し、土地所有を団地化し、土地利用を飼料作物栽培で集約化し、低廉な粕飼料を多給し、酪農の施設装備を拡充することにより成立、発展してきた。つまり、このような自立酪農経営は乳牛飼養、飼料給与、土地利用の集約化により特徴づけられ、「近郊酪農」の性格に近似している。

次に、大都市近郊外縁部の洪積台地では、普通畑作、あるいは開田化による水稻作と酪農の複合経営が長く続いたため、酪農経営の多頭育化と専門化は沖積低地のそれよりもさらに遅れた。しかし、酪農家は土地利用の作目構成を次第に調整し、飼料作物の栽培を集約化・単一化し、さらに家族農業労働力を強化し、乳牛飼養の多頭育化と経営の自立化を進めてきた。この地域においても、雇用機会の増大により、兼業化が深化している。したがって、酪農地域における自立酪農経営は農家全体の30%程度を占めるにすぎない。ここでの自立酪農経営の平均乳牛飼養規模は50頭であり、酪農家は乳牛飼養では乳量の増大と生産経費の節減を優先させている。そのため、搾乳牛は乳牛全体の80%程度を占めるが、調整牛と高経産牛の割合はそれぞれ乳牛全体の10%程度を占めるにすぎなくなっている。その反面、育成牛が搾乳牛の更新用として飼養されるようになり、その割合は乳牛全体の10%程度を占めるようになっている。

大都市近郊外縁部の洪積台地における自立酪農経営では、乳牛飼養の多頭育

化が経営耕地規模の拡大をともなっていることが特徴的である。耕地規模の拡大は、本来、住宅地や工場用地などの非農業的土地利用の拡大により不可能であったが、借地耕作が可能のため、酪農家は経営耕地規模を拡大することができた。したがって、飼料構成では自給飼料が飼料全体の40%から50%を占め、自給濃厚飼料も生産されている。このことは農家の収入支出にも反映し、乳飼比は50%程度に減少している。しかし、酪農の施設装備の償還費用が増大したため、所得率は30%程度にとどまっている。飼料構成からみれば、購入飼料への依存度は低下しているが、自立酪農経営は稲藁や配合飼料などの購入飼料に飼料全体の50%程度を依存している。

総じていえば、大都市近郊外縁部の洪積台地における自立酪農経営は、酪農経営の専門化を指向し、家族農業労働力を強化し、乳牛飼養を多頭育化し、搾乳牛の自家育成を行い、土地所有を団地化し、借地耕作により経営耕作規模を拡大し、土地利用を飼料作物栽培で集約化・単一化し、酪農の施設装備を拡充することにより成立、発展してきた。つまり、このような自立酪農経営は乳牛飼養規模の拡大と経営耕地規模の拡大、および借地耕作の可能性により特徴づけられている。そのため、自立酪農経営の集約化は「沖積低地中郊酪農」よりも低い。

他方、大都市遠郊部は通勤の雇用機会に恵まれていなかったが、従来から出稼や副業の盛んな地域であった。ここでの自立経営は、酪農や野菜栽培などの収益性の高い商品生産部門に特化する傾向にあり、土地条件の地域的差異などから酪農地域は野菜栽培地域と分化してきた。そのため、大都市遠郊部の酪農地域は比較的早くから形成され、酪農経営の自立化と専門化も大都市近郊に次いで、大都市近郊外縁部よりも早く進行した。また、自立酪農経営の集積密度が高いことも大都市遠郊部の特徴であり、自立酪農経営農家は酪農地域の農家全体の70%を占めていた。酪農家は相対的に広い経営耕地規模を背景にして、家族農業労働力を強化し、飼料作物の作付規模を拡大させ、酪農の施設装備を大型化し、乳牛飼養の多頭育化を進めてきた。自立酪農経営の平均乳牛飼養規

模は45頭であり、乳牛飼養では生産経費の節減と乳質の向上が優先されてきた。そのため、搾乳牛は乳牛全体の70%程度を占めるにすぎず、残りは搾乳牛の更新用の育成牛であった。搾乳牛においても、高経産牛の割合は10%程度に低下し、高等登録牛が乳牛全体の80%以上を占めるようになっている。

大都市遠郊部においては、乳牛飼養の多頭育化と相まって、土地基盤整備が経営耕地規模の拡大を含めて進められてきた。すなわち、土地所有を団地化し、経営耕地規模は新規の土地開発や里山増反により拡大してきた。このことは、大都市遠郊部において林野や里山が広く残存し、耕地規模拡大の可能性が高かったことを反映している。自立酪農経営における耕地は自給飼料の生産基盤であり、その土地利用は飼料作物で単一化している。自給飼料は飼料全体の60%程度を占め、そのなかでもサイレージ飼料が自給飼料全体の80%程度を占めるようになっている。これに対して稲藁や配合飼料の購入飼料は飼料全体の40%程度を占めており、自立酪農経営の購入飼料に依存する性格は変わらない。しかし、大都市遠郊部の自立酪農経営では、自給飼料が多給されており、乳飼比が40%程度に低下している。その反面、所得率は酪農の施設装備の経費や償還費用がさらに増大したため、30%程度にとどまっている。

総じていえば、大都市遠郊部の自立酪農経営は、酪農経営の専門化を指向し、家族農業労働力を強化し、乳牛飼養を高等登録牛により多頭育化し、乳牛の自家哺育と育成を拡大し、土地所有を団地化し、経営耕地規模を拡大し、土地利用を飼料作物栽培で単一化し、サイレージ飼料を多給し、酪農の施設装備を拡充することにより成立してきた。つまり、このような自立酪農経営は乳牛飼養規模と経営耕地規模の拡大、高い耕地規模拡大の可能性、サイレージ飼料の周年化により特徴づけられる。

全体的には、関東地方における自立酪農経営は農家における家族農業労働力と経営規模の拡大、乳牛飼養規模の拡大、低廉な粕飼料の利用や経営耕地規模の拡大などの飼料基盤の拡大、土地所有の団地化、土地利用の集約化と単一化、酪農の施設装備の拡充と大型化などにより支えられ成立してきた。しかし、自

立酪農経営の成立基盤は、粕飼料への近接性と耕地規模拡大の可能性の地域的差異により、土地集約型粕酪農と土地粗放型草地酪農の性格をもつようになる。土地集約型粕酪農は「近郊酪農」と「沖積低地中郊酪農」にあてはまり、土地粗放型草地酪農は「洪積台地中郊酪農」と「遠郊酪農」にあてはまる。「近郊酪農」と「沖積低地中郊酪農」は耕地規模拡大の可能性の低さを、粕飼料と市場への近接性、および経営の集約化で補い成立してきた。「洪積台地中郊酪農」は借地耕作により経営耕地規模の拡大をはかり、「遠郊酪農」は未利用地の耕地化によって規模拡大をはかることによって成立してきた。

さらに、関東地方における自立酪農経営の成立基盤のひとつとして、戦後開拓地固有の性格があげられる。戦後開拓地では、水稻作などの伝統的な農業生産基盤が脆弱であり、堆肥を投入して土地生産性をあげるため酪農などの有畜農業が導入されやすかった。また、耕地規模拡大の可能性が高かったことは土地粗放型草地酪農の重要な成立基盤になっている。さらに、満州開拓の引揚者で代表されるように、開拓農家は酪農などの有畜農業の経験を持ち、酪農経営を集团的に実践する団結力も兼ね具えていた。このような組織的な団結力は、酪農経営の規模拡大に必要な各種の補助金や融資の導入、そして自立酪農経営の成立に有利であった。したがって、自立酪農経営は酪農経営の潜在的な可能性と経験や伝統の集積した地域、および酪農経営における指導者が存在し、その強いリーダーシップに基づくまとまりある地域に成立してきた。この意味で、戦後開拓地は自立酪農経営の地域形成に寄与してきたといえる。