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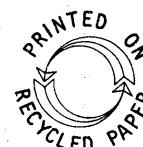
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**LAND IMPROVEMENT INVESTMENT AND
AGRICULTURAL ENTERPRISES IN JAPAN
– AS SEEN IN THE AZUSA RIVER SYSTEM**

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This paper is being circulated in a pre-publication form to elicit comments from readers and generate dialogue on the subject at this stage of the research.

I. THE SITUATION

Hata Village is located on the right bank of the Azusa River at the apex of a fan-shaped stretch of land. It has an altitude range from 600 m to 900 m above sea level, and, topographically, it is characterized by typical riverside terrace development, the usual classification being "lower," "middle," and "upper" terrace land. As described in another paper, the lower terrace land receives irrigation water from the Wada Canal, which passes through it, and in return for allowing the passage of this channel through it this land was granted permanent irrigation water service free of charge. Therefore it has never been threatened by drought damage, although it has had poor crops as the result of floods.

The middle and lower terrace lands, on the other hand, are serviced by the Hata Canal. Accordingly, they have always been at a disadvantage with respect to the existence of established irrigation practices and rights, including strict irrigation management, a system of providing irrigation water by order of priority, both of which stem from the circumstances under which the Hata Canal was built, the fact that a committee for maintenance and operation of the canal was established within the village assembly itself as part of the village's general administrative apparatus, and the fact that the construction costs of the canal were included in the village's general account budget.

As a result, these lands have suffered from an insufficient and unstable water supply year in and year out. As the farmers owning these lands have been anxious to cultivate rice, Japan's chief grain crop, it has even been necessary for them to buy water rights in order to ensure the successful cultivation of new paddy fields.

In fact, there are many local expressions and sayings connected with such an insufficient and unstable water supply which give a good idea of how bad conditions were and how local farmers craved for water.

For instance, there is the term kakemawashi, which generally refers to provision of irrigation water by order of priority. Here, however, it means the first ration of water, indicating how desperately farmers waited for it. Then there is the expression kiriageden, which means a field planted with soybeans because the chances for a good wet rice crop were poor. Another term often used was arakurejimai, arakure meaning the first "rough" harrowing. In this area harrowing was generally done in three stages in order to make the best of the water available, the first stage being arakure. What arakurejimai meant, then, was successful completion of the first stage of harrowing. If arakurejimai was not possible, the only alternative was kireageden.

Agriculture in this area being so dependent on the irrigation water situation, it was not possible to expand field crops and other intensive farming operations as farmers put their whole energy into their rice paddies during the spring work period. At that time the mainstay of farming operations in this area was sericulture, but in the course of the Showa agricultural recession, which set in at the beginning of the 1930s, the price of silk cocoons plunged, and when it seemed that sericulture was at last getting back on its feet again, farmers were forced to convert their mulberry fields to taros, beans, and various grains in line with wartime food production policy. Although sericulture recovered somewhat again after the Second World War, competition from synthetic fibres got stiffer and stiffer, and since about 1960 farmers have been engaged less and less in sericulture as they have been forced to turn to non-agricultural side employment and businesses.

We see therefore that, before the war, agriculture in Hata Village consisted primarily of two very unstable elements: rice cultivation based on an insufficient and unstable supply of irrigation water, and sericulture based on extremely unstable cocoon prices. This basic

pattern continued even after the war, but around 1970 agriculture in the village underwent a major change.

With completion of the national Chūshindaira Agricultural Irrigation Project in June 1971, the irrigation water supply became both abundant and stable and, in conjunction with this national irrigation and drainage project, a large-scale prefectural land improvement project was carried out between 1968 and 1973, with most of the investment being done in the middle and upper terrace lands. 286.5 hectares of paddy fields were consolidated and 855 m of main irrigation channels, 26,739 m of branch irrigation channels, 3,294 m of main drainage channels, 1,605 m of branch drainage channels, 3,322 m of main roads, and 24,871 m of branch roads were provided, among other things, for a total project cost of ¥456,015,000, or ¥159,600 per 10 a of farmland benefited.

Not until this epochal comprehensive land improvement project was implemented was it possible for drastic change in the structure of agriculture and a basic shift in the orientation of farming operations at Hata Village.

Let us first take a statistical look at this process of transformation and then consider what the situation is now, on the basis of the results of a survey of the farm households.

11. CHANGE IN THE STRUCTURE OF AGRICULTURE

Change in the Number of Farm Households

As of 1975 there were 1,093 farm households in Hata Village, versus 1,149 in 1950 as established by the agricultural census carried out immediately after the postwar land reform (see table 1). After falling off in the period 1950-1965, the number increased gradually again, only to decline again somewhat by 1975.

The following can be said concerning change in the breakdown of farm households by area of cultivated land. As can be seen in table 1, the average area of land under cultivation by a single farm household in Hata Village remained almost constant at about 90 a over the 25-year period in question. That means a concentration of farm households in the vicinity of 1 ha size. In other words, 53 per cent of the farm households had between 0.5 ha and 1.5 ha under cultivation in 1950, 325 households being in the 0.5-1.0 ha range, and 287 in the 1-1.5 ha range. Only 18 per cent of the farm households had less than 0.3 ha; and those with 2-3 ha were still fewer — 46 households, representing 4 per cent of the total number.

The structure of land ownership and tenant farming in Hata Village (it became a township in 1973) prior to the postwar land reform is not clear. About the only information available in this respect is the following statistics on the results of the land reform as given in "Land Reform in Nagano Prefecture," compiled by Nagano Prefecture Land Reform Records Compilation Committee and put out by the Shinano Mainichi Shimbun:

Total area of farmland	1,016.9 cho*
Paddy fields	478.1 cho
Upland fields	538.8 cho
Total area of farmland purchased or transferred	528.72 cho
Paddy fields	225.52 cho
Upland fields	303.20 cho
Total area of farmland sold	516.94 cho
Paddy fields	222.86 cho
Upland fields	294.08 cho

TABLE 1. Number of Farm Households by Size of Cultivated Land (Hata Village)

	1950	1960	1965	1970	1975
Total number of farm households	1,149	1,144	1,137	1,163	1,093
less than 0.3 ha	206	176	176	216	231
0.3 - 0.5	151	168	181	193	164
0.5 - 0.7	} 325	129	131	134	132
0.7 - 1.0		193	173	185	158
1.0 - 1.5		287	263	250	230
1.5 - 2.0	133	170	183	143	121
2.0 - 2.5	} 46	36	33	42	38
2.5 - 3.0		9	10	16	20
3.0 - 5.0		-	-	-	4
5.0 -	-	-	-	-	1
Others	1	-	-	-	-
(Average size of cultivated land per household)	89 a	91 a	91 a	87 a	87 a
Percentage breakdown					
Total number of farm households	100.0	100.0	100.0	100.0	100.0
less than 0.3 ha	17.9	15.4	15.5	18.6	21.1
0.3 - 0.5	13.1	14.7	15.9	16.6	15.0
0.5 - 0.7	} 28.3	11.3	11.5	11.5	12.1
0.7 - 1.0		16.9	15.2	15.9	14.5
1.0 - 1.5		25.0	23.0	22.0	19.8
1.5 - 2.0	11.6	14.9	16.1	12.3	11.1
2.0 - 2.5	} 4.0	3.1	2.9	3.6	3.5
2.5 - 3.0		0.8	0.9	1.4	1.8
3.0 - 5.0		-	-	-	0.3
5.0 -	-	-	-	-	0.1
Others	-	-	-	-	-

Notes: 1) Figures based on "Agricultural Census."

2) "Others" refers to a farm household with less than 0.1 ha of farmland but with agricultural product sales of more than ¥10,000 that year.

* 1 cho = 9,917.335 m².

The land purchased or transferred by the national government did not represent all the farmland that was being worked by tenants, since landlords were allowed to keep up to 1 ha of farmland under tenancy provided that they resided locally, but the area of land remaining under tenant cultivation was small enough to be ignored in calculating the following tenancy rates prior to the land reform:

Overall tenancy rate (area of farmland bought up by or transferred by the government/total area of farmland)	51.99 per cent
Tenancy rate for paddy fields	47.17 per cent
Tenancy rate for dry fields	56.27 per cent

The assumption that has been made, of course, is that the farmland purchased or transferred by the national government represented all of the tenancy land and no other land.

The higher tenancy rate for dry fields than for paddy fields is contrary to the overall pre-reform pattern in Japan, the probable reasons being the low productivity of wet paddy fields as a result of the instability of supply of irrigation water from the Hata Canal, as we have seen, which worked against a stable tenancy system, and the relative stability of tenant-landlord relations with respect to dry fields against a background of establishment and development of mulberry groves and sericulture.

The land reform created a large number of independent farmers with small holdings, mostly in the 0.5-1.5 ha range, and in the course of economic growth in the sixties and seventies there was differentiation of this group.

Such differentiation in terms of area of cultivated land became particularly pronounced after 1970, as can be seen by the considerable difference between the breakdowns of the total number of farm families by area of farmland holdings for the years up to 1965 and that for 1970 in table 1. First of all, there was a substantial decline in the number of households in the 1-1.5 ha and 1.5-2 ha ranges and a

corresponding increase in the number in the 2-2.5 ha, 2.5-3 ha and 3-5 ha ranges, meaning a relative shift to larger farms. At the other end of the ladder, there was also an increase in the number of farm households in the 0.3-0.5 ha and under 0.3 ha ranges. This differentiation was reflected by a decline to 47.2 per cent by 1970 from the 53.3 per cent of all the farm households represented by those in the 0.5-1.5 ha range immediately after the land reform and a corresponding increase in the ranks of those with more than 2 ha and those with less than 0.5 ha. In the period 1970-1975 this trend became even more pronounced, and at the same time 70 households left farming altogether, for a 6 per cent decline in the total number of farm households.

This change in the breakdown of farm families was a phenomenon that took place not just in Hata Village but throughout the country during that period. In the course of economic growth the labour market expanded, drawing labour off the farms, and more and more farmers began to engage in non-agricultural side employment and businesses. At the same time there was progress in mechanization of farming, and this resulted in the emergence of farmers oriented toward expansion of their acreage. In other words, the independent farmers with an average of about 1 ha of farmland that were created by the land reform differentiated into those who reduced their holdings and went into non-agricultural side employment and businesses and those who, continuing to specialize in agriculture, put more and more land under cultivation.

Besides these general conditions prevailing throughout the country, Hata Village was also characterized by some special circumstances of its own. These were a series of improvements in the agricultural production infrastructure, including improvement of farmland conditions through consolidation of farmland into large tracts of land, improvement of irrigation and drainage conditions, and provision of more farm roads, all in the context of a prefectural programme that began in 1968 in conjunction with a national irrigation improvement project. What these improvements did was bring about a complete change

in agriculture in Hata Village, and especially on the terrace land along the river. Where only oxen, horses, and small power tillers had been used in the past, large tractors and a variety of other large and medium-size farm machinery were introduced, and as wet-rice yields stabilized and rose sharply, it became possible to develop commercial farming in terms of other field crops. These special circumstances had a great deal to do with the change that took place in the numbers of farm households in Hata Village by the area of farmland owned and cultivated.

Increasing Engagement in Non-agricultural Side Businesses

In 1950, immediately after the land reform, half the farm households in Hata Village specialized entirely in agriculture; a quarter fell in the category of farm households engaged also in non-agricultural sidelines whose agricultural income made up more than half their total incomes; and the remaining quarter fell in the category of those with an agricultural income of less than half of their total income. However, with expansion of the labour market in the course of economic growth, there was a sharp decline in the number of farm households specializing only in agriculture. After 1960 the number of part-time farm households of the second category consistently increased, doubling by 1975, by which time they had come to represent 60 per cent of the total number of farm households. Those in the first category increased in number between 1960 and 1965 but declined after 1970. This major shift on the part of part-time farm households from the first to the second category was in evidence throughout the country during that period. Furthermore, more than 80 per cent of these part-time farm households in both categories represented employed labour, mostly regularly employed, with very few instances of casual or day labour or temporary work away from home. Those regularly employed worked for the most part in factories that were set up in the Matsumoto Basin after 1960 or as employees of various kinds of firms in the area.

It should be noted that quite a few of the part-time farm households

in the second category have been engaged in side businesses of their own rather than working as employed labour. As indicated in table 2, there were 112 such farm households in Hata Village in 1975, representing 10.2 per cent of the total. Although there are no statistics available, it would appear that most of these independent side businesses were commercial stores, factories, and other kinds of enterprises rather than forestry or fishing operations. In fact, one can assume that most of the factories subcontracting to the various kinds of firms located in the Matsumoto Basin are run by these part-time farmers. Most of them are probably what are usually described as "small rural factories" or small builders catering for public projects and other customers.

As the result of this shift toward non-agricultural sidelines, the number of full-time farm households declined from 191 in 1970 to 179 in 1975, and since 41 of these 179 households were without members of "production age," that is to say, consisted of old people, only 138, or 12.6 per cent of the total number of farm households, could really be considered to be households specializing in agriculture. Still, this is a fairly high percentage in comparison to the national average, Hokkaido excluded, of 8.2 per cent, and the Nagano Prefecture average of 8.3 per cent.

Naturally enough, this tendency toward adoption of side businesses or employment on the part of farm households has meant an increase in the number of farm households without agricultural labour. If farm households are looked at from the angle of state of engagement in agriculture, the results given in table 3 are obtained, statistics being available only for 1970 and 1975. As can be seen, there was a substantial increase between those two years in the number of farm households entirely without anyone engaged in agriculture full-time, which was taken to mean at least 150 days in the year up to the day before the survey, such farm households coming to represent 43.1 per cent of the total by 1975. While farm households with only female full-time agriculture labour remained at about 17.4 per cent throughout the five year period, those with at least one male member of the

TABLE 2. Number of Farm Households Classified by Full-Time and Part-Time (Hata Village)

	Actual Figures						Percentage						Indices (figures for 1960 representing 100)				
	1950	1960	1965	1970	1975	1950	1960	1965	1970	1975	1960	1965	1970	1975	1960	1970	1975
Total number of farm households	1,149	1,144	1,137	1,163	1,093	100.0	100.0	100.0	100.0	100.0	100.0	99.4	101.7	95.5			
Those in full-time agriculture	603	472	334	191	179	52.5	41.3	29.4	16.4	16.4	16.4	70.8	40.5	37.9			
Those of advanced age	-	-	-	-	41	-	-	-	-	-	-	-	-	3.8			
Part-time farm households of first category	272	340	368	360	267	23.7	29.7	32.4	30.9	24.4	24.4	108.2	105.9	78.5			
Those with subsidiary employment	-	297	352	343	231	-	26.0	31.0	29.5	21.1	21.1	118.5	115.4	77.8			
Those regularly engaged in wage labour	-	203	230	235	173	-	17.7	20.2	20.2	15.8	-	-	-	-			
Those serving as office workers	-	101	113	97	-	-	8.8	9.9	8.3	-	-	-	-	-			
Those engaged in temporary work away from home	-	2	15	-	2	-	0.2	1.3	-	0.2	-	-	-	0.2			
Those working as day labourers	-	92	107	108	56	-	8.0	9.4	9.3	5.1	-	-	-	5.1			
Those with their own non-agricultural business sidelines	-	43	16	17	36	-	3.6	1.4	1.5	3.3	3.3	37.2	39.5	83.7			
Part-time farm households of second category	274	332	435	612	647	23.8	29.0	38.2	52.6	59.2	59.2	131.0	184.3	194.8			
Those with subsidiary employment	-	266	347	509	535	-	23.3	30.5	43.8	48.9	48.9	130.4	191.3	201.1			
Those regularly engaged in wage labour	-	205	289	449	497	-	17.9	25.4	38.6	45.5	-	-	-	-			
Those serving as office workers	-	91	149	199	-	-	8.0	13.1	17.1	-	-	-	-	-			
Those engaged in temporary work away from home	-	4	23	3	1	-	0.3	2.0	0.2	0.1	-	-	-	0.1			
Those working as day labourers	-	57	35	57	37	-	5.0	3.1	4.9	3.4	-	-	-	3.4			
Those with their own non-agricultural business sidelines	-	76	88	103	112	-	6.6	7.7	8.9	10.2	10.2	115.7	135.5	147.4			

Note: Figures based on "Agricultural Census."

household engaged in agriculture full-time declined substantially in number, representing only 39.5 per cent of the total by 1975. Nevertheless, this percentage cannot be considered so very low if compared with the national average in that year, Hokkaido excluded, of 31.7 per cent, and the Nagano Prefecture average of 33.2 per cent.

TABLE 3. Number of Farm Households by State of Engagement in Agriculture (Hata Village)

	Actual Figures		Percentage	
	1970	1975	1970	1975
No member of household engaged full-time in agriculture	420	471	36.1	43.1
Only female member(s) of household engaged full-time in agriculture	206	190	17.7	17.4
Male member(s) of household engaged full-time in agriculture	537	432	46.2	39.5
Those households in which such male member(s) is/are under 60 years of age	-	316	-	28.9
Those with one such male member	451	383	38.8	35.0
Those with two or more such male members	86	49	7.4	4.5
	1,163	1,093	100.0	100.0

Notes: 1) Figures based on "Agricultural Census."

2) "Full-time" is defined here as at least 150 days a year.

Furthermore, in almost three in four of the cases of farm households with at least one household member engaged full-time in agriculture, at least one of the persons in question was a male under 60. In most such cases, however, there was only one such person.

The fact that the percentage of farm households in Hata Village with at least one male member engaged in agriculture full-time is fairly high is attributable to the fact that farm households there have a mixture of agricultural operations, including wet-rice cultivation, field crops, and orchards. As we have seen, a farmland improvement programme started in 1968, but before then wet-rice cultivation was very unstable, and this stood in the way of much progress being made in production of field crops for the market, although a large number of field crops were tried. With implementation of the farmland improvement programme, however, there was a pronounced improvement in the productivity of wet-rice cultivation, and it became possible to

develop market-oriented agriculture through strategic expansion of the field-crop sector. Such are the circumstances behind Hata Village's fairly high percentage of farm households still specializing in agriculture in spite of the trend toward engagement in non-agricultural side employment or businesses and its high percentage of farm households with at least one male member engaged full-time in agriculture. Let us now consider how the village's land-use structure has changed.

Change in the Structure of Land Use

First let us take a look, in table 4, at how total area of farmland has changed over the years. Agricultural census figures have been used, partly in order to be able to relate the findings to farm household statistics. Although there is a general tendency for the agriculture census statistics on area of farmland to be somewhat lower than those obtained in other surveys, including those concerning farmland area alone, the agricultural census figures will serve our purpose assuming there is no change in the rate of error from year to year, the absolute figures being not so important in this case.

In 1950, immediately after the land reform, the total area of farmland in Hata Village was 1,023 ha. By 1960 this figure had increased by over 20 ha with the conversion of new land to paddy fields and other farmland, but after that some of the existing farmland was gradually abandoned over the years, causing this figure to decline to 960 ha by 1975. This represents a 6 per cent decline over the 25-year period from 1950, which is much lower than elsewhere, the reason being that urbanization has not been very pronounced in that area.

Now let us take a look at how the areas of different types of farmland have changed over the years. In 1950 the area of paddy fields amounted to 481 ha, but only 475 ha were put under cultivation, probably because of a shortage of irrigation water. Thereafter the total area of paddy fields increased by 10 to 20 ha between each survey and the following one five years later, reaching 548 ha by 1975.

TABLE 4. Breakdown of Farmland by Type (Hata Village)

	Actual Figures (ha)					Percentage					Indices (Figures for 1960 representing 100)				
	1950	1960	1965	1970	1975	1950	1960	1965	1970	1975	1950	1960	1965	1970	1975
Total area of farmland in use	1,023	1,045	1,037	1,016	960	100.0	100.0	100.0	100.0	100.0	100.0	100.0	102	101	99
Total area of paddy fields	481	515	525	535	548	47.0	49.3	50.6	52.6	57.0	45.9	49.1	50.7	52.3	57.8
Area of paddy fields planted with rice	475	515	520	532	496	46.4	49.3	50.1	52.4	51.7	46.2	49.1	50.8	49.9	51.4
Upland fields	369	364	351	342	306	36.1	34.8	33.8	33.7	31.9	35.5	33.8	33.7	33.7	31.9
Orchards and groves	173	165	159	139	107	16.9	15.9	15.3	13.7	11.1	17.2	15.3	13.7	11.1	9.5
Orchards	19	59	73	76	83	1.9	5.6	7.0	7.5	8.6	1.9	5.6	7.5	8.6	9.5
Mulberry groves	154	106	84	61	24	15.0	10.1	8.1	6.0	2.5	15.0	10.1	6.0	2.5	1.5

Note: Figures based on "Agricultural Census."

However, as a result of the government policy, beginning in 1965, of restricting rice cultivation in order to cope with the surpluses of that grain, 5 ha of paddy fields were not planted with rice in 1965, 3 ha were not planted in 1970, and 52 ha were not planted in 1975, this last figure representing nearly 10 per cent of the paddy-field acreage. In that year those 52 ha were planted with watermelon instead, in an effort, as we shall see, to develop the area into one of major watermelon production.

In any case, as the area of paddy fields increased, there was a steady decline in the area of other fields, from 369 ha in 1950 to 306 ha in 1975, for a decrease of almost 20 per cent. This decline was particularly rapid after 1970 — 36 ha in five years, or more than 10 per cent of the area in 1970. The explanation is that, with completion of the irrigation improvement project in 1971, the supply of irrigation water became plentiful, and more land was converted to paddy fields in the context of the farmland improvement programme.

Also noteworthy is the change in the area of grove and orchard land, which amounted to 173 ha altogether in 1950 and only 107 ha in 1975, a decline of almost 40 per cent. Looking at the breakdown, however, we see that orchard land increased more than fourfold from 19 ha in 1950 to 83 ha in 1975, and mulberry groves declined sharply from 154 ha in 1950 to a mere 24 ha in 1975. If this rate of decline keeps up, one can expect mulberry groves to disappear altogether by 1980.

We see, therefore, that there has been tremendous change in the breakdown of farmland by type since the land reform, from 47 per cent paddy fields, 36 per cent other fields, 2 per cent orchards, and 15 per cent mulberry groves in 1950, to 57 per cent paddy fields, 32 per cent other fields, 9 per cent orchards, and 2 per cent mulberry groves in 1975.

Now let us take a look, in connection with this change in the breakdown of farmland by type, at the change in the breakdown of the crops grown.

Table 5 gives figures for the number of farm families in Hata Village that grew each kind of crop and the area that each kind of crop was grown on in the years in which an agricultural census was taken. Of course, these figures do not directly indicate what change took place in the structure of land use, but they can serve as a basis for roughly inferring what the change was. Only about half the number of different kinds of crops grown have been included in the table, since not all the censuses covered the same crops and many of the crops were grown in only a limited way for consumption by the farm household itself.

In 1950 the crops that were grown by the largest number of farm households were potatoes (1,057 households) and wheat and similar grains (1,041 households). Next came sweet potatoes (938 households), and then wet rice (913) in only fourth place. What this means is that although all the farm households in the village very much wanted to grow rice,

TABLE 5. Change over the Years in the Number of Farm Households Growing Each Kind of Crop and the Area on which Each Kind of Crop was Grown (Hata Village) (Area Given in Hectares)

		1950	1960	1965	1970	1975
Wet rice	Number of families	(A) 913	957	984	998	922
	Harvest area	(B) 435	471	483	491	462
Dry rice	(A)	183	22	8	3	-
	(B)	23	2	0	0	-
Wheat and similar grains	(A)	1,041	767	602	79	9
	(B)	181	143	51	5	0
Millet of different kinds	(A)	-	764	608	406	155
	(B)	144	111	71	30	10
Potatoes (Irish)	(A)	1,057	816	687	732	599
	(B)	27	21	32	29	13
Sweet potatoes	(A)	938	95	3	11	21
	(B)	23	1	0	0	0
Soya beans	(A)	908	834	623	434	406
	(B)	74	51	30	16	7
Red beans	(A)	556	313	139	145	85
	(B)	6	4	2	2	1
Other beans	(A)	-	50	-	202	54
	(B)	-	2	-	4	2
Tobacco	(A)	-	1	80	61	25
	(B)	-	0	11	9	5
Tomatoes	(A)	-	-	425	567	610
	(B)	1	2	14	28	18
Japanese radishes	(A)	-	-	682	890	734
	(B)	25	18	10	17	8
Watermelons	(A)	-	-	-	162	190
	(B)	1	3	-	18	54
Flowers	(A)	-	-	25	24	26
	(B)	-	-	1	2	11
Seedlings and saplings	(A)	43	145	176	166	108
	(B)	12	40	65	70	57

the inadequate supply of irrigation water kept about 140 of them from doing so. Instead, they grew dry rice, which was grown by 183 households in all. Next after wet rice came soya beans (908 households), and then red beans (550 households). No doubt almost all the farm households in Hata Village also grew different kinds of millet, although no statistics are available on this point.

To sum up, one can say that in 1950, when there was still a serious food shortage, wet rice was grown wherever possible, and millet, beans and, as a second crop, wheat and similar grains were grown in dry fields and paddy fields with insufficient irrigation water, with vegetables and other miscellaneous crops being grown on the remaining farmland. In addition, as we have seen, there were 154 ha of mulberry groves. In other words, the farming pattern was one of rice, sericulture and various grains, and this pattern determined the structure of land use. The figures for harvest area were 435 ha of wet rice, 183 ha of wheat and similar grains, 154 ha of mulberry groves, 144 ha of miscellaneous grains, 74 ha of soya beans, and 50 ha of potatoes and sweet potatoes, with only 25 ha of radishes as the chief vegetable crop.

There was some gradual change in this land-use structure in the 1960s but not a decisive one.

There was an increase in both the number of farm households growing wet rice and in the area on which it was grown, with a corresponding sharp decline in dry rice, but there was not much of a decline in the number of households growing wheat and similar grains, miscellaneous grains, potatoes and sweet potatoes, soya beans and so on, and the area devoted to the cultivation of these crops only declined to about half what it had been in 1950. The big change that took place in that period was the decline in mulberry groves and a corresponding increase in orchards and in such market crops as tomatoes, seedlings and saplings.

Let us take a closer look at how orchard cultivation developed in terms of the figures given in table 6. In this area there had been some

apple growing even before the war, and in spite of the food shortage that continued even after the land reform, 368 farm households in Hata Village grew apples on a total of 15 ha in 1950, although this only amounted to an average of 4 a per household. Between 1960 and 1965 there was a major increase in the area of apple cultivation to 56 ha, of which 38 ha represented fully mature orchards. After 1970, however, both the number of farm households growing apples and the area devoted to their cultivation dropped off as the result of increased import of bananas after liberalization of trade, the trend toward engagement on the part of farm households in non-agricultural employment and businesses, and a shift to higher-quality grades of apples.

TABLE 6. Number of Farm Households Engaged in Orchard Product Cultivation and the Area of Land Devoted to It (Hata Village)

		1950	1960	1965	1970	1975
Number of households:	Growing Apples (A)	368	406	188	225	173
	Growing Grapes (B)	-	49	56	51	42
	Growing Peaches (C)	14	29	38	43	30
Total area of cultivation:	(A)	122	51	36	29	67
	(B)	5	9	6	7	18
	(C)	5	7	6	6	6
Area representing mature orchards:	(A)	64	4	60	119	115
	(B)	1	1	0	15	18
	(C)	0	0	6	13	14
Farm households growing apples	(%)	32.0	35.5	16.5	19.3	15.8
Farm households growing grapes	(%)	10.6	4.5	3.2	2.5	6.2
Farm households growing peaches	(%)	5.6	0.3	5.3	10.2	10.5

There was also considerable cultivation of grapes in Hata Village. In 1950, 122 farm households in the village grew grapes on 5 ha of land, for an average of only about 4 a per household. In the 1960s and early 1970s there was a big decline in the number of households growing grapes, but the area of cultivation fluctuated, the figures for 1975 being 67 households growing grapes on 18 ha, for an average of about 27 a per household. Still, some of these households were specializing in grapes, growing mostly new varieties.

Another major orchard product was peaches. In 1950 they were only grown for home consumption, but in the 1970s the number of households growing them increased, and their area of cultivation reached 18 ha.

In 1975, 15 per cent of the farm households in Hata Village were growing apples, 6 per cent were growing grapes, and 10 per cent were growing peaches, and one can assume that almost 30 per cent were engaged in orchard cultivation of one kind or another.

Now let us go back to the overall land-use situation.

Needless to say, in 1975 wet rice was grown by more farm households on a greater area of land than any other crop. However, in line with the government policy of discouraging rice production, the number of households growing rice had declined again to about the same as after the farmland reform, and the area of cultivation declined to 462 ha, which was far below the peak that had been reached in rice's heyday. As for wheat and similar grains, only nine households were now growing them, and on very little land at that. Miscellaneous grains, potatoes, soya beans, etc. were only being grown for home consumption, and there had even been big declines in such market crops as tomatoes and tobacco. On the other hand, there had been a steady increase in watermelons, flowers, and seedlings and saplings. Furthermore, although not indicated in the table, there was some cultivation of hay (11 ha) and prematurely cut maize (25 ha) as animal husbandry increased, a tendency which we will look into later, and there was also an increase in long taros, a speciality in this area.

Especially noteworthy are watermelons. Only 3 ha in 1960, their area of cultivation increased to 18 ha in 1970 and 54 ha in 1975, by which time 190 farm households were growing them, for an average of 28 a per household, making them the village's most important speciality product.

Thus, as a result of the improvement of irrigation facilities and farmland that took place in the late 1960s and early 1970s, the picture is one of development of mixed farming and a mixed land-use pattern, based on rice cultivation with the addition of specialities such as watermelon and long taros and such market-oriented sectors as orchard products and animal husbandry, although there was also a decline in the total area of cultivation and in the rate of use of the land as

more and more farm households became engaged in non-agricultural side employment and businesses.

Development of Animal Husbandry

Having seen how the land-use and crop structures have changed, let us now turn our attention to the development of animal husbandry.

Table 7 shows the numbers of different domestic animals that were raised in Hata Village in agricultural census years from 1950 to 1975.

In 1950 the most commonly bred animals were chickens. The number of farm households raising them was 609, or 53 per cent of the total number of farm households in the village. Since the average was only about four birds per household, however, it is clear that they were only being raised for home consumption. Next most common were cattle, both for meat and labour, and horses. They were mainly raised as draft animals, and only now and then would a calf or foal be sold. The households with such livestock usually only had one, and the total number of both cattle and horses was less than half the number of farm households. The households without any had to make do with human labour for ploughing, ground levelling and even the carrying of loads. Only 94 households raised hogs, and only 25 had dairy cattle, and in both cases they usually only had one, as a very incidental part of their farming operations.

Instead of animal husbandry, it was sericulture that was most general. In 1950, 573 of the farm households in the village were engaged in this activity, but with an average cocoon output of only about 73 kilograms per household.

In the 1960s this structure of animal husbandry underwent substantial change. The number of households with dairy cattle increased rapidly, many households having two head, and some even more, though the average was only about 1.5 head per household. By 1960 the number of households

TABLE 7. Change in the Structure of Animal Husbandry (Hata Village)

	1950	1960	1965	1970	1975
Dairy Cattle:					
Number of farm households raising them	25	147	97	53	28
Number of head raised	31	214	220	229	317
Number of these two years or older	-	-	142	150	232
Total number of households with dairy cattle two years or older	-	102	69	37	26
Breakdown by number of such dairy cattle per household:					
1- 4 head	-	101	66	24	6
5- 9 head	-	-	2	13	10
10-14 head	-	1	1	-	5
15-29 head	-	-	-	-	5
30 or more	-	-	-	-	-
Percentage of total number of farm households raising dairy cattle	2.2	12.8	8.5	4.6	2.6
Average number of head per household	1.2	1.5	2.3	4.3	11.3
Meat and Draft Cattle:					
Number of farm households raising them	269	314	276	138	56
Number of head raised	274	322	292	398	311
Number of these of dairy type	-	-	-	-	134
Percentage of total number of farm households raising meat or draft cattle	23.4	27.4	24.2	11.9	5.1
Average number of head per household	1.0	1.0	1.1	2.9	5.6
Hogs:					
Number of farm households raising them	94	131	125	92	39
Number of head raised	103	190	484	1,138	1,919
Average number of head per household	1.1	1.5	3.9	12.4	49.2
Broilers:					
Number of farm households supplying them	-	-	-	7	5
Number supplied	-	-	-	54,000	98,000
Average number per household	-	-	-	7,714	19,600
Chickens:					
Number of farm households raising them	609	702	489	357	112
Number raised	2,313	6,936	6,208	3,198	1,728
Average number per household	3.8	9.9	12.7	8.9	15.4
Sericulture:					
Number of farm families producing silkworm eggs	573	556	469	339	81
Number of boxes of silkworm eggs produced	41,721*	49,539*	1,734	1,091	277
Percentage of total number of farm households engaged in sericulture	49.9	48.6	41.2	29.1	7.4
Horses:					
Number of farm families raising them	249	169	39	18	-
Number raised	250	169	39	19	-

Notes: 1) Figures based on "Agricultural Census."

2) * Number of kilograms of cocoons produced.

with cattle for meat or labour reached 27 per cent of the total, but each had only one head. The number of chickens and hogs, as well as the number of households raising them, also increased, but not much

beyond the home consumption level, and the number of horses was already declining. As for sericulture, 1960 was its peak year in terms of cocoon output.

Change in the structure of animal husbandry quickened its pace in the latter half of the 1960s, owing mainly to the replacement of draft animals by power tillers and tractors and the growing tendency for farmers to take up non-agricultural side employment or businesses, which were incompatible with animal husbandry.

Let us now take a look at the figures for 1970. After peaking in 1960, the number of farm families raising dairy cattle declined to 53 by 1970, or 4.6 per cent of the total number of farm households. However, the average number of head raised per household increased. As for draft cattle, there was a decisive shift toward raising them for meat rather than labour, beginning in the latter half of the 1960s, and this resulted in a decline in the percentage of farm households raising them (to 11.9 per cent in 1970) but an increase in the number raised, the average reaching almost three head per household in 1970. The trend for hogs was just about the same, with the number of households raising them declining, but the number of head being raised increasing substantially, for an increase in the average number per household as well. In 1970 there were also for the first time farm households engaged in the broiler business, and as large-scale operations at that, with only seven households producing 54,000 broilers between them. Chickens raised for eggs, however, for the most part only produced in quantities adequate for self-sufficiency.

The raising of draft horses declined too, with only 19 head being raised by 18 households in 1970, and there was a decisive decline in sericulture as well as fewer than one household in three continuing to engage in it.

These trends were still more pronounced by 1975. By then only 28 households, or 2.4 per cent of the total, were raising dairy cattle, but there was a large increase in the number raised per household, the

average surpassing 11 head and ten of the 28 households raising ten or more head each. The same trend was in evidence with respect to meat cattle, with the percentage of farm households raising them declining to 5.1 per cent, but the average number per household rising sharply to 5.6 head. The same goes for hogs, with the number of farm households raising them falling to 39, but the average number per household reaching 50. As for broilers, the five households producing them averaged 20,000 each. Fewer households kept layers, and those who continued to do so did not increase their production much beyond their own domestic needs. Horses disappeared altogether, and there was a big drop in the number of households engaged in sericulture to 81, or only 7.4 per cent of the total, with an average of only 3.4 boxes of silkworm eggs being kept by each. Sericulture, once practised by nearly half the farm households in the village, was now practically on its way out.

Thus we see in all categories, as more and more farmers went into non-agricultural side occupations, animal husbandry as an incidental part of farming disappearing and remaining only as an activity participated in by farmers specializing in it and oriented toward expansion of scale.

Change in the Structure of Agricultural Production

Having seen how the land-use and crop structures and animal husbandry production have changed over the years, let us now take an overall look at the change in the structure of agricultural production in terms of the value of gross agricultural production as given in table 8.

Despite the fact that there is some difference in the way the figures were obtained for different years, they are adequate enough for our purposes here, which is to get an idea of basic trends.

The reason I have chosen the figures for these years, which are different from the years which we have so far been considering in which agricultural censuses were carried out, is that I wanted to get a

TABLE 8. Gross Agricultural Production Figures for Hata Village

	Actual Figures				Percentage			Indices (figures for 1961 representing 100)			
	1961	1968	1973	1976	1961	1968	1973	1976	1968	1973	1976
Value of gross agricultural production	485	905	1,773	2,481	100.0	100.0	100.0	100.0	187	365	512
Total for crops and other field products	392	725	1,505	1,946	80.8	80.1	84.9	78.5	185	384	496
Rice	200	375	440	739	41.2	41.4	24.8	29.8	187	220	369
Wheat and similar grains	33	16	0	1	6.8	0.7	0	0.0	67	39	33
Miscellaneous grains and beans	16	7	9	14	3.3	0.8	0.5	0.6	44	56	87
Potatoes and sweet potatoes	52	147	418	545	10.7	16.2	23.6	22.1	282	804	1,048
Vegetables	22	50	118	187	4.5	5.5	6.7	7.5	227	536	850
Fruits	2	1	25	30	0.4	0.1	1.4	1.2	50	1,250	1,500
Flowers	8	18	14	27	1.6	2.0	0.8	1.1	225	175	338
Industrial crops	59	105	468	393	12.2	11.6	26.4	15.8	178	793	666
Seedlings and saplings											
Sericulture	44	56	33	13	9.1	6.2	1.8	0.5	127	75	30
Animal husbandry	49	124	235	522	10.1	13.7	13.3	21.0	253	480	1,065
Meat cattle	-	17	25	52	-	1.9	1.4	2.1	-	-	-
Dairy cattle	-	33	69	137	-	3.6	3.9	5.5	-	-	-
Hogs	-	53	91	232	-	5.8	5.1	9.4	-	-	-
Chickens	-	17	47	93	-	1.9	2.7	3.7	-	-	-
Processed agricultural products	0	0	3	8	-	0	0.2	0.3	-	-	-

Notes: 1) Figures for 1961 and 1968 based on "Agricultural Income Statistics."

2) Figures for 1973 and 1976 based on "Agricultural Production Income Statistics."

better picture of how agriculture in Hata Village changed as a result of the irrigation and farmland improvement projects that were carried out between 1968 and 1973.

The wet-rice crop was still unstable in 1961, as reflected by the agricultural production breakdown of 41 per cent rice, 7 per cent wheat, similar grains and miscellaneous grains, 3 per cent potatoes and sweet potatoes, 11 per cent vegetables, 4 per cent fruit, 14 per cent seeds and seedlings, flowers, and industrial art crops (these field crops totalling 81 per cent), 9 per cent sericulture, and 10 per cent animal husbandry.

By 1968 there was considerable change in this breakdown, with a rise in vegetables and fall in wheat and other grains and potatoes and sweet potatoes, although the total for field crops was still about 80 per cent and sericulture down to 6 per cent and animal husbandry up to 14 per cent.

By 1973 the breakdown had become 85 per cent field crops, 2 per cent sericulture, and 13 per cent animal husbandry. Sericulture had decisively declined while animal husbandry remained at about the same level, and, in the field-crop category, there had been a sharp decline in rice, as a result of the government policy of discouraging rice production, and a collective rise in vegetables, seedlings and saplings to about the same level as rice. Also to be taken into account, however, is the fact that the land-improvement project considerably reduced the rice acreage that year.

Since then this trend of less rice, more vegetables and seedlings and saplings, relegation of sericulture to relative insignificance, and more animal husbandry has remained basically unchanged.

In figure 1 one can see at a glance how the value of gross agricultural production has changed for different products. Although one may consider the decline in rice in 1973 to have been partly a temporary change, due to the land-improvement project works, one can see very

clearly how rice is trending down, vegetables and seedlings and saplings and saplings have increased, sericulture has waned, and animal husbandry has grown.

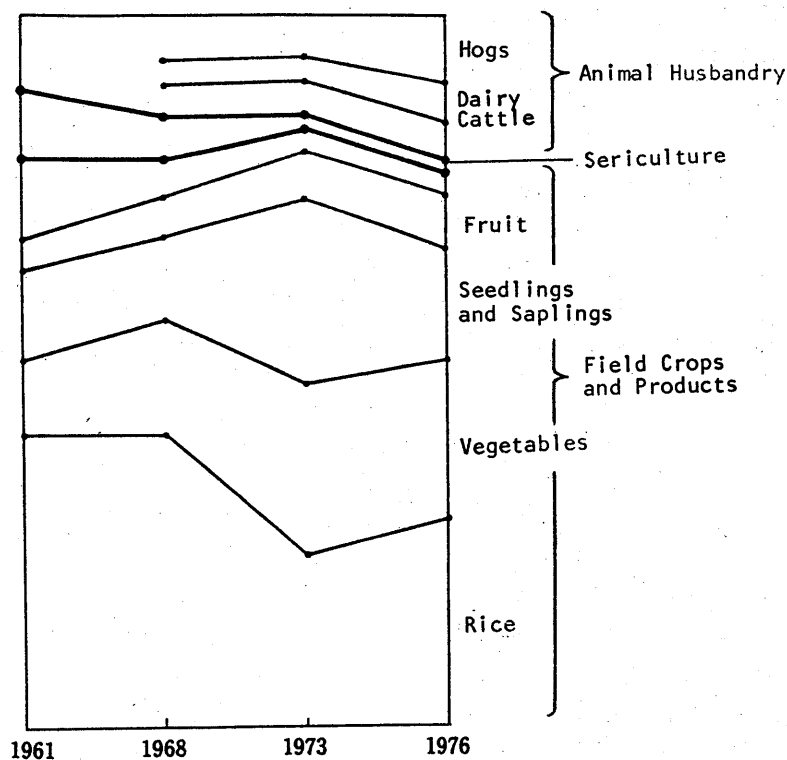


FIG. 1. Change in the Breakdown of Total Gross Agricultural Production (in terms of monetary value)

The farmers in Hata Village, faced with an unstable and insufficient supply of irrigation water, used to wish that they could grow more rice. It is rather ironic, therefore, that just when their wish might have come true thanks to the irrigation and farmland improvement projects, they were forced to turn away from rice to other crops by the government, which was burdened with a growing stockpile of surplus rice. Not in all cases did this move away from rice come off smoothly, but nevertheless the farmers of Hata Village were able to make the change in two directions. One was toward further part-time engagement in non-agricultural employment or businesses, and the other was toward development of speciality crops such as watermelon and long taros. Furthermore, many farmers expanded their production of seedlings and saplings, hogs, and dairy products.

We see, therefore, that the projects for improvement of irrigation

facilities and farmland had two effects: first, that of promoting movement away from agriculture in the form of more part-time engagement in non-agricultural employment and businesses and, second, that of providing an opportunity for expansion of the scale of farming operations.

Furthermore, it was rapid mechanization of agriculture that made movement in both these different directions possible, with the irrigation and land-improvement projects stimulating such mechanization. Let us now take a closer look at this process of agricultural mechanization.

Agricultural Mechanization

Cultivating machinery was first to be seen in Hata Village in the 1960 agricultural census. As can be seen in table 9, there was a total of 36 such machines in the village at that time — 17 privately-owned rotary tillers, another four owned in common, and 15 pull-type tillers. As already observed in connection with the state of animal husbandry, oxen and horse were then the main means of ploughing. While there were only 2.2 power tillers per 100 farm households, there were 43 head of such draft animals — 28 oxen and 15 horses. The kinds of agricultural equipment that were most prevalent were generators, electric motors, power threshers, etc., but even the most widely-owned type, power threshers, only numbered 29 for every 100 farm families, including those owned in common.

Between 1960 and 1965, however, there was a tremendous increase in the numbers of power tillers and tractors, power sprayers, farm trucks, and so on, and particularly power tillers which came to number 411 in all — 46 privately-owned rotary tillers and 11 owned in common, and 332 pull-type tillers and 22 owned in common. Most of this cultivating machinery was of the walking type with under 10 h.p. but there was a total of seven privately- or jointly-owned small tractors in the 10-20 h.p. range. By 1965 there were 36 such cultivating machines for every

100 farm families.

TABLE 9. Increase in the Number of Agricultural Machines (Hata Village)

	1960	1965	1970	1975
Power Tillers and Tractors:				
Number of farm families owning them	?	378 (80)	527 (?)	588 (?)
Total	32 (4)	378 (33)	617 (49)	715 (32)
Rotary type	17 (4)	46 (11)	-	-
Pull type	15 (-)	332 (22)	-	-
Under 5 h.p.	-	59 (1)	137 (9)	171 (3)
5-10 h.p.	-	266 (14)	431 (16)	438 (4)
10-15 h.p.	-	7 (7)	39 (4)	62 (4)
15-20 h.p.	-	-	6 (11)	22 (5)
20-30 h.p.	-	- (-)	2 (2)	15 (10)
Over 30 h.p.	-	- (-)	2 (7)	7 (6)
Power sprayers	-	242 (16)	395 (13)	498 (5)
Power dusters	-	44 (46)	297 (70)	257 (4)
Transplanters	-	- (-)	4 (-)	127 (54)
Binders	-	- (-)	59 (27)	303 (43)
Combines	-	- (-)	8 (2)	23 (3)
Rice and wheat dryers	-	- (-)	36 (5)	49 (5)
Milkers	-	18 (-)	30 (-)	27
Farm trucks	-	191 (-)	464 (2)	498
Number Per 100 Farm Families (those owned privately plus those owned in common):				
Power tillers and tractors	2.2	36	57	68
Transplanters	-	-	0.3	17
Combines	-	-	0.7	3
(1960 Only, For Reference)				
Generators	224 (46)			
Electric motors	230 (29)			
Power threshers	391 (63)			
Rice-hulling machines	30 (20)			

This trend had become much more pronounced by 1970, when the farmland improvement project was in progress, and still more by 1975, when it was completed.

By 1975, 588 farm households owned a total of 747 power tillers and tractors, 715 of them privately and 32 in common, which was equivalent to 68 per 100 farm families. Furthermore, there was not just an increase in number, but medium and large tractors came to represent a greater and greater percentage of such machinery. By 1975 there were 22 privately-owned tractors 20 h.p. and over and 16 that were owned in common:

Another characteristic feature of advancing mechanization of agriculture in the village was the introduction of power transplanters

and binders and combines. Although there were still only 17 power transplanters and three harvesting machines per 100 farm families in 1975, they appear to have become considerably more prevalent since then.

With increased use of chemicals in wet-rice cultivation, there was a considerable increase in the numbers of power sprayers and power dusters. We see, therefore, that agricultural mechanization centring on large- and medium-size machinery first became possible in Hata Village with completion of the land-improvement project. Even then, however, the village was about five years behind other areas in this respect on account of its poor production infrastructure. But once agricultural mechanization got under way, there were greater and greater manpower savings in wet-rice cultivation, and productivity improved tremendously, resulting, as we have seen, in two directions of development — one toward increased engagement in non-agricultural side employment and businesses and the other toward expansion of scale of other crops and agricultural products than rice.

Mechanization of agriculture, however, resulted, as in other areas of Japan, in overinvestment considering the scale of the agricultural operations and, again as elsewhere, this inevitably brought about a decline in the rate of net agricultural income, as indicated in table 10, which is based on "Agricultural Income Statistics." In 1968 net agricultural production income amounted to 58.4 per cent of gross agricultural production and thereafter declined to 56.3 per cent in 1973 and 56.2 per cent in 1976. Another factor contributing to this decline was expansion of animal husbandry operations, which entailed considerable expenditures for feed, but overinvestment in agricultural machinery was the main reason. Still, as a result of such investment, net agricultural production income per household increased to ¥1,280,000, or ¥127,000 per 10 a of farmland, in 1976. This was higher than the national average, Hokkaido excluded, of ¥985,000 per household, or ¥105,000 per 10 a, and the Nagano Prefecture average of ¥852,000 per household, or ¥110,000 per 10 a, a difference attributable, no doubt, to expansion at Hata Village of a complex of labour-intensive farming operations made possible by labour savings in rice cultivation.

TABLE 10. Net Agricultural Production Income Compared with Gross Agricultural Production (Hata Village)

	1968	1973	1976
Gross agricultural production (A) (millions of yen)	905	1,773	2,481
Net agricultural production income (B) (millions of yen)	529	999	1,396
B/A (%)	58.4	56.3	56.2
Agricultural production income per farm household (thousands of yen)	465	859	1,277
Agricultural production income per 10 a of farmland (thousands of yen)	51	87	127

Note: Figures based on "Agricultural Production Income Statistics" and "Agricultural Income Statistics."

As farmers have come to engage increasingly in non-agricultural side employment and businesses, more and more of them, even though they may own smaller agricultural machinery of their own, get farmers with larger agricultural machinery or farming associations to do much of their farmwork for them.

According to the results of the 1975 agricultural census, 543 farm households in Hata Village turned to such outside help in one form or another in growing their wet rice, as indicated in table 11, this being 58.9 per cent of those engaged in rice cultivation that year (as compared to 41.4 per cent for all of Nagano Prefecture and 29.7 per cent nationwide, Hokkaido excluded). Furthermore, this figure is just about the same as the number of those second-category part-time farm households that were engaged in non-agricultural side employment rather than businesses. This does not mean, however, that there was an exact correspondence between the two, for not all second-category part-time farm households which were engaged in side employment got others to do their rice-crop work for them, and even some full-time farm households did so because they were too busy taking care of their expanded watermelon operations. Still, the village was rather exceptional in having more than half of its farm households resort to such an arrangement.

Looking at the breakdown by the types of rice-crop work that farm households had others do for them in 1975, one sees that the most usual types were ploughing (523 households) and harrowing (507 households),

the area involved in the case of ploughing (201 ha) representing 36.7 per cent of the total area of rice paddies and 43.5 per cent of the total area actually planted with rice, and the area involved in the case of harrowing representing 34.5 per cent and 40.9 per cent of the same areas. Whichever way one looks at it, 30-40 per cent of the ploughing and the harrowing was not done by the farm households themselves. For transplanting and harvesting, the figures were 151 households (16.4 per cent of the total number of farm households) and 260 households (28.2 per cent respectively), and the areas involved were 54 ha and 87 ha, representing 11.7 per cent and 18.8 per cent respectively of the harvest area.

TABLE 11. Number of Farm Households Getting Others to Do Their Rice-Crop Work for Them

		1965	1970	1975
Total (no repetition)		-	588	543
Ploughing	{ Number of households (A)	456	562	523
	{ Area involved (ha) (B)	153	196	201
Harrowing	{ (A)	445	544	507
	{ (B)	144	186	189
Transplanting	{ (A)	49	54	151
	{ (B)	21	23	54
Harvesting	{ (A)	16	160	260
	{ (B)	6	57	87

Note: Based on "Agricultural Census."

A factor having a direct influence on this trend toward having more and more of the rice-crop area worked by others is the fact that the size of individual paddy fields increased to 20-30 a, which was too large for convenient and efficient use of the small power tillers that farm households owned. They therefore increasingly relied on farmers or others with large tractors to do such work for them rather than going to the expense of replacing their "obsolete" machinery with larger models. A more basic reason, however, was the fact that more and more farmers found they simply did not have enough time to do all their farmwork themselves on account of their non-agricultural side employment or businesses. As for the farmers who took the course of expanding their farming operation in preference to engaging in non-agricultural side employment or businesses, doing farmwork for those who followed the other course was one way of achieving such expansion,

if not entirely in terms of their own land. This coincidence of the interests of these two groups made it all the easier for the practice of commissioning farmwork to become so general. Probably what will happen in the future is that the farmers who are now having others do certain aspects of their rice-growing operations for them will instead just rent the farmland in question to them outright as they, the owners, come to have no labour power at all to manage any farming operations. There are not yet very complete statistics on the extent to which such a trend might already have progressed, but we discovered several pertinent cases in the course of our survey of farm households in the village. It might also be mentioned that the Hata Farmers' Cooperative is doing all it can to meet the considerable demand on the part of its members to have some of their farming operations done for them, but this is a subject that I will discuss in another paper.

III. CASE-STUDY OF A TYPICAL FARM HOUSEHOLD

As we have seen, the farmland improvement project that began in 1968 brought about tremendous changes in farming in Hata Village and particularly on the middle and upper terrace land, not only stimulating such change but also determining its direction. What I should like to do now is show the significance of that project in terms of a case-study of a typical farm household from among those surveyed as a means of adding flesh to the statistics that we have so far concerned ourselves with.

It should also be noted that farming on lower terrace lands has remained much the same as it was before, because farmers there have always enjoyed favourable irrigation conditions and have not had to experiment in order to survive. As a consequence, they are perhaps now in a more difficult situation, as a result of the trend toward increasing engagement in non-agricultural side employment and businesses, than the farmers on the middle and upper terrace lands. In our case-study of a typical farm household we shall contrast it with farm households on the lower terrace lands in order to put the impact of the farmland improvement project in sharper relief.

The Case of Mr. S (Ninth Area of Upper Hata)

1) Family Composition and Labour Force

Mr. S's family consists of seven persons — Mr. S himself, a 40-year-old agricultural high school graduate; his wife, aged 36; his father and mother, both aged 68; his grandfather, aged 90; and his two sons, aged

13 and 11. Both he and his wife are engaged full-time in agriculture, with no non-agricultural side employment, and his father and mother can be considered as furnishing, together, an amount of farm labour equivalent to one younger person.

2) Scale of Operations

He owns 136 a of rice paddies in five parcels and also 120 a of dry fields, again in five parcels, all of which he works himself, without renting any out or renting any other land to work himself. One of the dry-field parcels, with an area of 48 a, was newly planted with apple trees in 1974 and is now producing some yield (new-type Fuji and Tsugaru apples).

Before the land reform he owned about 7.5 ha, about one-third of which he worked himself and the rest of which he leased to tenants. About half of that tenant land went to the tenants, and the other half to two members of the family when they set up separate households. Since the land reform he has done some exchanging of his land for other parcels but has not done any buying or selling.

3) Farming Operations Prior to Land-improvement Project

The works in the context of this project were completed in this area in 1970. Let us take a look at Mr. S's farming operations before that. The main ones were rice, sericulture, and saplings and he also grew some vegetables. After graduating from high school in 1956, he went to work with his father on the farm. Up until 1965 all of the ploughing and harrowing was done by horse, after which they transplanted, harvested, and dried the rice by hand. Since there was often a very short supply of irrigation water, the harrowing was usually done three times, and in the case of paddy fields that did not hold water very well, only at the fourth time was it done carefully. Although the total area of the paddy fields was no more than now, it took at least 20 days for the ploughing and harrowing on account of the fact that the individual paddies were much smaller and scattered in

location. Because of the system then practised of receiving irrigation water by order of priority, however, such work was not done in 20 consecutive days, but was concentrated on particular days, with none at all being done on others in between them. Furthermore, in order to cultivate rice, it was not enough just to acquire the land itself. One also had to buy water rights for it. The actual management of the irrigation was left entirely to an irrigation manager, the individual farmers not having to bother themselves about it. Up until the year before completion of the farmland improvement it was the practice to tip this person about ¥1,000, which was enough to buy 2 "sho" (1 "sho" = 1.588 quarts) of sake, in addition to paying a service fee to the land-improvement district from which he received his wages.

In 1965 Mr. S bought a power tiller. Although the horse was no longer needed for ploughing, it was kept for a while for carrying loads. This power tiller, which was only used until 1970, when it was replaced by a tractor, did not prove to be any more efficient than the horse since it still took 20 days to do the ploughing and the harrowing while the transplanting and harvesting still had to be done by hand. Furthermore, it was still necessary to do the harrowing three times to prevent leakage of irrigation water.

Mr. S himself could not give much information on the household's sericulture operations in those days since they were left entirely up to his parents, but the raising of seedlings and saplings was his responsibility, and the emphasis there was on yew as green flowering trees, with several other species also grown. Since, however, the raising of seedlings and saplings was not very profitable, he switched his emphasis to watermelon in 1965. In fact, he was the first person in the ninth area of Upper Hata to start growing watermelon. Once he made his decision to go into watermelon and long taro as outstanding market crops, he adopted the crop-rotation sequence of long taro — watermelon — watermelon, at first on 5 a of paddy fields with good irrigation conditions and after 1970, when the farmland improvement project was completed, on 15 a, which was the limit in view of the amount of land and labour that had to be devoted to rice cultivation.

As it was, he had a hard time dividing his labour between the two since the planting season for open-field watermelon (April 20 to May 20) coincided with the season for rice-harrowing and -transplanting, which reached its peak about 15 May.

4) Farming Operations After Land-improvement Project

The land-improvement project increased the size of paddy fields to 30 a each, provided complete irrigation and drainage, improved farm roads, and grouped hitherto scattered paddy fields. Furthermore, three such 30 a paddy fields were made to form a parcel of land, thereby increasing the efficiency of working them.

The biggest change, however, was the introduction of large agricultural machinery. First of all, in 1971, 11 farm households got together and purchased three large tractors — a 60 h.p. Ferguson, a 30 h.p. Shibaura, and a 60 h.p. International — for their joint use. All three of these tractors had rotaries, harrows, manure spreaders, stump pullers, root-cutting edges for seedlings and saplings, and other attachments. Nine of the 11 farmers were able to operate the tractors themselves, and the members of the pool shared the burden of payments on them in proportion to the area of farmland on which they used them. Furthermore, they also did ploughing and harrowing for other farmers, whenever possible, in order to reduce the payments burden, the operator himself receiving ¥4,000-5,000 a day as an hourly wage, which was comparable to that paid for non-agricultural work.

In 1972 Mr. S together with another farmer bought a two-row transplanter, and after increasing his area of watermelon cultivation, he bought a four-row transplanter for medium-growth rice seedlings in 1978 on his own. In addition, the tractor pool introduced a binder in 1971 which was kept in full operation, including use in work done for other farmers, until it was paid off in 1974. Then, in 1975, four of the farmers in this group that had particularly large paddy-field areas, including Mr. S, bought a four-row combine for their joint use, a group of four being ideal since it took two to run it and alternate

use by two at a time was more efficient and reduced the payment burden of each. Moreover, the greater number of good-weather days in the Matsumoto Basin than in the Hokuriku, Northeast, and other regions made it possible to take turns in using it without missing the optimum time for harvesting.

Thanks to such mechanization, there was a considerable reduction in hours of labour. Previously, using cultivators for ploughing and harrowing while transplanting and harvesting by hand, it took a total of 80 hours for 10 a as follows:

Ploughing and harrowing	2 men x 1 day =	16 hours
Transplanting	4 men x 1 day =	32 hours
Harvesting	4 men x 1 day =	32 hours
Total		80 hours

Taking weeding, insecticiding, application of fertilizer and other management-type labour into consideration as well, it took over 90 hours per 10 a. With the use of tractors, transplanters, combines, and machine drying (by the Farmers' Cooperative "Rice Centre") on the other hand, less than 20 hours of labour were needed for the same work. And what is important is that besides such an increase in labour productivity, this saving of labour made it possible to allocate a good deal of labour to the cultivation of watermelon. In other words, besides the advantages of being able to do the work required by the rice crop in a short period of time and therefore with optimum timing, it was also possible to expand the scale of watermelon cultivation.

In 1971 Mr. S doubled the area of his watermelon crop to 30 a, and in 1978, the year he got his own combine, he tripled that to 90 a. The land-improvement project made it possible not only to introduce large machinery for wet-rice cultivation, and intensify and expand dry field-crop cultivation, thanks to such improvement of productivity, but also to manage the watermelon crop better, including the introduction of vinyl-hothouse and row-cover cultivation methods, thereby improving product quality for higher unit prices and a substantial increase in income. Now, with an amount of labour

equivalent to that of three persons, he is a major watermelon grower, 20 of his 90 a of that crop being grown in hothouses, 30 a in covered rows and 40 a in the open. Before the land-improvement project, he could not have managed more than 15 a no matter how hard he tried. Accordingly, he can thank that project for making it possible for him to increase his watermelon acreage sixfold and also to grow that crop more intensively in hothouses and covered rows.

Thus we see that the irrigation and land-improvement projects in question had the impact of promoting mechanization of rice cultivation in this area and making possible a great increase in agricultural income through expansion of intensive dry-field crops, all of which amounted to drastic change in the structure of farming in this area.