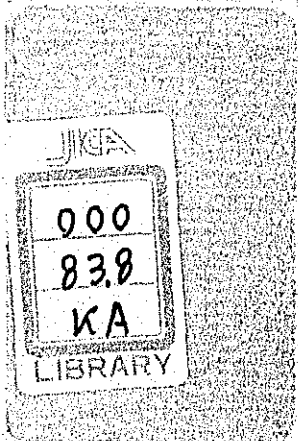


MECHANIZATION OF AGRICULTURE IN JAPAN

OCTOBER 1968

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MECHANIZATION OF AGRICULTURE IN JAPAN

Fertilizers and Agricultural Machinery Section
Agricultural Administration Bureau
Ministry of Agriculture and Forestry
Government of Japan

I DEVELOPMENT OF AGRICULTURAL MECHANIZATION

1. Factors Leading to Agricultural Mechanization

The agricultural mechanization of Japan has witnessed a very rapid growth since 1955 and the predominant factors for such a rapid growth are as follows:

- 1) Development in the improvement of agricultural machinery
- 2) Progress in farming techniques
- 3) Progress in land consolidation
- 4) Release from heavy labor
- 5) Increase in the shortage of rural labor and the increase in rural labor wages
- 6) Increase in agricultural income
- 7) The lowering of relative prices of agricultural machinery as against agricultural commodity prices due to mass production and the improved performance of agricultural machinery
- 8) Subsidy from the national and prefectural governments as well as guidance, education and extension of agricultural machinery and mechanization by agricultural extension.

2. History

The paddy rice cultivation in Japan is by far the mainstay of her agricultural production because of her geographical position. Out of about 5.938 million hectares of Japan's arable land 3.415 million hectares are paddy fields, constituting 57.5% of the total, and Japan's paddy rice cultivation is characterized by its small scale, an average holding being 1 ha. with a labor force of 2.7 persons per household (out of which 1.7 persons are full-workers). Because of this, the salient feature of Japanese agriculture is the intensive investment in labor and fertilizer by family labor with importance placed on the improvement of land productivity.

Up to 1945 draft animal power was a main source of mechanization but with the marked progress in mechanization since then motor power is a major source of mechanization at present.

The decrease in draft animal power is as follows:

unit : 1,000

	1923	1947	1955	1960	1961	1962	1963	1964	1965	1966
No. of draft horse	1,600	1,050	920	673	618	547	471	396	322	278

And the ratio of draft animals is as follows:

	Ratio used by upland farmers (%)	Ratio used by paddy rice cultivating farmers (%)
1961	20	49
1962	19	38
1963	17	29
1964	14	21
1965	11	12

As the above tables are self-explanatory the draft animal has been replaced by mechanical power. However, such a mechanization has been in most cases, the use of power tillers individually operated, the result being small scale mechanization which continued the small-scale type of farm maintenance carried out heretofore.

With the rapid growth in the national economy a gradual increase in part-time farmers became salient. The increase rate of part-time farmers was 50% in 1950, 65% in 1955, 65.7% in 1960 and 78.5% in 1965. This phenomenon is parallel with the trend in the increase of the use of the power tiller and with the increase in farm household income due to part-time jobs. Mechanization was to supplement the decrease in the rural labor shortage.

Furthermore, according to the trial computation of 1962 the cost of power tillers performing 130 - 150 hours a year was cheaper than the use of draft animal power. However, in spite of the increase in the cost of draft animal power since then, the price of power tillers did not rise so much. The annual working hours of about 100 hours by power tillers was more profitable than the use of draft animal power.

Average income per farm household

	Income from farming	Income from other sources	Farm household income	Surplus
1958	197.7	152.6	350.2	26.4
1960	225.2	184.3	409.5	50.7
1966	413.3	448.1	861.4	149.8

(1) Mechanization of threshing, hulling and polishing

Initial mechanization in farming operations first took place in threshing, hulling and polishing which introduced already before 1945, among which the number of power threshers were:

Unit : 1,000 sets

	1942	1945	1955	1967
No.	210	350	2,000	3,300

And a power thresher is owned by 1.6 farm households. Practically all of the 5 million farm households owned a set by 1960.

(2) Mechanization of plowing and disease and insect control

The next mechanization took place in tillage and weeding by powered machinery which moves about the fields. In 1949 the number of farm households using draft animals mainly for tillage was 4.6 million and the number of farm households using power tillers was about 30,000. In 1960 the number of farm households using draft animals for tillage in paddy fields was 3 million, power tillers, 1.5 million, in 1961 for draft animals, 2.5 million and for power, 3 million and in 1965 the same ratio was 1 million and 4.3 million. Moreover, the rate of power till acreage is as shown below which indicates that power tillers are mostly used in paddy fields.

	1960	1961	1967
Paddy field	47%	57%	89%
Upland	14%	17%	34%

The number of farm households using powered control machinery

<u>1960</u>	<u>1965</u>
2.169 million	2.287 million

- (3) Mechanization in fertilizer application, seed sowing, managing operations, harvesting and transplanting.

Since the 1960s mechanization has gradually been introduced into fertilizer application and seed sowing. Managing operations followed by the mechanization of harvesting and transplanting in paddy fields. With such a progress in mechanization, labor invested in per 10 ares of paddy rice cultivation, which was 181.9 hours in 1958, was reduced to 172.9 hours in 1960, 139.4 hours in 1967 — — — a reduction of about 40 hours in 7 years.

- (4) Introduction of high efficiency machinery

The very rapid growth of the national economy from 1960 brought about an adverse impact on agriculture in that the outflow of rural labor to other industries accelerated the reduction of the number of rural labor by 2.20 million by 1965. On top of that, the deterioration in the labor structure was caused by the use of the remaining women and older men, who became the mainstay of farming work. Moreover, the ensuring of viable farming to insure a farm income comparable to the income of non-agriculture workers is becoming a necessity by promoting an enterprise-like farming to meet the impact of trade liberalization. And an effort is being directed toward agriculture structure improvement by the rapid introduction of high efficiency machinery, with concentration on the use of a riding tractor.

The number of riding tractors is as follows:

	1955	1960		1965	1966	1967
No.	1,000	4,500	10,000	36,000	50,000	77,870

Such a rapid growth in the use of tractors in recent years is expected to increase in the future and the Ministry of Agriculture and Forestry instituted in 1966 the Basic Program for the Introduction of High Efficiency Agricultural Machinery to promote sound mechanization.

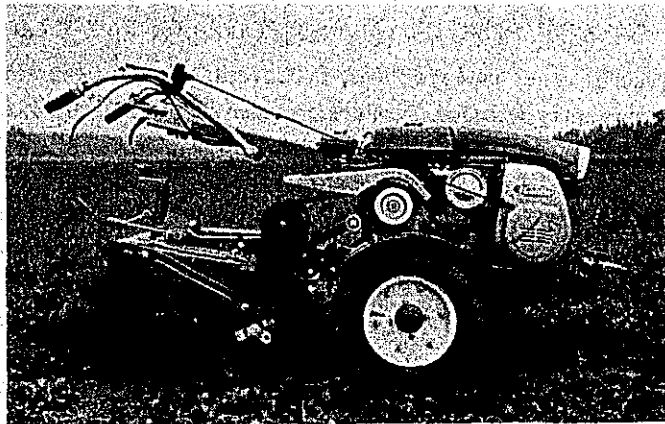
Moreover, to train tractor operators and mechanics, the Government established the National Training Center in Ibaraki Prefecture and each prefecture is encouraged to establish such a training center under national government subsidy.

3. Outline of Various Machinery

The development and improvement of agricultural machinery have been carried out by national and prefectural research institutions and by makers' research establishments. And, in 1962, the Institute of Agricultural Machinery was established under investment by State and private industries to promote research.

(1) Power tillers

In the early stage of the use of power tillers during 1945 major types were crank and screw types but with the improvement of claws they have gradually been exchanged for rotary types which are the dominant types at present.



Since 1951 the national inspection of power tillers has been instituted which has contributed in a large measure to the improvement of performance and from 1962 the Agricultural Machineries Research has been commissioned by the State to carry out the said inspection.

In 1953 the Merry Tiller was introduced from the United States. And

because of its adaptation to a wide range of usages and due to its small size, light weight and simple structure, similar types have been manufactured domestically and since 1955 its use has gradually increased. A further improvement has been made by a smaller and lighter type with changing speed from medium to high, accompanied by a stabilized performance of an air-cooled engine. A rapid extension in the use of machinery has been brought about by the lowering of the price by mass production.

Changes in purchasing price of power tillers

unit : Yen

	1961	1962	1963	1964	1965	1966
Driven type	198,488	198,302	197,000	192,900	193,200	195,600
Pull type	123,790	125,736	126,600	128,800	128,200	130,000

No. of Power tillers used

	1955	1956	1964	1965	1966	1967
Driven type	82,000	137,000	511,400	590,000	630,000	702,000
Pull type	6,500	90,000	1,672,000	1,900,000	2,096,000	2,320,000

At first the driven type was predominant but gradually it has been replaced by the pull type which is advantageous for general purpose. Because the driven type is for the exclusive use of plowing the horse power tends to increase to 6 - 10 HP and is mainly used in farms of a comparatively large scale management. In recent years the riding type has increased.

On the other hand, the 3-4 HP class predominates in the pull type because it can be used in various operations such as in transportation in addition to plowing. This type is mainly introduced into small scale management. Extended use of this type is in puddling of paddy fields because of its durability and its dir-proof in paddy fields.

(2) Wheel tractors

Wheel tractors have been introduced to upland cultivation in Hokkaido since the 1950s and its use has gradually been increasing. And with the implementation of the 'Cold-Regions Agriculture Promotion Program' in 1957 the use of State-owned tractors has been increased for loan. At that time all of this type of tractor was practically imported, but development

research of domestic makes has been carried out parallel with imports and gradually put on the market. As stated above the tractor was mainly used in upland fields at first. Since 1960 it has been found that it can be fully used in paddy fields. Only it has been clarified that many problems existed in its use in paddy fields because of water and soil proof standpoints and counter measures therefor were under-taken, resulting in the development of the 10-20 HP class tractor adaptable in paddy fields. With a further improvement in performance and stabilization it came to be widely used in paddy rice single-cropping districts from around 1963 on.



Major uses thereof in paddy fields are for plowing, puddling and transporting so that, even though its annual performance is inevitably shorter than that of upland fields, because the attached operating machines can be limited to rotary tillers and trailers, the necessary investment is small.

Number of wheel tractors used by year and by HP

	1960	1963	1964	1965
9 - 15 HP		2,291	3,181	6,169
16 - 25		4,946	8,452	12,600
26 - 35		1,982	2,549	3,094
over 35		4,933	7,229	9,840
Total	3,369	14,152	21,411	31,711

(3) Insect and disease control machinery

The development of new agricultural chemicals has greatly expedited the use of powered control machinery. The use of DDT and BHC powder since 1947 initiated research in the development of the power duster and with the change of those chemicals to liquid form research in the development of the power sprayer has also been launched. Particularly, a marked progress has been witnessed in the development of a small shoulder-carrying type. Many types of control machinery are used for the dual purposes of spraying and dusting.

Since 1961 a wide-range sprayer using a gun nozzle has been made and marketed which has made possible the spraying of a distance of more than 30 meters, enabling the spraying of the paddy field from the sides of the fields, spraying an area of 10 ares in about 5 minutes.



Domestic made speed sprayers have been put on the market since 1955 and are used mainly in fruit producing districts. The number of control machinery used is:

	1960	1966
Power sprayers	263,000	717,000
Power dusters	143,000	409,000
Speed sprayers	344	2,272

(4) Thresher

Threshers were mainly handled by hand. Since 1948 - 9 a gradual increase has been seen in the use of the self-feeding type and such a trend has increased since 1952.

Number of threshers used:

	1955	1960	1965
Self-feeding type	200,000	570,000	2,980,000
Ordinary type	2,000,000	2,130,000	

Production number of threshers

	1960	1963	1966
Self-feeding type	124,124	176,863	293,791
Ordinary type	183,121	95,349	51,164

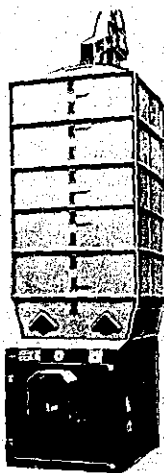


Since the 1950s the semi-steel type has been developed, followed by a gradual progress in mass production and the production of lighter machines which has contributed greatly to a wide use of these machines. Furthermore, due to a rural labor shortage, particularly during the harvesting season of drying the harvested rice plant, the practice of threshing undried rice plants is increasing. And, threshing immediately after the harvest became widely practiced on paddy-fields. The improvements made in a lighter machine and

in an engine which facilitates the moving of the machine has contributed to its increased use. And the wide use of threshers on fields brought about the development of various types, such as the thresher attached with a rice straw cutter, making possible the threshing of high moisture-content rice plants, self-propelled threshers and the use of one attached to a trailer, making its movement easier.

(5) Grain dryers

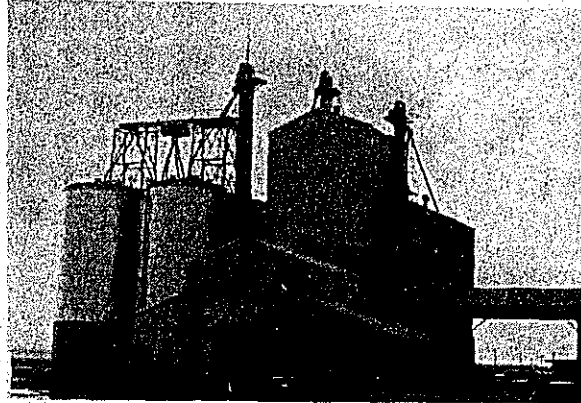
Since the late 1920s the use of grain dryers has been recommended to improve rice quality and since 1956 ventilating dryers have been produced and widely used to improve rice quality.



Since 1961 - 2 the improved vertical type has been manufactured, enabling the putting in and taking out of paddy automatically and because of its advantage of not occupying a large space for installation it is becoming very popular.

The number of dryers used is 1,073,230 as of 1966.

Practically all dryers are individually owned. Their purpose is not only for drying to improve rice quality, but also for saving labor. The use of a larger type dryer operated by agricultural cooperatives such as 'rice mill' is increasing. The number thereof at the end of 1966 was 476, and at the end of 1967 20 "country elevators" were constructed for both drying and storing the paddy.



4. Standardization

The Industrial Standardization Law was enacted in 1949 and agricultural machinery which is subjected to the standards of the Japan Industrial Standard (JIS) are: hand and power threshers, hand paddy field weeders, automatic threshers and 22 other items, and JIS designated machinery is: hand threshing machines besides 16 other items. The permission to use the mark of the JIS is issued on agricultural machinery by the Japan Agricultural Machineries Industry Association under commission from the Japan Industrial Standard Investigation Association.

5. Development of Special Techniques

(1) Weeding techniques

Perhaps the most effective labor saving in paddy rice cultivation is the development of weeding techniques brought about by the emergence of herbicide. The practical use of 2-4-D in 1950, MCP in 1954 and PCP in 1959 greatly reduced the weeding labor by 50% from 31.6 hours in 1956 to 26.7 hours in 1960 and to 16.4 hours in 1966. 3.7 million rice cultivating farmers used herbicide in 1964.

(2) Threshing techniques

The practice of threshing in fields immediately after harvesting without drying, by hanging the paddy on poles, which required about 10 hours per 10 ares, has contributed immeasurably to the saving of labor. Particularly, the development of threshers by the improvement of the selecting parts, which makes possible threshing immediately after the harvest, has been effective. Drying by hanging the paddy on poles is practiced in 57% of the total rice cultivating districts.

(3) Drying techniques

The drying of high moisture content paddy has been improved by adapting a high temperature ventilating system and the paddy tempering system, resulting the reduction of the cost of drying and in promoting the efficiency of the harvesting operation.

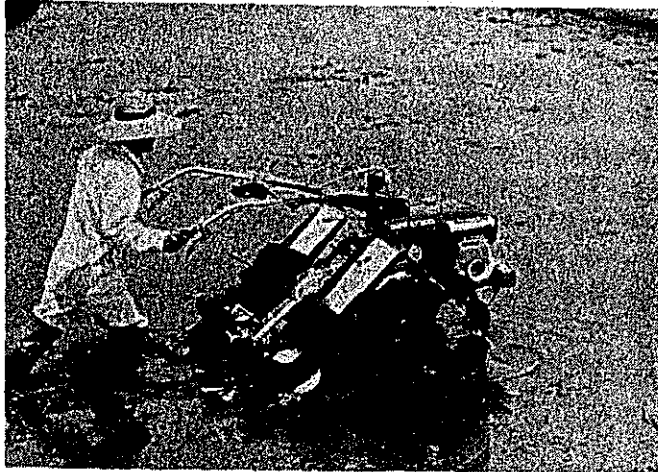
(4) Transplanting and harvesting operations

As stated above labor requirements for paddy rice cultivation have been reduced year after year, but practically no change has taken place in the labor requirements for transplanting. In 1956 the labor requirements per 10 ares were 26.6 hours and in 1966, 23.9 hours. The harvesting hours have somewhat been reduced: 37.2 hours per 10 ares in 1956 and 20.4 hours in 1966. Such a reduction has been brought about by the harvesting machines described herein later. If the labor requirements can be reduced by the mechanization of transplanting and harvesting then much labor can be saved in paddy rice cultivation. In addition, such labor saving would eliminate the labor peak during planting and harvesting which will have a far reaching impact on rice cultivation.

(a) Transplanters

From as far back as the 1880s various ideas on transplanters have been proposed but none has been put into practical use. Recently, two types have been developed, namely the root-washed seedling and the type for soil-attached seedling. And for the time being some are being sold on the market, having approached the stage of practical use.

The root-washed seedling system makes use of the seedling under the normal practice of pulling out the seedling by hand, but whereas the trans-



planting of the seedling by the normal practice of transplanting by hand requires much time – about 20-25 hours per 10 ares, the root washed seedling system of transplanting by machine reduces the above hours by 50%. The soil attached seedling is grown by a special seedling-growing machine. Because the seedling is smaller the labor requirement is only 1/6 of the normal method but there is a problem in that the cultivation method differs. Moreover, because the puddling has to be done more carefully than normally and the depth of plowing has to be within 15 cm application conditions are quite limited. Particularly when a tractor is used the soil concentrates in the middle which limits the use of this system. In such a way there are still many problems to be solved prior to practical application of this system.

(b) Harvesting machines

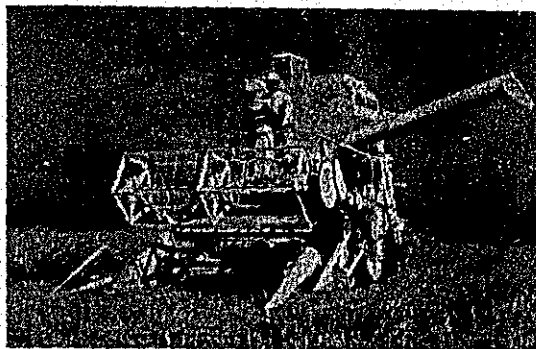
Research was launched in 1955 and first the side-delivery reaper type was put into practical use followed by the dropper type and the binder type. The time required per 10 ares for each type is:

Traditional hand harvesting	30 hrs. (including the binding)
Side-delivery reaper type	25 hrs. (including the binding)
Dropper type	6 hrs. (including the binding)
Binder type	1.2 hrs.



(c) Combines

Research on combines was launched in 1957. And in 1962 an agriculture-mechanization test community introduced combines and the experiment has clarified that it has practicability. So since 1964 its introduction has been launched for the purpose of education and demonstration, and since 1965 the agriculture structure improvement project has adapted its introduction and it now has come to be put into practical use. The efficiency at 3 m class is 0.5 hour per 10 ares. The number of combines at the end of 1967 was 324.



Because of the fact that combines can not be fully utilized without the necessary land conditions, intensive land consolidation programs are being carried out. The use of combines requires an efficient drying installation so that construction thereof is going on at the same time.

In districts where conditions have not improved enough to enable the introduction of combines, such as narrow roads, small land plots or where the organization of such a system is difficult, harvesting machines or self-threshing type combines are employed.

(d) Self-feeding thresher type combines

This type combine is an advanced self-feeding thresher to which the driving motor and harvesting machine have been attached. Research has been launched since 1957, and since 1967 some have been put on the market. Its efficiency is about 2 hours per 10 ares.



II POSSIBILITIES OF MEETING THE DEMAND FOR AGRICULTURAL MECHANIZATION

I. Relationship of Agricultural Mechanization to Industrialization and Economic Planning

The industrialization of agricultural machinery production of Japan has reached a high level and practically all agricultural machinery needed is of domestic make. On the other hand, a very rapid development in secondary and tertiary industries has brought about an acute shortage in agricultural labor, and perhaps this is a single major factor which has caused the introduction of agricultural machinery. To meet such a growing demand the production of agricultural machinery is increasing each year.

Labor-population by industry (over 15 years old)

	Total No. of laborers	Ratio	Agr. laborers	Ratio
1962	45,740,000	100%	12,050,000	26.4%
1963	48,470,000	100%	10,800,000	22.3%

Production of the agricultural machinery industry

unit: 100 million

	1960	1961	1962	1963	1964	1965
Production	569	679	713	742	815	913

Number of enterprises according to the number of employees

No. of employees	over 1000	over 500	over 300	over 200	over 100	over 50	less 50	Total
No. of enterprises	4	5	13	15	35	45	77	194
Ratio (%)	2	3	7	8	18	23	39	100

Number of enterprises by capital

No. of employees	over 1 billion	over 500 mill.	over 200 mill.	over 100 mill.	over 50 mill.	over 30 mill.	over 10 mill.	over 5 mill.	less 5 mill.	Total
No. of enterprises	10	4	5	11	11	18	37	37	61	194
Ratio (%)	5	2	3	6	6	9	19	19	31	100

2. Possibilities of Production of Various Agricultural Equipment and Machinery Needed for Farming Operation and Production Stages

Change in production number of major agricultural machinery

	Combustion engines			Power tillers			Tractors		
	Diesel	Kerosene	Gasoline	Driven type	Pull type	Total	Less 20 HP	20-30 HP	Over 30 HP
1956	67,179	151,799	57,841			64,700			
1960	133,218	114,439	340,489	108,500	197,500	306,000			
1966	328,434	151,607	844,065	216,200	200,500	474,400	9,666	5,959	272

	Power control machines		Harvesting machines	Threshers			Drying machines	Hallows, plows	
	Sprayers	Dusters		Hand	Power self feed	Power hand feed		Draft animals	Tractors use
1956	32,700	15,500		17,500				6,300	750
1960	66,400	48,600	12,500	8,300	124,100	138,100		62,300	189,900
1966	135,000	273,700	86,600	443	293,800	51,200	215,600	13,900	149,800

Change in the imported number of major agricultural machinery

	Plows	Hallows	Rotary tillers	Others	Wheel tractors
1956	208	107	217	346	756
1960	226	153	125	140	843
1966	2,229	64	1,466		2,911

Practically all wheel tractors under 30 HP are of domestic make with 10-20 HP types occupying a major portion. On the other hand, the demand for a large tractor over 30 HP is not yet so large that at present the domestic production is ineconomical, with the supply being dependent mostly on import. As for operating machines the domestic make is gradually increasing, practically meeting the demand. However, tractors over 30 HP related to harvesting are mostly imported, but gradually domestic production is increasing.

III VARIOUS CONDITIONS FOR AGRICULTURAL MECHANIZATION

1. Land System, Land Holding and Cropping Patterns

The pre-war land tenure system of Japan was characterized by wide spread tenancy accompanied by high land rent. The famous, unprecedented land reform of Japan of 1946 completely changed such a system, establishing owner farmers. At present 95% of all agricultural land is cultivated by owner farmers. And the establishment of the owner farmer type system contributed in a large measure to the promotion of agricultural investment and techniques and ultimately to increased production. However, because the scale of land holding became so small, an average of 1 ha. per farmer, agricultural mechanization has been forced to meet such a condition with the introduction of small powered machinery such as hand tractors.

The salient growth of the national economy has brought about an increased demand for agricultural commodities and a shortage in agricultural labor force. Furthermore, the disparity in income and productivity between agriculture and non-agriculture has expanded. So in order to counter such situations, the improvement of agricultural productivity has become an important issue of agricultural policies by promoting mechanization with the increased use of large machinery. For that purpose the expansion of land holding is being planned, but, still difficulty is being confronted in the liquidity of agricultural land because of the strong trend to hold agricultural land as an asset. On the other hand, a system for intensive and cooperative utilization of agricultural machinery is being organized along with the increase in the use of larger machinery.

As stated above 56% of Japan's arable land is paddy field, 83% of which is cultivated by tractors and power tillers. However, each plot is too small for the use of large machinery. Only about 910,000 ha. constituting 27% of paddy field

acreage are land-consolidated for the introduction of large machinery, and about 850,000 ha. are to be consolidated under the long term land improvement plan.

Moreover, because of her poor land resources, agricultural land can not be expanded. Mechanization which causes a decrease in unit yield can not be adapted. Because of this, the mechanization of paddy field cultivation during the transplanting and harvesting stages did not make much progress in the past, but with the recent improvement in machinery the mechanization of these sectors is fast developing.

The mechanization in upland fields, particularly, in vegetable growing is far less developed compared with paddy fields. This is because upland crop acreage per farm household is smaller, and the land is intensively utilized with complicated crop patterns. Only about 30% of the total upland acreage is cultivated by tractors and other machinery.

2. Soil

Large machines are being introduced into 'Akiuchi' paddy fields* to increase the yield by sub-soil plowing. About 45% of the total paddy field acreage is water-logged or half water-logged so that as such, the introduction of large machinery is difficult. Therefore under the 10-year land improvement plan 850,000 ha. are to be improved with irrigation and drainage.

Japan's upland fields consist mostly of volcanic ash soil so that soil improvement is necessary to strengthen the soil fertility with the introduction of large machines under the national government subsidy for subsoil plowing and soil-layers-mixing plowing beside the application of organic fertilizer.

3. Fertilizers

The application of organic fertilizer is indispensable to increase land productivity. But with the decrease in the use of draft animals, as a consequence of the progress of mechanization, a shortage of organic fertilizer and compost has come about. Moreover, in paddy fields plowing gathers the soil in the center besides requiring more time, so that rotary plowing becomes strongly desirable. On the

* Degraded fields lacking in iron with poor rice plant growth and poor crop yield.

other hand, rotary plowing can not plow organic fertilizer under. So the spreading of organic fertilizer or compost is spread by hand or a method is adapted in which fresh rice straw is cut by cutters at the time of threshing then spread on the fields.

When applying inorganic fertilizer a granular form is necessary and it is now being manufactured. In case the seeds are sowed by drill it is applied simultaneously. When application is to be made covering whole fields the use of power tillers is difficult, and because the land plot is small, in most cases, hand labor is used. When using tractors spreading is made by broadcasters and limesowers.

4. Irrigation

95% of Japan's paddy fields are artificially irrigated. So the introduction of machinery is simple. However, during the irrigation period the puddling has to be done at a certain period and in a short time. And because all farm households launch upon this operation at the same time, each farm household owns a power tiller. Even in the case of joint ownership of tractors practically each member owns a power tiller for puddling.

5. Distribution of Labor Force

In Japan the range of the proper farming operation period is limited, in general, because of her climatic conditions, requiring an intensive labor investment. Because of the mechanization of plowing, control and weeding operation, the labor peak is concentrated in the transplanting and harvesting stages. Against this, hired labor or mutual cooperation of labor among the neighbors has solved the problem, but even that is becoming difficult. So it is safe to assume that rapid progress must be made in developing transplanting and harvesting machines.

6. Technical Level of Labor Force

There is no problem in the technical level of agricultural machinery production, neither is there a problem in the use of small type machinery by farmers. Only when using comparatively large machines does the technical level of the operator greatly influence efficiency. So the State and prefectures have established operator training centers so that agricultural extension is also directed

toward the training of operators. In addition makers and dealers give technical guidance. As a result no problem is being faced on the technical level of operation.

7. Hiring and Rural Labor

As stated time and again, the growth of non-agriculture sectors has caused an outflow of the rural labor force, coupled with the abandoning of farming and the increase in part-time farming. Rural labor shortage is becoming a bottleneck in agricultural production. Particularly, the reduction in the number of junior and senior high school graduates required to engage in farming has become so acute that the shortage of the main rural labor force is becoming salient. At the same time the rural labor wage has risen and as a countermeasure therefor mechanization has made progress. However, because the liquidity of agricultural land is not progressing so smoothly, aged persons still stay on farms as agricultural laborers, so that ultimately the acreage per agricultural labor population has not increased much.

	Labor population					
	Total	Labor			Employed unem- ployed	Agr. Labor ratio (B)/(A)
		Total	Agr. & forestry (B)	Non-agr. & forestry		
1961	4,562	4,518	1,353	3,161	44	29.7%
1962	4,614	4,574	1,311	3,260	40	28.4%
1963	4,652	4,613	1,240	3,369	40	26.7%
1964	4,710	4,673	1,197	3,471	37	25.4%
1965	4,787	4,784	1,154	3,590	39	24.1%
1966	4,891	4,847	1,114	3,730	44	22.8%

8. Development of Local Industry

The regions extending from the central part of the mainland to the northern part of Kyushu Island are becoming highly industrialized and in other districts industry is developing because labor can thus be procured easily. The outflow of rural laborers to non-agriculture is being accelerated. So upon the premise of the present agricultural technique system the development of local industry as a countermeasure for surplus labor force does not present much of a problem.

IV NATIONAL POLICIES

1. Legislation

The Agricultural Mechanization Promotion Law was enacted in 1953 which codifies among other things, the inspection system of agricultural machinery, improvement of research and experiment systems and the extension of necessary capital, etc.

The same Law was partially amended in 1962, authorizing the establishment of Institute of Agricultural Machinery under the joint investments from the State and private industry, which carries out the development and improvement of agricultural machinery and the inspection and appraisal of agricultural machinery under request.

In 1965, the 'Basic Program for the Introduction of Highly Efficient Agricultural Machineries' has been established to increase agricultural productivity and to improve farm management.

2. Investment from the National Treasury

Agriculture Improvement Fund Capital is loaned without interest for the purchase of agricultural equipment and machinery to improve agricultural productivity and management by introducing new techniques. For agricultural machinery in 1967 the fiscal appropriation was 1350 million yen.

Agriculture Modernization Fund Credit for the purchase of agricultural machinery and installations. In 1967 the fiscal appropriation was 37.0 billion yen with an annual interest rate of 6%.

3. Improvement of Agricultural Productivity

A. The agriculture structure improvement program and other various production measure programs

a. Agriculture Structure Improvement Program The 1967 appropriation was 23.7 billion yen out of which about 10% is for agricultural machinery. The Agriculture Basic Law enacted in 1961 codifies among other things, selective expansion of agricultural production, effective utilization and exploitation of land and water resources, fostering of

- viable farming and joint farming operations, and to ensure the said objectives, installations are to be introduced to improve and develop the agricultural production foundation and to modernize farm management, in which particular attention is to be paid to the structure improvement problems related to poor capital and small land holdings.
- b. Rice, wheat and barley production measure programs 1968 appropriation for agricultural machineries was 767 million yen.
- a) Intensive group cultivation program (247.221 million yen)
Promotion of joint farming operation by using highly efficient machinery to ensure a large scale and efficient group cultivation.
 - b) Model plant construction plan for the marketing rationalization of rice, wheat and barley (175.49 million yen)
Construction of plants which do the drying and storage of rice, wheat and barley to improve marketing.
 - c) Wheat and barley production measure program (344.620 million yen)
Necessary machinery is to be introduced for the expansion of planted acreage of wheat and barley, to rationalize the production, to improve the quality and to stabilize the supply of seed.
- c. Self-supplying feed production measure. In 1967 the appropriation for machineries was 618.504 million yen.
- a) Feed crop production increase project (597 million yen)
Introduction of cooperative mechanization of production, processing and storage to increase the planted acreage of feed crops.
 - b) Machinery introduction for pasture land control (21 million yen)
Mechanization of drying and silage-production of cooperatively-produced feed crops.
- d. Sugar resource production measure program. In 1967 the appropriation was 686 million yen)
- a) Introduction of machinery to promote the production rationalization of sugar beet (561 million yen)

- b) Introduction of machinery for soil improvement and production rationalization of sugar cane (19 million yen)
- e. Special-use-crops production measure program. In 1967 the appropriation was 461 million yen.

To improve the productivity of white and sweet potatoes, beans and rapeseed which occupy an important place in some districts, group planting, mechanization of operation and cooperative processing and marketing are to be carried out.

4. Programs for Repairing Work and Extension Work

Repairing work: The Government has established a training institute in Ibaraki Prefecture for repairing of machinery and each prefecture is establishing the same institute under Government subsidy. In order to further consolidate the repairing system, the Government carried out a survey of the repairing shops' situation and a survey of the situation concerning repairing of highly efficient agricultural machinery in 1966. Upon the results therefrom, an agricultural machinery repair system is to be instituted. There are 2,800 repair shops established by agricultural cooperatives and 2,700 commercial repair shops.

Agricultural-extension: Agricultural extension work is a joint program of national and prefectural governments with extension workers stationed throughout the country at the Area Extension Office giving advice and guidance directly to farmers. Particularly, in the light of rapid mechanization, special guidance is directed toward the effective use of machinery in agriculture structure improvement programs.

5. Education and Training

As stated above both the national and prefectural governments established training centers for highly efficient machinery such as tractors and combines. The Japan Agriculture Mechanization Association carries out research and performance-exhibition under national government subsidy and the State also carries out the training of prefectural officials and subject-matter specials on machinery.

6. Production and Import of Agricultural Machinery

a. Production

The kinds of agricultural machinery designated in 1966 under the Machinery Industry Promotion Special Measure Law are power tillers, agricultural tractors and power control machinery. As a new field of development tractors for paddy fields transplanting machines have been taken up. Among agricultural machines manufactured tractor-use operating machines, agricultural-use drying machines and feed cutting machines have been designated under the Small and Medium Enterprise Modernization Promotion Law enacted in April, 1965.

b. Import

Some machinery which is not made in Japan and which is needed for the development of industries have been exempted from the import tariff under the Import Tariff Temporary Measure Law. However, with the progress in domestic industry the list of machinery has gradually been reduced, and at present there is no agricultural machinery under the said list.

c. Development and Improvement of Agricultural Machinery

The Institute of Agricultural Machinery established by the joint investment of 2.7 billion yen by the State and private industry is carrying on large scale research the development and improvement of agricultural machinery.

d. State Inspection and Testing

To ensure the maintenance and improvement of quality and performance the same Institute carries out State inspection and testing.

