
RICE MECHANIZATION IN ASIA

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ABSTRACT

Rice Production in Asia

Asian countries are occupying 89% of the world total paddy area, and producing 90% of the total rice production. In the last 8 years, the sales of Kubota's tractors, combine harvesters and rice planters in Asia have increased very rapidly, especially in China, Thailand, Vietnam and India. In other Asian countries, the mechanization of farming has just started or is going to start in the near future. In most Asian countries where economic growth and population are exploding, the shortage of agriculture labor, income gap between cities and villages, risk of stable food supply to the rapidly growing population are common subjects.

Rice Transplanter for Asian Market

1. Saving labor cost

Shortage of labor for manual rice planting can cause the failure of scheduled transplanting. Manual rice transplanting needs 8hrs of work by 20 labors for 1ha of paddy field. A transplanter needs 2 persons and 8hrs of work for 1ha paddy. The total working hours are only 16hrs. The rice transplanter can realize low cost production and higher rice yield. With the rice transplanter, farmer needs only 2 persons to control the transplanter.

2. Yield Increase

The transplanting system can also increase rice yield. The key factor in increased yield is to transplant young two-week-old seedlings compared to four-week-old seedlings in manual transplanting. Younger rice seedlings grow vigorously under better airflow and higher sun exposure conditions, resulting in higher shoot numbers and yield than manual planting. With the manual planting system, four-week-old seedlings, with less room for further growth, are used. Insufficient air and sunlight reduce growth and increase disease risk.

3. Production at Low Cost

Compared to manual planting, a transplanter plants young seedlings with regular space and can decrease rice seedling costs by 57%.

4. Making Transplanter More Popular

In South East and South Asian countries, farmers are usually reluctant to adopt new methods, being afraid of higher risk in rice production. Our first approach is to make raising seedlings for transplanters, popular among farmers in those areas.

Tractor for Asian Market

Kubota is now proposing the use of tractor with rotary tiller for rice paddies in South East Asia. There are differences in soil size between cultivators and our rotary tillers. With rotary tiller, soil is finished smoothly. With the help of rotary cover, land leveling can be done at the same time as rotary cultivation. Kubota tractor with rotary tiller creates good soil conditions for rice production. Light Kubota Tractor is most suitable for works in a paddy field. Heavy weight ordinary tractor destroys the hard pan of paddy. Once tires sink into soil, work efficiency of heavy tractors decreases so badly. Light body weighted Kubota tractor will not disturb the soil hard pan. Rice transplanter keeping a stable posture on soil hard pan can be operated with higher efficiency. As a result, seedlings are uniformly planted. The "Light weight" of Kubota tractor is most suited for many operations on paddy fields. Ordinary heavy tractor can easily destroy soil hard pan. Tires of heavy tractors often sink into the soil and badly reduce work efficiency. The rice transplanter keeping a stable position on hard pan can work more efficiently and can uniformly

transplant rice seedlings. Other great advantages of Kubota tractor are the four-wheel drive (4WD) system and the waterproof structure. The first advantage is the increased traction of 4WD system making uniform and deep tillage easy. The second advantage is the decreased slippage of the light-weight tractor, the third advantage is reduced soil compaction and damage to soil hard pan. The third advantage is enabling the light-weight tractor to work more efficiently in a paddy field without cage wheels that are necessary, are not required like a traditional heavy tractor. Fourthly, waterproof structure including front axle is designed to prevent break-downs caused by water flowing into chassis in a wet paddy field. For all of these reasons, Kubota tractor is best fitted for the use in a wet paddy field.

Harvester

In Asia, contracting harvest is becoming popular business. Combine owners undertake harvest of crops for farmers at a reasonable price. Highly efficient and durable harvesters are required by customers. We have introduced Combine Harvesters in the Asian market since 1998 and have sold more than 100 thousand units since then.

Kubota produces two types of combines. One is a head-feeder type and the other is a conventional type. Head-feeder type used in East Asia is suitable for harvesting japonica rice. In South and Southeast Asia, the conventional type of combine harvester is popular and suitable for Indica rice. We have three models of conventional type combines to match different field conditions.

Kubota has developed a wide range of products from cultivator to combine harvester for the mechanization of farming. Kubota wants to contribute to the development of farming systems of Asian countries through the development of farm machineries, meeting the demands of farmers.

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Rice Mechanization in Asia

Dr. Joji Arihara
Technical Adviser
Kubota Corporation

Food, water and the environment link the world

Kubota

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Corporate Data

① Established	February 1890
② Employees Consolidated	31,436
③ Consolidated Net Sales	11.7billion US\$
④ President & CEO	Yasuo Masumoto

KUBOTA Corporation

- Farm & Industrial Machinery Sector
- Water & Environment Systems Sector

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Kubota Farm Machinery Business in Asia

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Potential of Asian Market

(Production and planted acreage of rice)

Region	Planted Acreage (Mha)	Production (Mt)	Yield (t/ha)
East Asia	33.2	210	6.3
Japan	1.8	10.8	6.0
Asia	137	607	4.4
South Asia	54.4	180	3.3
Southeast Asia	48.5	201	4.1
Africa	9.1	23	2.5
Europe	0.7	4.4	6.3
America	7.3	97	13.3

◇ Asia produces occupy **89%** of the world paddy area and produces **90%** of total world rice production

[Source: FAOSTAT 2010]

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Situation of Asian Farm Machinery Market

Greatly-Expanded Sales in Asia
In 2012 vs. 2006

▲ Combine harvester used in Vietnam

▲ Tractor used in Thailand

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Paddy Production Issues in Asian countries

~ Solution by Rice Transplanter ~

Trend in Asia	Agricultural problem	Transplanter's solution
Economic growth along with industrialization	Agricultural labour power shortage	Labour saving
	Income gap between city and village	Production at low cost
Population boom	Stable food supply	Yield increase

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Rice Transplanter for the Asian Market

2 rows walk-behind rice transplanter

4 rows walk-behind rice transplanter

6 rows ride-on rice transplanter

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PADDY TRANSPLANTATION COMPLETED WITH KUBOTA TRANSPLANTER SriAg Farms, Timadam, in coastal AP, India

Acute shortage of labor especially during transplantation season. They decided to support govt. mission of mechanized farming.

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Production at Low Cost

Hand Planting

Rice-Transplanter

Transplanting time saved by transplanter

	Required Persons /ha	Required Time /ha	Total Work Hours	Balance
Manual	20	8hr	160hr	Saving 144hr!
Rice Transplanter	2	8hr	16hr	

*In case of India

Rice seeds saved by transplanter

	Required Seed /ha	Balance
Manual	60kg	Saving 34kg!
Rice Transplanter	26kg	Saving 57%!

*In case of India

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Yield Increases by 10-20% with higher shoot no.s, better air flow & higher sun exposure

Reason 1: Plant Young seedlings

Hand Planting

Plant young seedlings at weeks → Already grown up when planted → FEW shoots

Rice-Transplanter

Plant young seedlings at weeks → Grow more after planted → MANY shoots

Reason 2: Adequate Airflow & Sun Exposure

Hand Planting

Increased row distance, full space and shading depth → Inadequate airflow and sun exposure → Poor growth and diseases

Rice-Transplanter

Consistent row distance, full space and shading depth → Adequate airflow and sun exposure → Healthy growth and RICH GAIN!

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Weedings become easy, SriAg Farms, A.P. India

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Kubota's Approach for Making Transplanter More Popular

Popularization of raising seedlings

- Instruct farmers on raising seedlings in cooperation with governmental institutions.
- Foster contractors of raising seedlings.

Transition to mechanical transplanting

- Demonstrate transplanting at field so as to familiarize farmers with mechanical transplanting.
- Foster contractors of mechanical transplanting.

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Our customers preparing rice seedling nursery bed Near Chennai T.N., 2012 08/29

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Our customers preparing rice seedling nursery bed Near Chennai T.N., 2012 08/29

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India Kubota personnel demonstrating mechanical transplanting, Near Chennai T.N., 2012 08/29

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For the very first time, a transplanting machine has been introduced to farmers in Hoa Binh District in the Mekong Delta province of Bac Lieu.

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Tractor for Asian Market

Operation in the wet rice paddy

Tractor with Rotary Tiller

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Proposal of KUBOTA Tractor and Rotary

Kubota L4708 Tractor for wet paddy field	Ordinary tractor for dry field
1,430 kg Light Weight 4WD 47PS Waterproofing structure	1,850 kg Heavy 2WD 45PS Necessary to attach cage wheels in paddy field.
<ul style="list-style-type: none"> 4WD: <ul style="list-style-type: none"> More powerful effect in traction Less slippage Light weight and Compact design: <ul style="list-style-type: none"> Prevention from soil compaction More efficient work without cage wheels Waterproofing structure, including front-axle 	
Effect "Uniformed deep tillage" "Less soil compaction," "no damage" to hard pan "High Durability" (No break down) even in wet field	

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Proposal of KUBOTA Tractor and Rotary

1. Secure cultivation with rotary tiller blades

- With rotary tiller, soil is finished smoothly and is rich in oxygen.

2. Sufficient for soil preparation and leveling

- Thanks to rotary cover, land leveling can be done at the same time with rotary cultivation.

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Proposal of KUBOTA Tractor and Rotary

3. Light weight tractor is friendly to the soil hard pan

Heavy weight tractor

Ordinary tractor

Tractor tires sink, resulting in poorer work efficiency.

Light weight tractor

Kubota

Efficient work for rice transplanting.

- Kubota tractor is designed with light body weight, and so no fear of damage to the hard pan.
- Then, rice transplanter can keep a stable posture on the hard pan and work more efficiently. As a result, seedlings are uniformly planted.

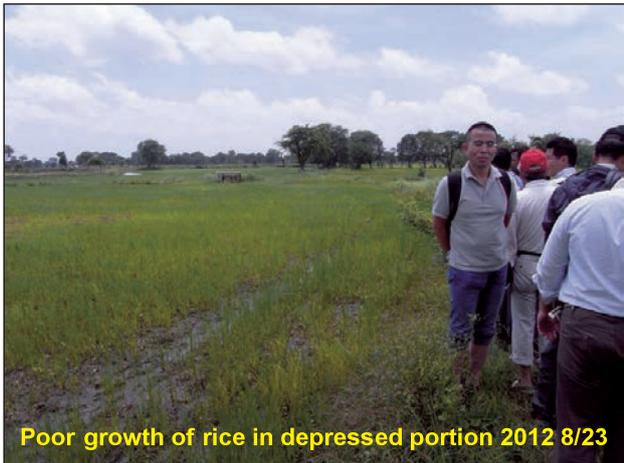
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Poor growth of rice in depressed portion 2012 8/23

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Madhya Pradesh, 2012 8/23

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Crawler Tractors (28 - 45 hp) suitable for FFB evacuation in soggy area in oil plantation, Malaysia

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Combine Harvester for Asian Market

Harvesting Trend in Asia => **Harvesting Contract Business**

Demand for Combine Harvester
=> **High efficiency and high durability machine**

East Asia	South-East Asia • South Asia
Type: Head-feeder Suitable for: Japonica rice	Type: Conventional Suitable for: Indica rice

3 Model Lineup ;
DC-35 (35ps, harvest width 1500mm)
DC-70 (69ps, 2075mm)
DC-95 (95ps, 2550mm)
meets the needs according to field size.

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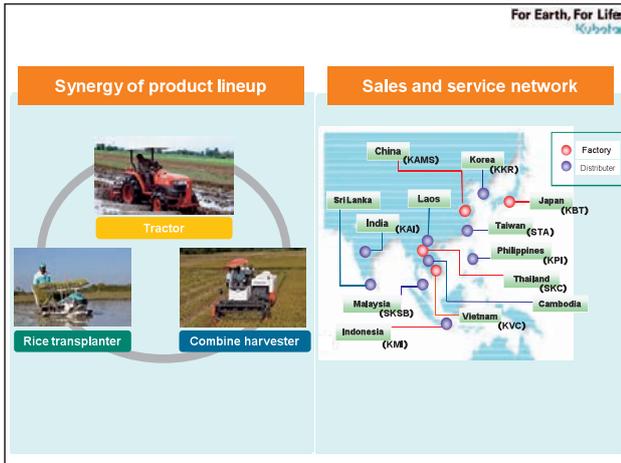


Harvesting Soybean, Thailand, 2010 11/2

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Chair Matsunaga: Good morning, ladies and gentlemen. I am Ryoichi Matsunaga. I will chair this session. In this session we have three prominent speakers. They are going to present Japanese advanced technologies in their fields, which have been developed particularly in Japan. Some of them have already expanded into Asia; some of them have not yet. However, they have great potential for expansion to Asian countries to contribute to the sustainable agriculture.

Before starting the presentation, I would like to remind speakers. You have 20 minutes for your presentation. I would appreciate it if you give me a few minutes for short questions from the floor. Before ending this session we will have 20 minutes for general discussion. Let's start the session's presentations.

The first speaker is Dr. Joji Arihara. He holds a doctorate degree in agricultural science from Tohoku University. He is currently Technical Advisor of Kubota Corporation, one of the major manufacturing companies of agricultural machinery in Japan. His expertise is in the area of crop science. Particularly, he has been leading soybean research for a long time in Japan. Today's presentation is "Rice Mechanization in Asia." Dr. Arihara, please.

Joji Arihara: Good morning, ladies and gentlemen. I am now working at Kubota Corporation as a technical advisor. The subject of presentation given to me is "Rice Mechanization in Asia." I'd like to introduce the activity of Kubota Corporation.

Kubota Corporation is one of the biggest agricultural machinery corporations in Japan. Kubota has two sectors of business: one is the farm machinery sector and another is the water and environmental systems sector. Kubota originated from a company of water pipe construction made by iron. After World War II, Kubota started producing diesel engines and then went into agricultural machinery utilizing casting technologies.

Asian countries are now producing nearly 90 percent of total rice production of the world. Asian countries are also occupying nearly 90 percent of the world paddy area. Now the sales of our machineries are expanding very rapidly in the Asian region. From 2006 to 2013, sales have expanded very rapidly, almost five times more than 2006. We are mainly producing tractors, transplanters, and combine harvesters.

In many Asian countries, because of the rapid economic growth along with industrialization, the income gap between urban and rural areas is expanding rapidly. The severe shortage of agriculture labor power in rural area resulting from draining labors to cities, it becomes important issue to save labor in the agricultural sector. The population boom in Asian countries also demands farming sectors to increase agricultural productions at low cost. Farming sectors in Asia have to increase crop yield, especially rice, the main food of Asian people.

Firstly, I'd like to introduce rice transplanters. Kubota has several types of transplanters, from small ones, the walk-behind type, to a large ride-on type rice planters. In India, the shortage of labor is also becoming very severe. The scenery of hand transplanting is fading out even in rice producing areas in India.

This rice paddy is the SriAg Farms in the coastal area of Andhra Pradesh, India. Because of the shortage of labor, especially during the transplanting season, they decided to introduce transplanters into their farm according to the state government mission on mechanized farming.

They are using this type, a ride-on type, large-sized trans-planter for relatively large scaled farmers, since 2011. They could complete transplantation with this Kubota planter in only one week. Before they have to spend so many days and labors for doing this.

As I said before, reducing the production cost is becoming a very important issue for Asian farmers. It is also same for India. Of course they have to invest much money in the beginning, but they can gradually produce benefits as the transplanting time can be well saved.

In the case of manual transplanting, 20 persons have to work for eight hours to complete transplanting for 1ha paddy. With a rice transplanter, only 2 persons can finish transplanting for 1ha paddy. Total work hours become only one-tenth compared to the manual planting. They can also save the seeds, about 60 percent.

Of course if this yield is not the same as or better than manual transplanting, this calculation is not effective, but in the case of transplanting with transplanting machines,

The grain yield of rice transplanted with transplanter is, in general, 10 to 20 percent better than manual transplanting. Younger seedlings, two-week-old used with machinery transplanter can grow better than four-week-old seedlings used in manual transplanting. Younger seedlings can grow more after transplanting than older seedlings. More uniformly transplanted seedlings with machinery transplanter can grow better than manual-trans planting. Uniformly transplanted young seedlings grow vigorously with uniform wind flow and sunshine. According to the results of Kubota Corporation on-site test, 10 to 20 percent increased realized on average. The very high increase in rice yield, such as 50 percent level is also often obtained.

Uniform planting by machinery transplanter makes weeding much easier and effective. Uniform space between rows makes weeding machines to remove weeds more efficiently.

Now Kubota is trying to introduce this mechanical transplanting system of rice in cooperation with governmental institutes in each country. We are also trying to foster the contractors of raising seedlings. In the case of mechanical transplanting, we are usually demonstrating how to transplant rice with machinery transplanters in front of the farmers. We are also trying to foster the mechanical transplanting farmers like in Japan. Most of them usually transplant in other people's paddy field to pay back the cost of the machinery. This is a very popular style in Asian agricultural scene.

This is a picture of the near Chennai, Tamil Nadu, India. They are trying, to make nursery beds of rice. This method was instructed by personnel of Kubota working in India. Farmers are very happy to show me how effectively they can sow rice seeds and make beds of rice seedlings. The farmer of this picture proudly showed me seedling beds of rice indicating the good harvest of rice after the introduction of transplanter.

Rice production system of Japan is highly appreciated in most of Asian countries. This farmer also praised Kubota transplanters. He appreciated the accuracy in transplanting, high speed in operation, the improved growth and yield of mechanically transplanted rice. He is very happy with his transplanters.

In India, we have Indian staff who can operate the transplanter after training by Japanese staff stationed in India Kubota. Now, Indian staffs also can demonstrate mechanical transplanting of rice seedlings in front of the people. We have so many personnel like him all over Asian areas. We are going to expand rice production technologies to countries in Asia and Africa too.

This is a demonstration in front of farmers in a Mekong Delta province of Vietnam. You can see how eagerly farmers are watching the demonstration.

We are also producing tractors suitable to paddy soil conditions. Compared to the American or European tractors, Japanese tractors are very light. Even with a similar horsepower engine, total weight of Japanese tractor is much lighter than American or European tractors. Japanese tractors do not need to attach a cage on the rear wheels to prevent sinking. Especially Kubota tractors with four-wheel drive system do not damage hard pan layer of paddy, called as *shirokakiso* in Japanese.

Kubota is introducing the rotary cultivating system for paddy soil preparations. Generally, farmers use cultivators for paddy soil preparation. Cultivators, however, cannot make soil surface flat and smooth. A rotary cultivator can make a very flat and smooth soil surface without undulant.

The lightweight tractor also does not destroy the compaction soil layers or *shirokakiso*. *Shirokakiso* helps rice to be uniformly transplanted with transplanter and grow growth of the rice by machinery.

In India, many farmers are using this kind of heavy tractor, but this is in Tamil Nadu state. This soil is alfisols, and this soil is relatively hard, and then they can use this kind of heavy tractor with a cage, but in other areas, like Madhya Pradesh, the soil is quite different. This is vertisols, black cotton soil, and then very soft under wet conditions, and you can see in some areas the rice is showing very poor growth.

And then why growth is less? This is the area where water is stagnating in this portion and rice grows, especially seeding stage, it's suppressed. And if they can make the surface of the paddy field flat, they can expect much better rice growth and yield. The preparation of the field is very important. This is my impression after seeing this.

And in the worst case. And then we are also making sales of harvesters. We have two types especially designed for rice production, and then another is generally used for rice and soybeans and other things. This is a harvester, combining soybeans. And we are also still producing tillers for Burma and other countries. And then we have a very big network in the Asian area and we are going to introduce Japanese technology into those areas and then try to increase or improve the farmers' life, and also we are trying to expand our company. And then we hope we can extend further this kind of activity in Asian countries. Thank you very much.

Chair Matsunaga: Thank you very much, Dr. Arihara. I am sure there are some questions from the floor, but more than 20 minutes have passed. Please forgive me to proceed to the next presentation. Thank you very much, Dr. Arihara.