CLUB OF BOLOGNA

PROCEEDINGS OF THE 15th MEMBERS' MEETING

Bologna (Italy), November 12th - 13th 2004

XXXV EIMA

Conclusions and Recommendations

Session 1

China Agricultural Machinery and Mechanisation

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Cost Benefits of the Platform Principles for the Tractors and other Agricultural Machinery

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Conclusions and Recommendations

Presidency and Management Committee

Ettore Gasparetto, President

1. Presidency and Management Committee

After the 14th Meeting of the Full Members of the Club of Bologna in 2003, the President of the Club Prof. Giuseppe Pellizzi resigned from his charge.
Before the 15th Meeting of the Full Members in 2004, the Management Committee (MC):

- confirmed the two new members of the MC, who were designated in 2003: Prof. El Houssine Bartali, replacing Prof. Ali M. El Hossary; Mr. Yoshisuke Kishida, replacing Prof. Osamu Kitani;
- elected four new MC members: Mr. Jacques Dehollain. Secretary General of CEMA (European Agricultural Machinery Manufacturers); Prof. Ettore Gasparetto, University of Milan (Italy); Prof. Luis Márquez, Universidad Politécnica of Madrid (Spain); Prof. Axel Munack, integrating the German FAL and acting President of CIGR (2003/04);
- unanimously voted the updated Club of Bologna Internal Rules.

After the 15th Meeting of the Full Members, the Management Committee unanimously ratified the new President of the Club, appointed by UNACOMA, Prof. Ettore Gasparetto.
Both the Full Members' Meeting and the Management Committee expressed their gratitude to Prof. Giuseppe Pellizzi for his long activity as President of the Club of Bologna.

2. Conclusions and Recommendations

36 experts from **16 countries** took part in the 15th Club of Bologna meeting, held on 12 and 13 November 2004 within the XXXV EIMA Show, under the aegis of **CIGR** and with the sponsorship of UNACOMA.

There were three topics under discussion, of which the first was **"China Agricultural Machinery and Mechanisation"** with contributions by a guest, Prof. Yuan Jiaping, **"Actual State of China's Agricultural Machinery Industry and Prospects for International Cooperation"** and by a Club member, Prof. Li Shujun **"Agricultural Mechanisation Promotion in China – Current Situation and Future"**.
The second topic was **"Cost Benefits of the Platform Principles for the Tractors and other Agricultural Machinery"**, with a keynote paper by Dr. Giuseppe Gavioli, representing the CNH tractor and equipment manufacturer.
The third topic was **"EU (European Union) Enlargement and its Influence on Agriculture and Mechanisation"**, with a keynote report by Prof. Andrea Segrè of the University of Bologna.

2.1 Conclusions

1. **China Agricultural Machinery and Mechanisation**. The first paper, pointing to the present state of Chinese agricultural machinery industry and to the prospects for international cooperation, focused on the industrial side of the problem, was presented by Prof. Yuan Jiaping, former Vice-President of the CAAMS (Chinese Academy of Agricultural Mechanisation Sciences). After a period of self-development in the field of agricultural machinery, China began to cooperate with foreign manufacturers and now foreign-funded machinery ventures are an important part of China's agricultural machinery industry.
   As a result of both autonomous development and of collaboration with outside manufacturers, the output of tractors and agricultural machinery increased, putting China's agricultural machinery industry among the top world entities, at least in produced units. Anyway the highest percentage of agricultural machinery is produced in private units, followed by state-owned manufacturers, while the foreign funded

enterprises represent a small percentage (5-6%).
Following the economic liberalisation, both imports and exports increased repeatedly in the last years. Up to almost 20 projects of introduction of foreign manufacturing technologies for farm machinery have been signed or are at present under study.
The second paper was presented by Prof. Li Shujun, present Vice-President of CAAMS. Prof. Li carried out a study on the current situation and the future of the agricultural mechanisation promotion in China. With 8 % of the world's farmland, China's agriculture is able to sustain 23 % of the world's population. The total output of national agricultural products reached the first place in the world and the ancient long-term shortage of food changed into a basic balance and into a surplus in good harvest years. Of course this positive change has been the consequence – among other factors – of the agricultural mechanisation development. Nevertheless, the agricultural machinery utilisation in China is still in its elementary stage with a great market and development potential; there is a big difference between a more developed East China in contrast to a West with less favourable conditions. Anyway agricultural machinery industry in China entered into a fast development: the output and sales value are increasing by 20 % per year in the last period.

2. **Cost Benefits of the Platform Principles for the Tractor and other Agricultural Machinery**. The presentation by Dr. Giuseppe Gavioli pointed out at the world's steady or decreasing volumes of demand for agricultural tractors and machinery, together with the necessity to increase the number of models, the machine power capacity and automation. At the same time there is a strong demand for less pollution, more safety and an increased demand for services.
To reduce or to keep constant the cost it is necessary to balance the higher product differentiation with an advanced component standardisation. In addition the following measures are pointed out: develop/expand product families; develop global products; globalise the supplier base; carefully plan the product development, to optimise investments.
Among the agricultural machines the tractor is the most important item, both in agriculture and in the agricultural machinery industry. As a consequence a special interest shall be applied to its development, which must consider not only off-road working but also public traffic regulations.

3. **EU Enlargement and its Influence on Agriculture and Mechanisation**. The presentation by Prof. Andrea Segrè carried out an exam of the conditions of economy, agriculture and agricultural machinery utilisation and manufacturing in 10 of the 12 countries, that have just entered, or will enter in a period of two years, the European Union. The two island countries – Cyprus and Malta – were not taken into account, because of the relatively small importance of their surface and – overall – of the agriculture in their economic context.
Generally speaking, fragmentation of farm structure is common in these ten countries, with an exception for Czech Republic, Slovakia and Hungary. The level of farm mechanisation is usually low. Access to new agricultural machinery is limited since farms in general do not own sufficient capital for machinery renewal and a high percentage of manpower is still employed in agriculture. Although Western European and other developed countries' products have already appeared, the machinery market is still dominated by local production and by imports from Eastern Europe. This trend is, however, likely to change due to the necessity to improve the structures for national agricultural mechanisation and to meet the environmental requirements regarding

engine emissions, ergonomics and safety posed by the EU.
The entry of these 8 new countries (and of other two in a couple of years) will significantly influence the agricultural machinery market due, on one hand, to the higher importance of the agricultural sector and, on the other hand, to the current generally obsolete and inefficient machinery stock available.

2.2 Recommendations

Topic 1

- **Having noted** that the successful modernisation and mechanisation of Chinese agriculture is the most important issue in the 21st century for all the world, because of its big population and surface;
- **Having recognised** that Chinese Government policy and laws strongly influenced the trend to agricultural mechanisation, such that agricultural mechanisation in China may be regarded more as a consequence of the rural development than as a catalyst to it;
- **Having noted** that both the Chinese policy of granting more privately owned equipment and the new law for the promotion of agricultural mechanisation will lead to an increase in larger scale equipment;
- **Having recognised** that China offers a big market with large potential for foreign investors and that the political climate for private investment by farmers seems to be very favourable in the moment;

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- **Recommend** that an increased promotion of international cooperation is essential to further improve the already favourable conditions of Chinese agricultural mechanisation;
- **Underline** that education will be even more important than food, energy and environment and **recommend** that the Club of Bologna should play a role to promote a more advanced education through world organisations and regional networks as well;
- **Acknowledge** that China is following a process of privatisation like in new EU countries and that a great deal of today's small farmers will be in the future part-time farmers or merge into bigger farms;
- **Recommend** that drying, processing and storing of agricultural products be considered as an important factor of improvement of Chinese agriculture and economy, as up to now these processes have been partly left behind.

Topic 2

- **Having recognised** that tractor and implement manufacturers seem to follow different development strategies and that there is a scarce relation between the updating of these fundamental branches of agricultural machinery;

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- **Underline** that there should be for the future a better exchange of information between tractor and implement manufacturers in order to improve both the multi-functionality of the tractors and a better adaptability/fitting of equipment;
- **Recommend** that new studies are needed to develop new tractor concepts for providing different sources of power and on-cab controls of the equipment, with the consideration of both the off-road working and of the circulation on public roads;
- **Confirm** that education at all levels is a fundamental factor for favouring the improvement of agricultural machinery understanding and utilisation;
- **Having noted** that the platform principle is very useful to reduce the cost of produced machinery and that, at the same time, it is necessary to develop better systems to fit each farmer requirements and an increased need for specialised machines in case of big farms or contractor operation;
- **Reassert** that an efficient service is necessary for the machinery performance improvement in all the sectors of

production, stocking and distribution systems;
- **Recommend** that machinery producers should combine standardisation and common platforms with innovations and advanced technologies from research institutes
- **Recognise** that the image and perception of agricultural machinery should be changed from "biological production" to "biological systems", including humans, animals and plants, to attract young people;
- **Recommend** the establishment of incentives to promote innovations within the platform production lines and the cooperation between industry and research;
- **Recommend** that the machine manufacturers should more strictly contact the farmers and other interested sectors, in such a manner to remain competitive.

Topic 3
- **Having recognised** the fragmentation of farm structure in most of the new members of EU;
- **Having noted** that an easier access to the EU markets after enlargement is seen as an opportunity and that, at the same time, the possibility of increased competition in domestic markets is a threat;
- **Having noted** that demand for agricultural machinery will develop in conformity to the application of the EU rural development policy;

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- **Underline** that the purchase of agricultural machinery is expected to become increasingly dependent on real productive necessity since financial resources will be different;
- **Recognise** that mechanisation will be in a position to develop, provided that the machines respond to the requirements imposed by the new approach and provided that incentives are given to process rationalisation, manpower qualification and environmental compatibility;
- **Recognise** that machinery has to change, due to increased labour cost and to allow the use of renewable energies;
- **Recommend** that the European Union supports the agricultural mechanisation in the new member countries;
- **Recommend** that a special consideration is given to the mechanisation of the small farms, to solve social problems and that part-time farming is considered as an important point;
- **Recommend** that economic and technological conditions in the extended European Union are considered to promote a financing credit structure;
- **Recommend** that the existing agricultural machinery manufacturers are considered for a different production in the different economic systems, changing their line into spare parts and/or other industrial items.

SESSION 1

China Agricultural Machinery and Mechanisation

Leading person: ***Axel Munack*****, Germany**

Agricultural Mechanization Promotion in China : Current Situation and Future

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China is a big agriculture country. The agriculture in China achieved marvelous success after 20 years of reformation and opening to the outside world. With 8% of the world farmland, China has succeeded in sustaining 23% of the world population.

The total output of main agro-products jumped to the first place in the world, the relations of supply and demand for main agro-products changed from long-term shortage to basic balance and has surplus in good harvest years.
Along with the rapid growth of national economy, the agricultural mechanization in China entered the fast development orbit and has become an important component of the world agricultural mechanization development.

Nevertheless the agricultural mechanization in China, which still in the elementary stage with great market and developing potential, will provide the rare opportunity for world agricultural mechanization development.

1. Background

The agricultural mechanization cause in China started from the beginning of 50s' of last century with running state-owned mechanization farms and tractors stations. Over 50 years, Chinese government has been taken the mechanization of agricultural production as one of its vital strategic targets for building modernized agriculture. After endless exploring and developing, we now formed a more appropriate way out for the development of agricultural mechanization in China. Reviewing the development history of agricultural mechanization in China, it can roughly be divided into three phases, administrative promotion phase, system reform and market-oriented phase, internationalized phase.

1.1 Administrative Promotion Phase (1949 –1980)

Under the high concentration of planned economy system, the agriculture developed in the collective operation mode of the people's communes. Being the important means of agricultural production, agricultural machinery were invested, owned and managed by the state and collectivity. The plan for agricultural machinery manufacturing was worked out by the government, products were allocated in the centralized way, and the prices for agro-machinery and agricultural mechanization service charge were all fixed by the government. Central government set up more than 2100 organizations for agro-machinery development and extension at the provincial, municipal and county levels by way of administrative orders and various

preferential policies to push forward the development of the large-medium sized agro-machineries that suited for people's communes. While in the same time the animal-draft machines coexisted.

1.2 System Reform and Market Oriented Phase (1980 – 2000)

Chinese government endowed the right of use and management of the farmland to the farmers in 1978. The overall implementation of the system of household contract responsibility with remuneration linked with output was adopted in 1980 and agriculture entered into the stage of small-scale family farms as the main mode. The control and management of our government for agro-machinery industry loosened gradually and farmers were allowed to purchase and use agricultural machines on their own will, so the small-scale agricultural machinery, such as small-sized tractors, low-speed rural transport vehicles for farmers developed rapidly.

Under the guidance of concerned regulations and laws of our government, the main bodies of investment fundamentally changed. At the beginning of this century, the investment resources for agricultural machinery were national financial oriented investment that took 2.01%, collective farm organizations taking 1.89%, and rural families covering 96.1%. Farmers were the main investment bodies while contract household and rural enterprises coexisted. The process of marketing for agricultural mechanization speeded up and the agricultural machinery operation services of plough and harvest agents appeared, while at the same time the possessing capacity and grain production mechanization level fast increased.

1.3 Internationalized Phase (2000 – Present)

After China entered WTO, the opening of domestic agro-products market and the increasing of international trade of agro-products made plantation, animal husbandry, and fishery production develop from simply seeking for the quantity to the direction of standardization and high quality.

Our government constituted the agricultural production development strategy of food security, food safety and ecology safety. Based on the regulations of WTO, our government provided the subsidies for agricultural machinery purchasing and implemented supporting policies for promoting the extension of new tech on agricultural mechanization so as to put forward the sustainable development of grain processing mechanization and the start of mechanization on forage production, livestock raising, seed processing, vegetable and fruit and horticultural machinery; the agricultural service industry included seed, fertilizer, pesticide supplying and agricultural machinery operation services progressively formed. Among it, there are 270 thousand service organizations engaged in professional agricultural machinery operation. The establishment of domestic capital market, the policy of multi-investment bodies and the opening policy accelerated the fast development of the corporations at the stock market, private enterprise, the sole investment and joint-ventures of agricultural machinery manufacturing.

Figg. 1 to 4 reflect the basic history of agricultural mechanization in China, portrays the great changes in the last 30 years.

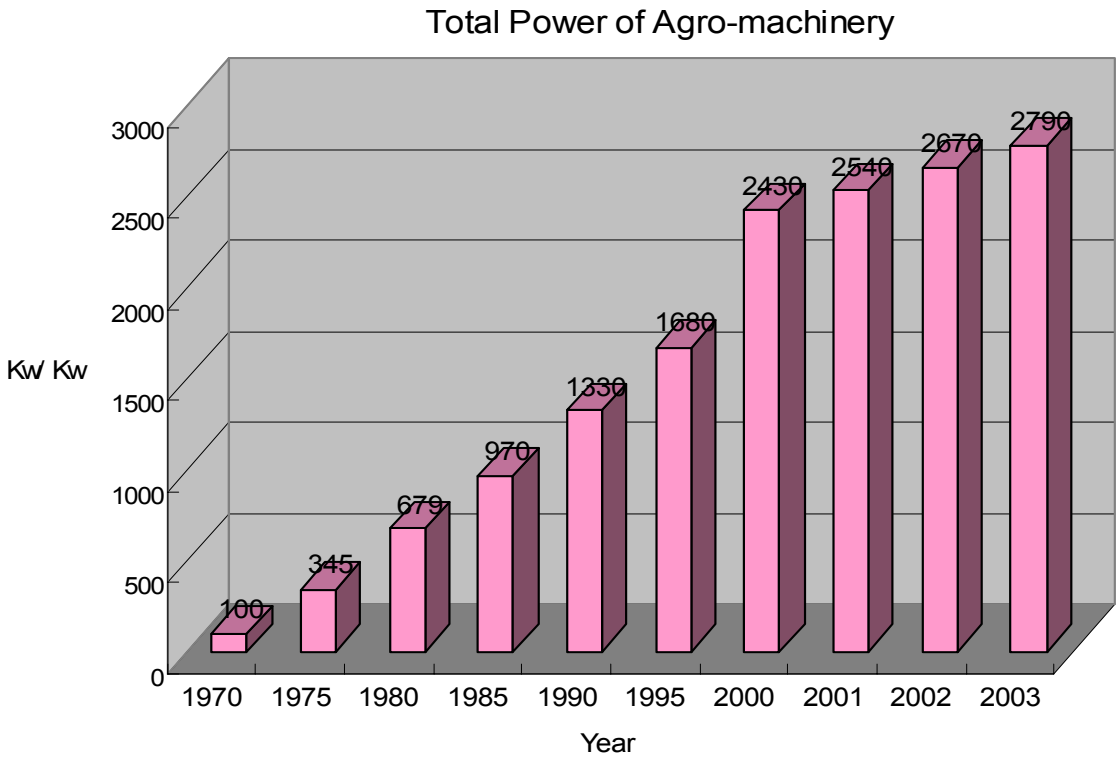

Figure 1 - Relative Change of Process Quantity of Total Power of Agro-machinery in China from 1970 to 2003 (year 1970 = 100).

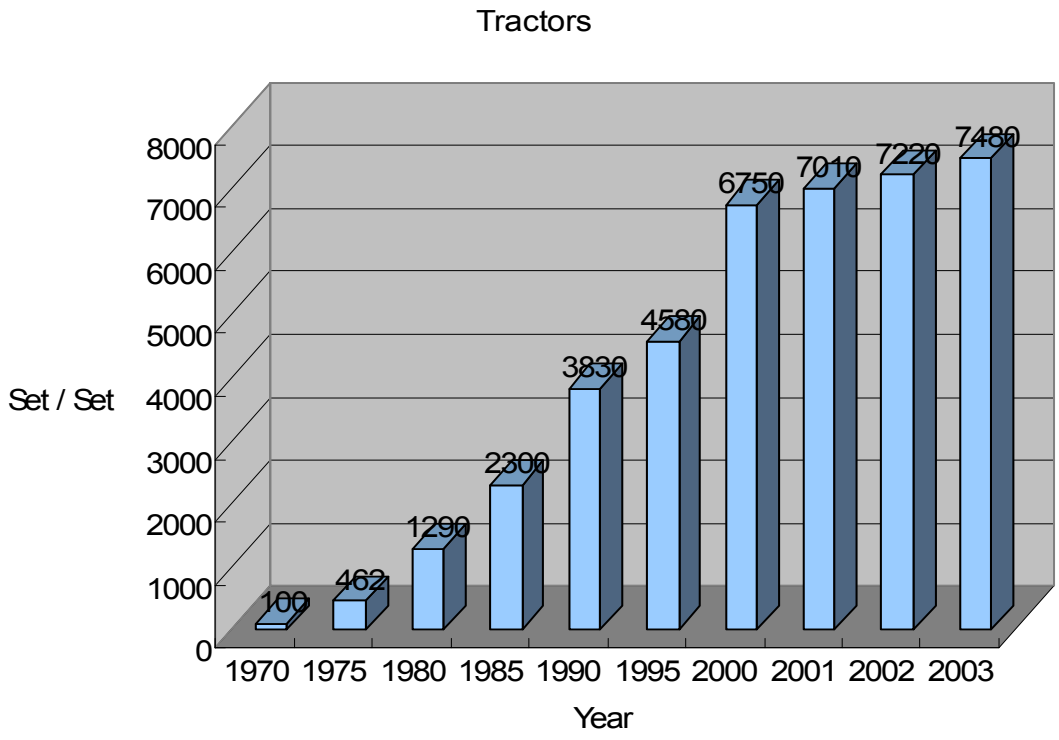

Figure 2 - Relative Change of Process Quantity of Tractors in China from 1970 to 2003 (year 1970 = 100).

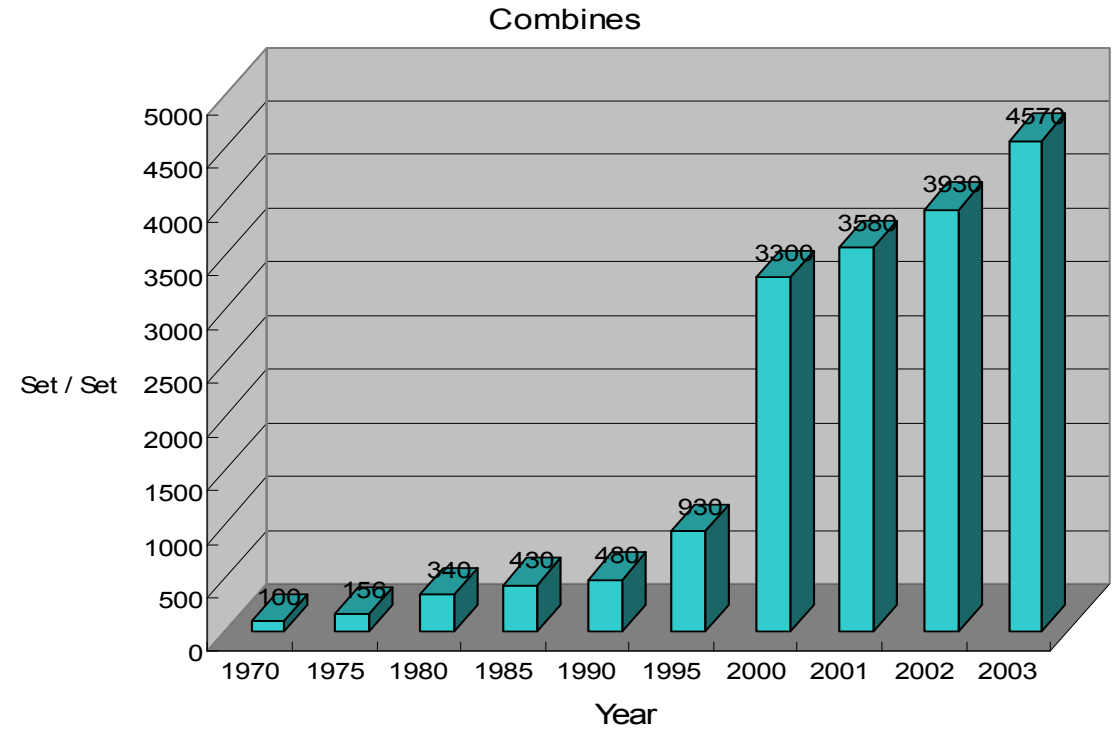

Figure 3 - Relative Change of Process Quantity of Combines in China from 1970 to 2003 (year 1970 = 100).

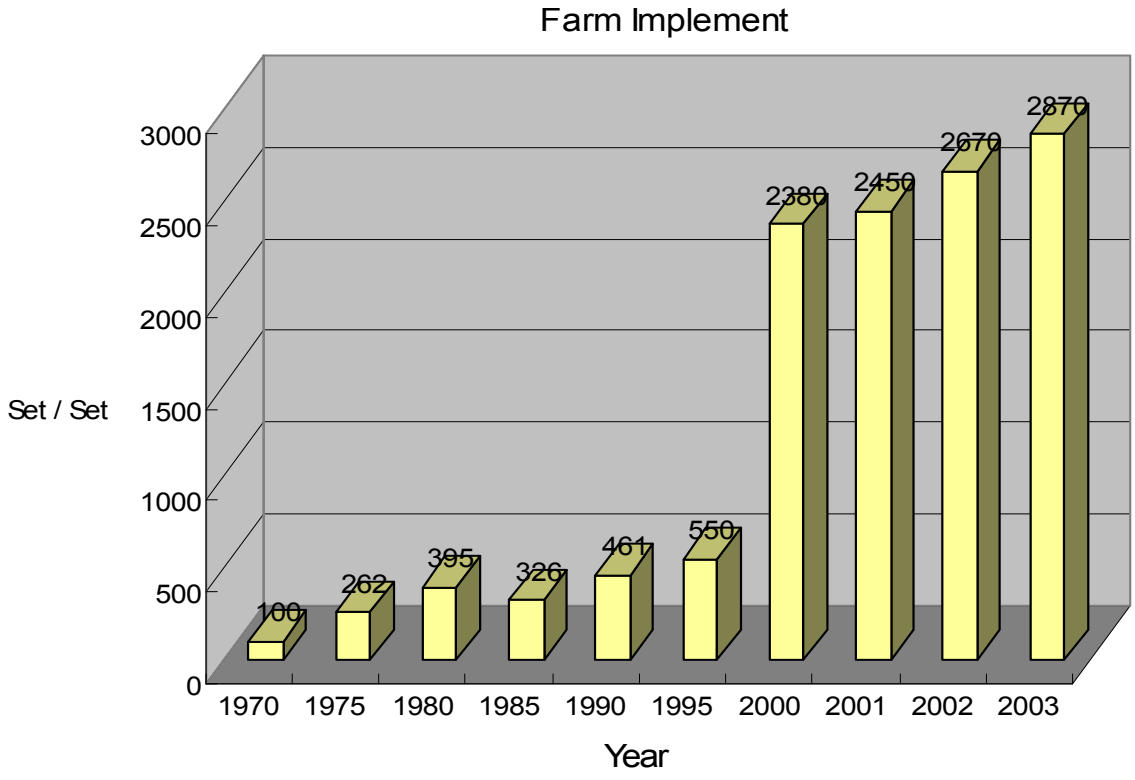

Figure 4 - Relative Change of Process Quantity of Farm Implement in China from 1970 to 2003 (year 1970 = 100).

Compared with 1970, the total power of agro-machinery increased by 26.9 times, tractors increased by 73.8 times, combines increased by 44.7 times and farm implements increased by 27.7 times.

2. The Present Situation of Agricultural Mechanization Development in China

After unremitting efforts of over 50 years, China primarily established the agricultural mechanization R&D system with the combination of scientific research units; colleges and universities and enterprises; the agricultural machinery industry system of industrialized production and multi-investments; the demonstration and trans-regional operation service system with the combination of manufacturing enterprises and agricultural machinery extension offices; the objects of agricultural machinery products service cover agriculture, forestry, animal husbandry, fishery and agro-product processing industry; the mechanization levels of tractor plowing, seeding and harvesting respectively reached 47%, 27% and 20%. Field operation for wheat basically realized mechanization. The imports and exports of agro-machinery products are continuously going up.

2.1. The Development of Agricultural Machinery Technology

2.1.1 The Technologies of Agro-products Safe Production and Agricultural Sustainable Development

In recent dozens years, we developed research work on the key technology that focused on major links of grain crops production mechanization and achieved great progress. The area of new technology application in mechanization covering mechanical film covering; deep tillage; precision seeding; straw chopping and returning to field; water, fertilizer and pesticide precision spraying rapidly enlarged and wheat basically realized mechanization production. In whole process mechanization of rice production, the technologies of industrialized rice raise seedling, high-speed transplanting and head-feed combines are gradually extended; the technologies of corn combine harvesting, cost-saving and high efficiency of dry land farming are at the stage of demonstration and extension.

Dry-land farming area takes 52% of the cultivated land in China. Moldboard plowing for years caused serious soil erosion; it is also the main reason for dust storms in recent years. So our government paid much more attention to the R & D for technology and equipment of agricultural environmental protection. A key Laboratory of conservation tillage technology was established in China mainly does the research work on soil corrosion and erosion, migrating mechanism under the normal farming system as well as the control measures. Farming and Planting Branch Center of National Technology Research Center of Agricultural Machinery Engineering established, focused its research work on seeding and fertilizing under the condition of lowing soil moving and tillage and with crop straws covering. It developed the technologies of crop straw returned to field in dry-land areas, wheat subsoil seeding and fertilizing, corn subsoil seeding and fertilizing, grassland subsurface tillage, forage and the related operation tools.

China is a country with abundant varieties of agro-products. The harvesting technology for some products is full of challenging apart from the one for some cereal. We concentrated the main energy on the two directions when doing harvesting technology research in recent years. First of all, solve the harvesting technology that not yet being done for industrial crops with comparative advantages in the world. We accomplished R & D for cotton-picker, potato combine, rapeseed combine, sugarcane combine, tomato harvesting, Grape harvesting for wine, oil seed and bulbs harvesting and it is in the stage of manufacturing and testing. Secondly, we did the research on early stage technology mechanism for special variety of fruit and vegetable harvesting and installed the testing devices. The agro-products that came into our consideration are tomato, grape for wine, oil seed and bulbs.

For the purpose of upgrading the agro-products quality and raising the comprehensive benefits of agriculture, in the field of technology for safe production of agro-products, for resources saving and effectively controlling the negative effect to the crops quality caused by improper use of fertilizer, pesticide and water, on the present foundation, CAAMS researched and developed the technology and equipment of variable rate treatment of seed, fertilizer, pesticide and irrigation water based on 3S system. In demonstration farm, we used the combine equipped with measuring (weight of grain and water) devices, the variable-volume grain seeder and fertilizing machine that operates according to the comprehensive prescription of water content rate in the soil, soil fertility and field output data, the variable-volume pesticide sprayer and large-scale linear irrigation system that operates according to low altitude remote sensing index and the prescription of agricultural expert system. CAAMS also developed R & D of detecting technology and equipment for grain outside and inside quality with near infrared, provided technological support for quality control of the whole process grain production as well as during the period of storage and transportation.

2.1.2 The Technologies of High Utilization of Water Resources and Protected Agriculture

China is one of the countries that lacks of water resources. Water resource per capita is only 2300 m^3, roughly taking 25% of the world per capita. The total water use in agriculture irrigation in China is 350 billion m^3, taking 67% of the water in whole China. The annual average water shortage for agriculture irrigation is more than 30 billion m^3, plus the fast development of protected agriculture of vegetable and orchard that need more water, water shortage has become main factor that restrained agricultural development and long stable growth of food production in particular. Realizing the high efficiency utilization of agriculture irrigation water is a long and hard strategic task of our country.

The area that controlled by mechanical water-saving irrigation reached 83 million ha. in grain, fruit, vegetable and cotton production, use the main market products of center-pivot irrigation system, large-scale linear irrigation sprinklers, small-scale movable irrigation system that we developed in the mid of 1980's. In late 1990's, we successfully developed

combined operating technology of cotton planting, film covering drip irrigation system installed under film in Xinjiang cotton area, we successfully developed the technology of long distance sprinkler and variable-volume sprinkler. Now the technologies and equipment system of sprinkler for grain production, micro-sprinkler and dripping for fruit and vegetable production and dripping for cotton production have been formed.

Protected agriculture is an important measure for agro-product processing with "high efficiency, good quality and high yield" and realizing balanced and safe production. The planting area of protected agriculture in China is 2,067 million hm^2, listed the first place in the world. Since 1998, Water-saving Irrigation Engineering Technology Center has been monitoring the organisms' behavior and physiology of plants and made the systematic research with the technology of nutrition adjusting at proper time, developed the sensors to monitor the stem flow, evaporation of leaves and growing of fruit; at present, it developed greenhouse mass control irrigation system with the combination of the requirement of reasonable use of water, fertilizer and pesticide of agricultural expert system. From the year of 2000, it researched on the technology of desalination of sea-water (bitter and salty water) with solar energy, developed relevant soil-less cultivation irrigation system and built vegetable demonstration production base.

2.1.3 The Technologies of Livestock Mechanical Raising and Forage Production

For a quite long time, the livestock raising in China focused on pig, egg chicken and meat chicken. By way of adjusting the structure of animal husbandry production in recent years, the scale of meat cattle, cow and sheep raising in pen has been enlarged, standardized feeding developed rapidly, that greatly stimulated the demand from feed production industry and forage planting industry for the related equipment and technology. We made a series of technological research and the products development: developed and manufactured grass non-tillage fertilizing seeder, forage baler; silage corn combine; forage and grass seeds of legume harvesting and processing equipment, and storage equipment; the application technology and equipment of crop straw fodder; TMR Mixer/feeder for meat and dairy cattle; technology of individual cattle recognizing and milk yield accounting, technology and equipment of multi-position milk collecting, milk yield of individual cow and automatic feeding and controlling.

Intensive Livestock raising needs more strict standard for disease control technology and equipment. In recent two years, CAAMS emphasized on researching the technology of cooked fodder and developed feed extruder so as to raise the hygiene standard in feed production: researching on the technology of individual animal water and feed supply and successfully developed inlay touch drinker and fast simultaneous feeding system so as to control the infection rate between animals while drinking and eating.

2.1.4 The Technology of Agro-products Processing

For a long time, Chinese government attaches great importance to rely on science and technology progress to accelerate the development of agro-product processing

industry. Technology research and development for agro-product processing was identified as the important content in our National Development Program for Main Agro-product Processing Industry and Food Industry. Science and technology investment has been continuously increasing and brought active results.

First we mainly developed the complete technologies and equipments of small-scale oil pressers, rice grinding machine, fodder and carbonated beverage. We solved the problem of basic living demands.

Secondly we mainly developed the complete technologies and medium sized equipments for refinery oil, grade rice, flour processing, formulated fodder, poultry slaughtering, meat processing, beer and fruit juice beverage. We solved the problem of the preliminary processing.

In the middle and late of 90s' , the research and industrialized demonstration focused on the key technologies of agro-products further processing and equipment, food safety and milk industry speeded up the steps of agro-product processing field to link up with the world, realized the transition from the elementary processing to precise and further processing with reasonable utilization of the resources. Technologies of vacuum freeze drying, microwave sterilization, membrane separation, supercritical extraction, micro-capsule, super-fine grinding have been applied gradually, in particular, the application and extension of new hi-tech of biological technology, information technology, flexible and green manufacturing technology laid a solid technological foundation for technology and equipment renewal of agro-product processing in our country and upgrading the overall level of the industrialization in China.

2.1.5 Digital Agriculture Technology

We now emphasis on researching on the technology and equipment for the fast information gathering of water content, nutrition content, crop growing, yield, quality and plant diseases, insect pests and wild grass in the fields, build up the system of agriculture digital accounting; develop technology and equipment for precise production with quantum adjusting operation and online measurement, set up the precise agriculture production technological system with quantum decision, precise fixing and quantum adjusting operation; research and develop biological information of plant production, environmental information and intelligent control system, build digital information platform for plant production.

For the purpose of upgrading the agro-product quality and saving resources, we researched and developed the technology and equipment of variable rate treatment of seed, fertilizer, pesticide and irrigation water based on 3S system; the combine yield mapping system; detecting technology and equipment for grain quality with near infrared.

2.2 The Present Situation of Agricultural Machinery Industry

2.2.1 The Service Object of Agricultural Machinery Covers the Whole Agricultural Field

The service object of agricultural machinery includes agriculture, forestry, animal husbandry, sideline production and

fishery. Owing to the vast territory in China, the natural condition and economic situation is varies among different regions, the categories of agricultural machinery are also complicated with many types. At present, Chinese enterprises can manufacture 3,000 kinds of agricultural machinery under 95-small-type and 14-big-category. The output of main agricultural machinery in China in 2003 and in the first half of 2004 is as following (**Tab. 1**).

Table 1 - The Output of Main Agro-machinery Products.

Product Name	Unit	The output in 2003	The output in the half of 2004
Big-mid-size tractor	set	48,544	48,822
Small-size tractor	set	1,864,540	867,878
Engine	10,000 kW	33,010.50	21,695.70
Harvesting machinery	set	193,265	119,091
Field operating machinery	set	137,955	63,162
Farm transportation machinery	set	2,581,952	1,117,246
Grain processing machinery	set	664,645	378,184
Feed processing machinery	set	130,873	60,736
Tobacco processing machinery	set	4,534	3,291
Cotton processing machinery	set	12,746	10,231
Pump	set	22,638,779	12,681,069

2.2.2 Multi-Investment Bodies and private Enterprises Have Grown up Rapidly

There are about 8,000 agricultural machinery manufacturers in China, which is a bigger one in machinery industry. According to the statistics in 2003 by National Bureau of Statistics of P.R. China, there were 1,469 scale enterprises with the annual sale income of over 5 million RMB Yuan, excluding the enterprises of farm diesel engine and irrigation and drainage machinery, there were only 4 enterprises with the annual sale income of over 2 billion RMB Yuan. There were 181 tractor manufacturers with the annual sale income of over 5 million RMB Yuan, the total sales was 16.4 billion RMB Yuan, the average sale income was 90 million RMB Yuan for each one.

Before the reform and opening up in China, the agricultural machinery manufacturers were all state-owned and collective-owned, with the stress on the former. However, along with the reform and opening up in China, the nongovernmental enterprises have developed rapidly and become a very important part in Chinese agricultural machinery industry. According to the statistics in 2003 by National Bureau of Statistics of P.R. China, there were 920 private enterprises among 1,469 scale enterprises with the annual sale income of over 5 million RMB Yuan, covering 62.6% of the total, its assets 43.6% and sale income 63%. The number, assets and sale income of state-owned or state-owned holding enterprises, private enterprises and joint ventures, cooperative business and exclusively foreign-owned enterprises in China are as following (**Tab. 2**).

Table 2 - The Structure of Agro-machinery Industry Enterprises and Their Products Sales.

Enterprise type	Number	The total assets		Sale income	
		Assets value (100 million Yuan)	Ratio (%)	Income value (100 million Yuan)	Ratio (%)
Scale enterprises	1469	659.0	100.0	695.9	100.0
State-owned or state-owned holding enterprises	481	328.3	49.8	218.6	31.4
Private enterprises	918	287.4	43.6	438.6	63.0
Joint venture, cooperative business and exclusively foreign-owned enterprises	70	43.3	6.6	38.7	5.6

2.2.3 The International Trade for Agricultural Machinery is Increasing

Due to the practicality and lower price, the exports for Chinese agricultural machinery have risen rapidly in recent years. According to the statistics of Chinese customs, the main exported agricultural machinery, including diesel engine and irrigation and drainage machinery, were mid-small-power diesel engine, farm irrigation and drainage machinery, tractor and spare parts in the past three years. Meanwhile the imports of agricultural machinery have also increased greatly on account of the adjustment of agricultural structure in China. The main imported agricultural machinery include diesel engine, big-horsepower tractor, cotton picker, grass machinery, agricultural products processing machinery and so on (**Tab. 3**).

Table 3 - The Import and Export of Agro-machinery.

Year	Exports value (100 million USD)	Imports value (100 million USD)
2002	15.21	19.55
2003	21.31	42.19
The half of 2004	14.92	32.34

Exports increased by 28.6% and imports increased by 53.7%.

2.2.4 Agricultural Machinery Industries Entered Into High Developing Phase

The agricultural machinery industry in China has stably grown in recent years, because the economy develops rapidly, the central government pays great attention to the development of agricultural machinery industry and agricultural mechanization, the rural labor forces move into industry production. Since 2003, the increase rate for the total output value of industry and sale income have both been over 20%. The economic benefit has also risen year after year, the increase rate reached 61.7% in 2003. The situation of production, sale and profit for the scale enterprises, excluding

the enterprises of farm diesel engine and irrigation and drainage machinery, in 2002, 2003 and in the half of 2004 are as following (**Tab. 4**).

Table 4: The Situation of Production, Sale and Profit for the Scale Enterprises of Agriculture Machinery

Year	The total output value of industry		Sale income		The total profit	
	Output value (100 million Yuan)	Increase rate (%)	Income value (100 million Yuan)	Increase rate (%)	Total amount (100 million Yuan)	Increase rate(%)
2002	634.8	18	551.8	16	9.9	53.0
2003	753.4	22	695.9	26	16.3	61.7
First half of 2004	437.4	20	400.8	22	11.1	21.4

2.3 Present Situation of Agricultural Mechanization

2.3.1 The Total Amount of Agricultural Machinery Is Smoothly Increasing

The total power of agricultural machinery reached 0.61 billion kW. in 2003, increased by 5% of the previous year. The annual power increasing rate smoothly keeps at the level of 20 million kW. For each 1000 ha. cultivated land, there are 312 kW agricultural mechanical power, 11 tractors; tractor power is 85 kW, 148 farm vehicles and 165 farm tools. The value of agricultural machinery all over China was about USD 43 billion, the average value of agricultural machinery per rural family takes 1/3 of rural family's fixed property for production. The popularized rate of tractors for farmers is 6.1% and that of farm vehicles is 8.3%. Deducting non-agriculture farmers in the countryside, the popularized rates respectively reached 7.8% and 10.6%, surpassed the products oriented phase and entered fast developing growth phase.

2.3.2 The Field Operation by Machines Is Raising Gradually

In 2003, mechanical plowing/harrowing, mechanical seeding and mechanical harvesting only took 47.2%, 27.2% and 18.5% of the total mechanical operation volume. Among them, the level of wheat mechanical seeding and harvesting respectively reached to 73% and 70%, generally realized farm mechanization: Level of maize mechanical seeding and harvesting respectively reached to 47% and 1.7%: Level of rice mechanical transplanting and harvesting respectively reached to 6% and 20%. Along with the development of cereal production mechanization, the extension and application of newly introduced agricultural mechanization speeded up. The farm area of mechanical water-saving irrigation accounted for 12.8% of the irrigation-controlled area; the area for corps straw returned to field took 7% of the seeding area. The area of forage mechanical seeding and harvesting started from blank but now respectively reached to 720000 ha. and 16

million tons. The crops of cotton, sugarcane, rapeseed, potato all entered mechanical operation extension period.

2.3.3 Remarkable Result of Agricultural Machinery Socialization Services (Field Operation Service System)

For many years, innovations for the forms of agricultural machinery service appeared continuously from a farmer offered operation services with his machine, several rural families' joint operations, and groups contracting service to trans-regional operation. All kinds of agricultural mechanical operation service organizations and service families in whole China were 29.67million with 35.54 million employees. Among them, agricultural mechanical service families were 29.4 million, took 12% of the total number of rural families. The number of those who specialized in agricultural machinery operation service was 3.3 million, took about 11% of the total number of agricultural mechanical service families. Agricultural mechanical service families and agricultural production business organizations became the main parts of agricultural machinery socialization service. Especially the service model of combine trans-regional operation for wheat harvesting started in 1996 accelerated the marketing process of agricultural machinery service, specialization and socialization. The number of combines involved in trans-regional operation in 2003 reached to 200000 sets, finished 18.6 million hm^{2} wheat harvesting area;. The efficiency of trans-regional operation of agricultural machinery greatly raised and the result of cost-saving and income growing for the grain planting families was obvious, that solved the contradictory between family scale business with mechanical operation, thus well accepted by the farmers.

At present, trans-regional machinery harvesting developed from wheat to the main crops of rice, corn, soybean and potato. Agricultural machinery operation scope extended from harvesting to pre-harvesting, post-harvesting, extended fields from planting to animal husbandry and agro-product processing industry.

2.3.4 The Organization and Policy Supporting System for Agricultural Mechanization Development

- The Organization System of Agricultural Mechanization

Experienced many years of reformation and development, China gradually formed a fairly complete and perfect supporting system for the development of agricultural mechanization of agricultural machinery management, scientific research, identification, authentication, technology extension, education and training, safety supervision and managing, repairing, social service and etc. There are 31 agricultural mechanization management organizations at provincial level, 346 at regional level, 2745 at county level and 34317 at town level across the country. There are 49 agricultural machinery test and appraise organizations at regional and city level, 122 agricultural machinery research institutes. 2413 agricultural machinery technology extension organizations at county level, 2900 safety supervision and managing organizations for agricultural machinery, 2213 agricultural machinery education and training organizations. The administrative regions above county level in China all set up the organizations of agricultural

machinery management, technology extension and supervision, more than 260000 employees engaged in agricultural machinery management, extension, identification and supervision, of which the scientific and technological staff takes 50%.

- Supporting Policy for Agricultural Mechanization Development

In recent years, government at each and different levels formulated a series of policies and measures to support agricultural mechanization development. First, it provides subsidy to the farmers who purchased new agricultural machine. From 1998, financial department of Center Government in China allocated a special funding to subsidy the agriculture for heavy occurrence of plant diseases and insect pests, agricultural environmental protection machinery and new agricultural machinery. The formulation on "Laws of Agricultural Mechanization Promoting" started in 2004, placed supporting for agricultural mechanization development into the orbit of legal system. Starting from 1990, financial departments at each rank provided 20% -- 40% subsidy based on purchasing prices to the new machinery for local advantage crop production, environmental protection and anti-disaster agricultural machinery. Secondly, it provides financial support for agricultural machinery R & D work. Since 1998, each five-year program of our country all established special projects for the important scientific research in agricultural mechanization, supported the developing work on fundamental products with social benefits. Thirdly, it provides special funding support for important new technology modeling and extension projects in agricultural mechanization. Such as straw mechanization and returned to field, grain drying in growing area, conservation tillage, mechanical water-saving and construction of commercial grain base, agricultural machinery investment in construction of agro-products base and etc. Fourthly, adopting the policy of favorite value-added tax rate with 13% to the agricultural machinery manufacturers (the other trade is 17%). It provides convenience and favorite support for trans-regional operation of agricultural machinery in the respects of passing roads and bridges. Especially in recent 5 years, nearly half of the provincial (regional and municipal) governments worked out resolutions or decisions on accelerating the agricultural mechanization development, created better developing surroundings for agricultural mechanization development, played an important role in speeding up the development.

3. The Future of Agricultural Mechanization Development in China

In quite a long period of coming days, the agriculture in China will still be at the transition phase from traditional agriculture to modern agriculture. The co-existence of small-scale household farm and the large modern farms with concentrated operation will be the necessity option of the future agriculture operation in China. At the era of economy globalization, the development of agricultural mechanization in China will take the international comparative advantages to promote actively the technology of production mechanization of industrial crops and fruit, vegetable and horticulture meanwhile continuous improving the technology of modernization equipment for grain production; during

developing the mechanization technology for harvesting, we'll extend the technologies for prior and post-harvesting, make efforts to forward the technology that is in keeping with agriculture sustainable development and agro-products value-added processing; lay emphasis on R & D for traceability of mechanization technology in every field of agriculture, actively adopt the modern electronics technology and information technology.

1. Mechanization during the whole production process of the main grains that guarantees food safety will develop to rice and corn whole production process after basically realizing mechanization for wheat during the whole production process. At the same time, the mechanization level for seeds breeding will be greatly upgraded. We'll apply the high-tech. achievements of electronic information to develop the machinery with large-medium size, high speed and easy operation. Raise the technical characteristics and reliability of the machinery operation by way of traceability control and diagnosis to the breakdown so as to realize high efficiency, high quality and low cost of machinery operation.

2. Accelerate the strategic adjustment to the agriculture and rural economy structure, the technology of agricultural mechanization for increasing farmers' income will be rapidly developed. Take the advantages of market competition of industrial crops to quicken up the develop of animal husbandry, made great efforts on developing agro-products processing industry, adjust the patterns of agriculture, widen the space for farmers employment are the top tasks of agricultural structure adjustment and raising farmers' income at the new stage in China. The production mechanization for superiority industrial crops and the technologies of storage and processing will be developed rapidly, such as the mechanization technology of oil-bearing crop (soybean, rape and peanut), cotton, potato and tomato. The complete technology of animal husbandry intensive raising, high new-tech and equipment of agro-products further processing will be the focus fields that need to be opened up in the development of agricultural mechanization.

3. The technology of improving agricultural ecological environment and realizing sustainable development becomes the highlight fields of the development of agricultural mechanization. The technologies of high efficiency utilization of agricultural resources, mechanization technology of protected agricultural engineering, mechanization technology of grasslands ecology and animal husbandry engineering, mechanization technology of comprehensive prevention and control to the biological calamity, the agricultural aviation technology and the technology of traceability for food production will have fairly good market.

In order to adapt to the development of economic globalization, the technical levels of agricultural machinery products will be raised continuously. At present, the production capacity for small-scale agricultural machinery is comparatively surplus in agro-machinery manufacture industry in China and the market competition is fierce. The production capacity for medium and large sized products is obviously insufficient. Quite numbers of the agricultural machinery from the world famous enterprises entered into the Chinese market. Their coming greatly pushed the technological progress in this

industry. General technologies of modern designing method of agricultural machinery, reliability design technology, testing technology, advanced manufacturing technology and fundamental parts, modern hydraulic technology, instrument and control technology, modern microelectronic technology and information technology will be successively applied.

China is a big agriculture producer with over 0.2 billion rural families. The population in China takes 1/5 of the world population, but regarding to the natural resources, water resources per capita in China only takes 1/4 of the world average level, while farmland per capita is only 1/3 of the world average level, the area of grasslands per capita is 1/2 of the world average level, agricultural production needs the advanced agricultural mechanization technologies and products.

The Status of China's Agricultural Machinery Industry and the Prospects for International Cooperation

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Part A. The Status of China's Agricultural machinery Industry

China is a big developing agricultural country with a large population of 1.3 billion and limited cultivated farmland of 0.08 ha per capita.

With only about 7% of the world's total cultivated farmland, China has managed support 20% of the world's population.

Agriculture is the foundation of the national economy. Agricultural machinery is the base of agricultural modernization. With the development of agriculture, China's agricultural machinery industry has achieved great successes. China has become a big nation of production of agricultural machinery.

1. Brief history of the development

China's agricultural machinery industry has undergone some rise and fall stages in the history of its development due to the adjustment, reform of the national economy and transform from planning economy to market economy (**figg. 1 and 2**).

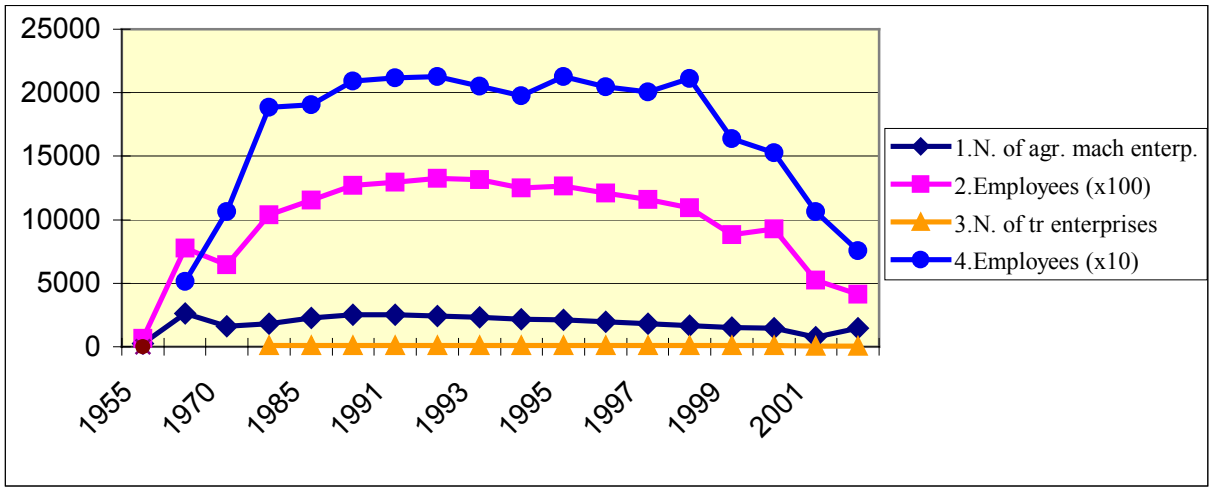

Fig. 1 - Number of agricultural machinery enterprises and employees (1955-2002).

The history could be divided into 5 stages.

First stage - from 1949 to 1960

Before the foundation of new China in 1949, there were only 36 agricultural implement factories with 4,000 employees.

In 1955, China manufactured first farm crawler tractor.

In 1957, China produced first farm wheel tractor.

In 1959, China built first tractor factory – now named China First Tractor Group Co.

By the end of 1957, number of agricultural machinery factories reached 276 with 123,000 employees.
Since late of 1950s, China built its own agricultural machinery industry.

In the end of 1950s, former Chairman Mao called big jump, the number of agricultural machinery enterprises and employees increased rapidly, but it was not normal development.

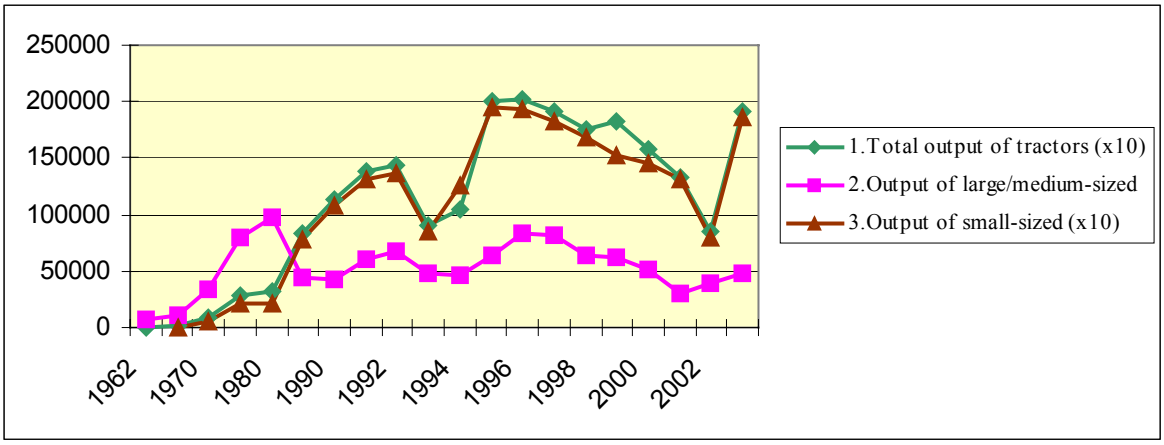

Fig. 2 - Output of tractors (1962-2003)

Second stage - from 1960 to 1980
Chinese government had to take adjustment of the national economy. The number of agricultural machinery enterprises and employees reduced.
Then the central government made mistake again to set goal to mechanize agriculture basically in 1980. In 1970s, the number of agricultural machinery enterprises and employees raised rapidly (fig. 1 and also fig. 2).

Third stage - from 1980 to 1992
In 1978 China started reform of rural economy. Before, the governments bought tractors and farm machines for state farms and tractor stations. After 1979, the farmers bought farm machines by themselves. There were characteristic changes of the tractor structure (fig. 2):
Output of large and medium-sized tractors dropped quickly, but output of small-sized tractors increased greatly, because farmers needed small-sized tractors for their small-scale farming.

Fourth stage - from 1992 to 2003
The central government started economic reform since the beginning of 2000s: transfer the planning economy to marketing economy. Output of tractors dropped, then raised and dropped to the lowest tide in 2002.

Fifth stage - from second half of 2003 and beginning of 2004
From 2003, a new stage began: the central government started reform of ownership system, especially state-owned enterprises.
The State has adopted some policies and taken a lot of measures, which promoted the development of agricultural mechanization (see A-2).

2. The present situation of China's agricultural machinery industry

According to the State Statistics Bureau, there were 1,469 agricultural machinery enterprises with scale (with employees

more than 100) in 2003 (total was 8,000 enterprises, most of them with employees less than 100), in which: 481 state-owned, accounted for 32.7%, 918 private (non-state-owned), accounted for 62.5%, and 70 foreign-invested, accounted for 4.8% (**figg. 3 and 4**).

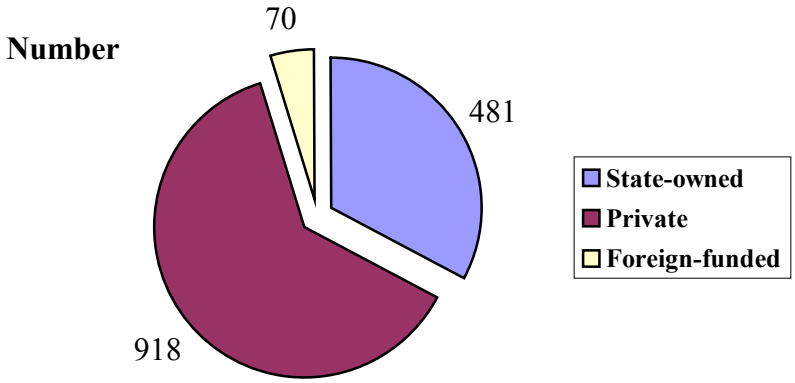

Fig. 3 - Number of agricultural machinery enterprises in 2003.

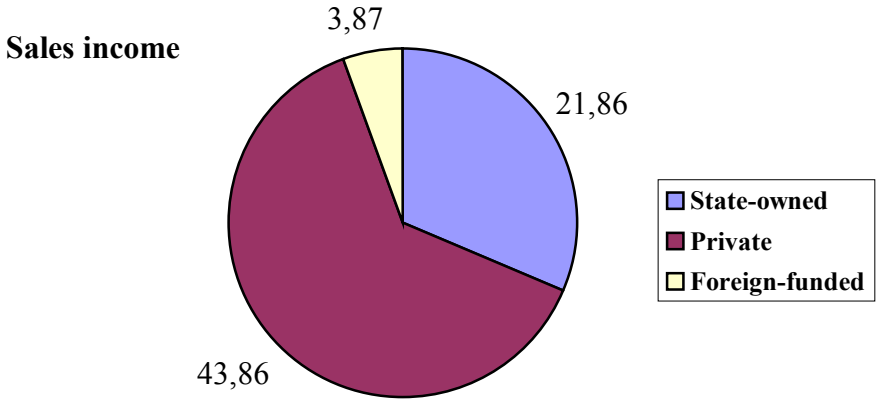

Fig. 4 - Sales income of agricultural machinery enterprises in 2003.

Recently, China can produce 14 different specialist categories, 95 merchandise items and more than 3,000 different machine/equipment models.

But the technical standards of China's agricultural machinery industry is still lower at the level of developed countries in 1970s. Gross industrial output of agricultural machinery increased 18% in 2002, 22% in 2003 and 20% in the first half of 2004 (**tab. 1**).

Output of main agricultural machinery in 2003 and first half of 2004 are showed in **tab. 2**.

- Output of large and medium-sized tractors in the first eight months of 2004 increased 57.7% to 65,743 units, sales increased 68.3% to 64,522 units, both output and sales of large and medium-sized tractors have exceeded total output and sales in 2003 (**fig. 5**).
- Output of small-sized tractors in the first eight months of 2004 reached 855,500 units, an increase of 1.9%, in which: small-sized 4W tractors dropped 8.3% to 481,000 units and walking tractors increased 15.45% to 415,000 units.

Tab. 1 - Gross industrial output value and sales income of agri machinery enterprises with scale.

Year	Output value		Sales income	
	Billion yuan	Variation %	Billion yuan	Variation %
2002	64.48	18.0	55.18	16.0
2003	75.34	22.0	69.59	26.0
First half of 2004	43.74	20.0	40.08	22.0

Tab. 2 - Output of main agricultural machinery in 2003 and 2004.

No.	Products	Output in 2003		Total output in Jan.-Aug. 2004	
		Output in 2003	Var.% 2003/2002	Output in Jan.-Aug. 2004	Var. % Jan.-Aug. 2004/2003
1.	Large/medium-sized tractors	48,544	-6.14	69,720	66.05
2.	Small-sized tractors	1,864,540	-2.33	1,117,418	-5.41
3.	Harvesting mach.	205,894	5.99	161,859	-5.98
4.	Barnyard machinery	138,688	0.53	86,198	4.49
5.*	Farm transport mach.	2,645,534	2.46	1,357,735	-9.52
6.	Grain processing	726,091	9.24	519,344	9.15
7	mac	130,873	0	86,390	4.72
	Feed processing mac.				

Source: China General Confederation of Machinery Industry

(*) = Barnyard machinery includes: motor threshers, grain cleaners, grain driers, seed graders and others

Output of large and medium-sized tractors are expected to reach 80,000 units in 2004, the highest record in recent years. Output of small-sized tractors will develop steadily in a high level.

The rapid development of China's economy and continuous adjustment of agricultural structure have brought China's agricultural machinery industry and also foreign farm machinery companies good opportunities for their development in China.

In the beginning of 2004, the State has adopted some policies and taken a lot of measures to support rural areas, agriculture and farmers:

- No.1 document for 2004 to boost farmers' income;
- "Law on the Promotion of Agricultural Mechanization" has been put into effect from November 1, 2004;
- the Government has decided to cut the agricultural tax within five years;
- to provide subsidies for grain production;
- to provide subsidies to farmers for purchasing farm machines;
- the central government has decided to put its central financing of 70 million yuan (in which 30 million yuan for state farms) and local governments will also provide 410 million yuan to farmers for purchasing farm machines.

All these policies and measures have promoted and will promote rapid development of China's agricultural machinery industry.

A new stage of agricultural mechanization and agricultural machinery industry is coming. As the general manager of Deere-Tiangjin Tractor co said: the spring for agricultural machinery industry in China is coming soon.

There are bright prospects for China's agricultural machinery industry.

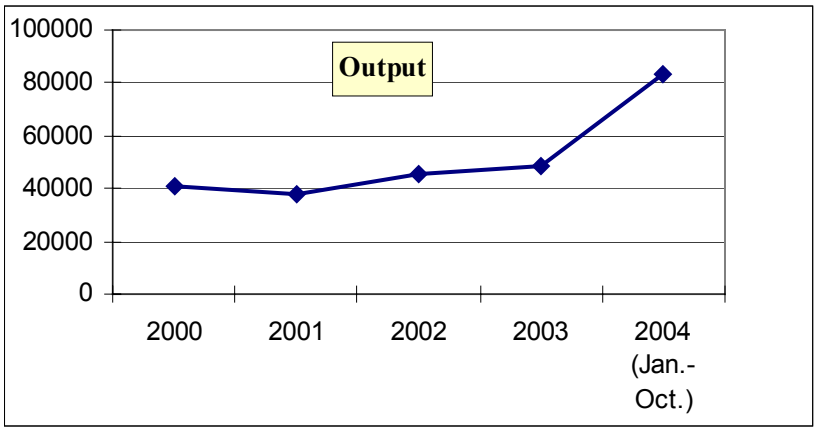

Fig. 5 - Output of large and medium-sized tractors (2000-2004).

Part B. The Prospects for International co-operation

China has obvious advantages for exports of agricultural machinery with cheaper prices and variety of products.

China's access to the WTO brought its agricultural machinery good opportunity into international markets.

In the meantime, China's market needs also new foreign farm machinery products and advanced technologies.

- There are the possibilities and opportunities of co-operation and trade of agricultural machinery for foreign companies.
- More and more foreign farm machinery companies have recognized that China is a big potential market of agricultural machinery.
- China's agriculture must be mechanized, agricultural mechanization is the only way to increase agricultural productivity and effective tool to increase farmers' income;
- Agricultural machinery is an important base for modernization of agriculture;
- Recently, China's agricultural mechanization level is still lower and the technical level of agricultural machinery industry is also lower.

At present, China's agricultural machinery manufacturers can not supply all farm machines in quality and quantity for market demand.

The reliability of China-made farm machines is still unsatisfactory.

The quality of farm machinery products has yet to be improved.

China needs new foreign farm machinery products and advanced technologies.

China has to import some farm machines.

Chinese agricultural machinery manufacturers are seeking foreign partners for co-operation.

We can see the good opportunities and possibilities of co-operation and trade for foreign farm machinery companies in China.

1. Trade

China started agricultural mechanization with imports of foreign farm machines and

the establishment of state farms and tractor stations in the beginning of 1950s.

China imported 16,750 units of large and medium-sized tractors and implements during the period 1949-1957 mainly from Soviet, Eastern European countries, and Britain.

"Beijing 12 foreign agricultural machinery exhibition", held in Beijing in 1978, was a historical turning point for foreign co-operation and trade in China. After the exhibition, foreign farm machinery companies started to enter Chinese market. Imports and exports of agricultural machinery increased rapidly since 1978.

State farms were the major importers of farm machines for field works.

From 1978 to 1996, only state farms in Heilongjiang province imported a total 4,000 units of large-sized tractors and implements through different ways (**tab. 3**).

Table 3 - Imports of large-sized tractors and farm implements for state farms (mainly in Heilongjiang province).

No.	Items	1950-1957	1978	1980	1983	1985	1996	1997	1999
1	Name of projects	For State farms, tractor stations	Friendship state farm	Honghe joint farm	State farms	Sanjiang plain agri develop.	Honhhe joint farm	State farms	Sanjiang plain agri. develop.
2	Import units. In which:	16,750		700	450	2,800	32	1,000	2,713
	tractors		7 (110-130)		60	55 (4450)	25	1,000	363 (N.H.)
3	Volume (mil.US$)		1.00	13.50	60.00	76.00	20.00	24.00	200.00
4	Foreign partner			Nichimen co (Japan)			Nichimen co (Japan)		
5	Resource of funds			Japanese loan		World bank Loan	Japanese Loan		Japanese loan
6	Form of Trade	Direct trade	Direct trade	Compens. trade	Direct trade	Direct trade	Compens. trade	Direct trade	Invitation for Bids
7	Importer	Ministry of Agriculture	Ministry of Agriculture	GBSF* of Heilong.	GBSF* of Heilong.	GBSF * of Heilong.	GBSF* of Heilong.	Ministry of Agriculture	GBSF* of Heilong.
8	Supplier	USSR, UK	John Deere	USA, Japan	John Deere	John Deere, Hitachi	John Deere	Yugosl. Belgrade co	New Holland, John Deere

(*) = GBSF, General Bureau of State farms in Heilongjiang province.

2 = From 1978 to 1996, only state farms in Heilongjiang imported about 4,000 units of large & medium-sized tractors, implements and combine harvesters, among them 1,000 units of large-sized tractors with 160 Hp, in which 600 units of 4WD and 50% from John Deere; 2,800 units of combine harvesters, 198 units of tractor-drawn implements and other farm machines from John Deere, Case, JCB, New Holland, F.M, Kubota.

Imports and exports of agricultural machinery increased rapidly since 2000 (**fig. 6**), especially in 2003, import and export volume hit US$6.35 billion, an increase of 43.57%; In which imports increased 44.8%, while exports rose 41.2% (**tabb. 4, 5 and 6 and figg. 7 and 8**).

Imports and exports of agricultural machinery in the first half of 2004 increased 57.88% to US$4.73 billion; In which imports increased 64.5% and exports rose 45.3%.

Some possible ways for trade:

(1) Direct trade;
(2) Invitation for bids;
(3) Compensation (barter) trade);
(4) Export credits of foreign governments;
(5) Co-operation projects (joint farms).

2. Introduction of foreign manufacturing technologies for agricultural machinery in China started in 1978

By 1993, China signed a total of 105 contracts for introduction of manufacturing technologies for agricultural machinery with foreign companies, in which 100 contracts signed from 1978 to 1990. Most of these contracts were involved licences trade and technical consultancy (**tab. 7**). 7 contracts for tractors, accounted for 6.7%; 72 contracts for engines and its spare parts, accounted for 68.5%; 26 contracts for agricultural implements, animal husbandry and agricultural product processing machinery, accounted for 24.8%. Most of these machines have not put into massive production. After 1993, China almost stopped to introduce foreign manufacturing technologies alone.

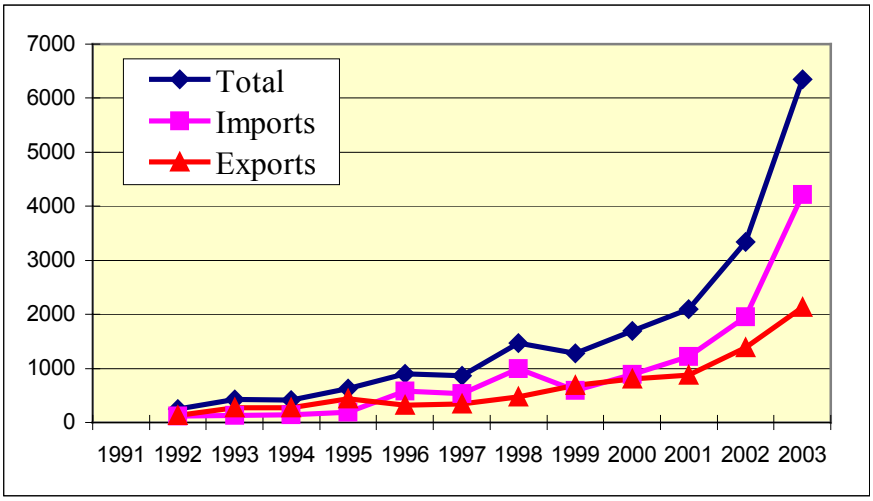

Fig. 6 - Imports and exports of agricultural machinery (1992-2003).

Table 4 - Imports of agricultural machinery in 2003.

No.	Products	Units/tons	Var.%	Mil. US$	Var.%
01	Diesel engines	646,080	40.4	875.80	28.4
	In which: diesel engines with 18 Hp and smaller	3,208	32.6	4.56	52.7
01a	Spare parts of diesel engines	167,390t	31.8	1,557.61	66.4
02	Drainage/irrigation machinery	16,340,530	61.3	688.97	51.1
02a	Spare parts	12,839t	20.0	184.16	22.5
03	Tractors and tractor trucks	2,177	40.5	102.20	31.9
03a	Spare parts of tractors and trucks	565,380t	27.3	29.07	55.4
04	Diesel engine generator sets and spare parts	2,288,300	72.5	561.09	33.8
05	Harvesting machinery & spare parts	1,755,605	79.6	78.51	39.9
06	Plant protection mach. & spare parts	209,382	30.0	15.21	-4.3
07	Attached implements and spare parts	190,403	10.0	19.24	44.7
08	Poultry breeding mach. & spare parts	549,475	26.1	22.57	-12.2
09	Farm vehicles and trailers	421	-17.7	8.76	15.1
10	Grain processing mach. & spare parts	142,561	43.2	65.34	84.4
11	Milk processing mach. & spare parts	467,926	24.7	41.82	5.5
12	Other agricultural machinery	58,680	39.1	28.42	126.2

Table 5 - Exports of agricultural machinery in 2003.

No.	Products	Units/tons	Var.%	Mil.US$	Var.%
01	Diesel engines	1,935,745	29.4	227.43	21.6
	In which: diesel engines with 18 and smaller	920,065	8.4	116.48	10.9
01a	Spare parts of diesel engines	2,630,243t	18.1	376.56	10.3
02	Drainage/irrigation machinery	42,511,447	61.7	370.18	46.7
02a	Spare parts	891,467	19.0	209.83	26.9
03	Tractors and tractor trucks	69,941	12.0	92.24	31.2
03a	Spare parts of tractors an trucks	7,737,5778t	6.3	107.28	-5.5
04	Diesel engine generator sets & spare parts	25,974,709	69.6	325.08	148.1
05	Harvesting machinery & spare parts	36,755,697	51.8	192.95	119.9
06	Plant protection mach. & spare parts	13,463,148	66.9	27.86	17.6
07	Attached implements and spare parts	34,642,030	14.8	57.29	50.8
08	Poultry breeding mach. & spare parts	10,853,729	22.6	51.28	48.9
09	Farm vehicles and trailers	21,126	66.5	61.46	81.1
10	Grain processing mach. & spare parts	8,695,005	25.2	41.36	33.5
11	Milk processing mach. & spare parts	837,942	53.3	10.19	7.3
12	Other agricultural machinery	2,801,334	27.6	11.31	9.1

Table 6 - Market for exports and imports of agricultural machinery in 2003.

Countries & regions	Exports				Imports			
	No.	Mil. US$	Var. %	Accounted for %	No.	Mil. US$	Var. %	Accounted for %
Total	**185**	**2131**	**41.20**	**100.00**	**82**	**4219.0**	**44.80**	**100**
Asia	***40***	***994.00***	***28.14***	***46.63***	***22***	***1662.0***	***19.32***	***39.40***
In which:								
Japan		148.04	29.61			1176.0	46.84	
Korea		36.49	21.95			285.0	115.66	
Africa	***51***	***203.00***	***86.58***	***9.54***	***20***	***8.0***	***563.933***	***0.19***
Europe	***42***	***336.00***	***44.68***	***15.77***	***31***	***1914.0***	***46.47***	***45.36***
In which:								
France		17.36	-6.08			181.0	200.42	
UK		53.90	108.02			186.0	0.12	
Germany		86.26	36.42			1066.0	58.31	
Italy		48.77	96.44			93.46	45.38	
S. America	***36***	***58.00***	***49.45***	***2.73***	***5***	***123.0***	***46.02***	***2.91***
N. America	***3***	***469.00***	***51.07***	***22.00***	***2***	***497.0***	***25.22***	***11.77***
In which:								
USA		434.63	49.55			444.0	20.66	
Pacific	***13***	***43.00***	***50.35***	***2.01***	***2***	***2.0***	***30.48***	***0.05***

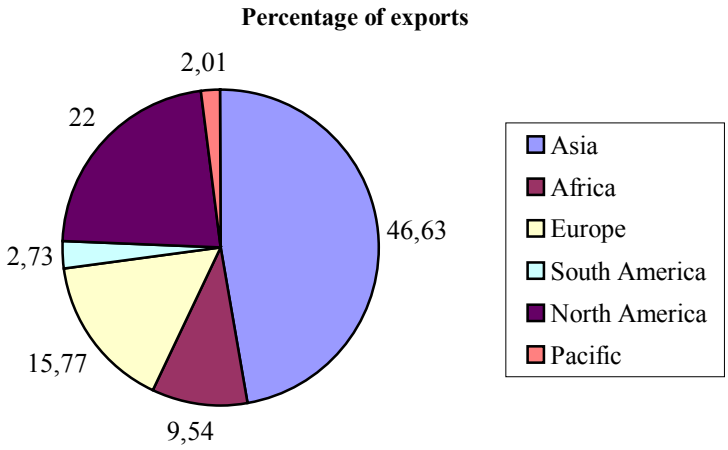

Fig. 7 - Percentage subdivision of exports of agri machinery in 2003.

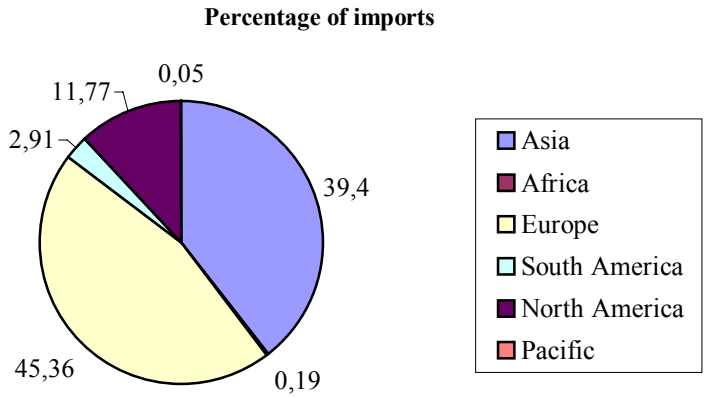

Fig. 8 - Percentage subdivision of imports of agri machinery in 2003.

Table 7 - Projects of introduction of foreign manufacturing technologies for farm machinery (1978-1986).

No.	*Projects*	Chinese Co	Main imported contents	Forms	Foreign Country	Foreign Co	Date of contract
01	Tractor DFH-54	First Tractor W*	Manufact. technology & equipment	Licence	USSR		
02	Large & medium-sized tractors	Shenyang, Tianjin & Changchun T W.**	Same as above	Licence	USA	John Deere	12/09/83
03	Medium-sized 4 wheel tractors	First & Shanghai Tractor Co	Manufact. techn of chassis and necessary equipment	*Licence*	*Italy*	*Fiat*	07/06/86
04	Forestry tractor model 518	Harbin Tractor Works	Same as above	Licence	USA	Caterpillar	29/12/86
05	Deutz tractors	Shandong Tract. Co	Design & manufacturing technology & documents	Licence	Germany	DEUTZ	09/06/86
06	*Small-sized tractors*	*Xingtai Tractor Fact*	Manufact. technology	*Licence*	Italy	Goldoni	31/10/84
07	Internal combustion engine (1st project)	Shanghai Int. Com. Eng. Research Inst.	Design & training	Consulting	Britain	Ricardo	18/11/78
08	95 series diesel	Weifang Machinery W	Design drawings	Consulting	Britain	Ricardo	19/03/79
09	engines	Shanghai Int. Com.	Improvement	Consulting	Britain	Ricardo	13/11/80
10	Internal combustion engine (2nd project)	Eng. Research Inst. Same as above	Technical know-how & documents	Consulting	Britain	Ricardo	10/03/82
11	Internal combustion engine (3rd project)	Beinei Engine Co	Improvement of design	Consulting	Britain	Ricardo	07/11/83
12	492Q gasoline engine	First Tractor Works	Same as above	Consulting	Britain	Ricardo	16/10/82
13	100 series diesel engine	Shanghai Int. Com. Eng. Research Inst.	Technical documents	Consulting	Britain	Ricardo	30/07/84
14	**I**nternal combustion	Same as above	Improvement	Consulting	Britain	Ricardo	31/10/84
15	engine (4th project)	Beinei Engine Co	Improvement	Consulting	Japan		09/84
16	490 diesel engine 4115 diesel engine B495Q diesel engine	Shanghai Int. Com. Eng. Co	Improvement of direct injection	Consulting	Austria	Lister	23/03/85

W* = Works TW** = Tractor Works

2 Co-operation

China started to set up foreign-funded ventures of agricultural machinery in 1984. But real joint ventures of agricultural machinery were set up after 1990.

Recently, there are more than 10 foreign-funded agricultural machinery ventures in China (**tab. 8**). More and more foreign farm machinery companies have recognized also that it is not only way to directly sell their farm machine in the Chinese market, because the difficulties and problems, especially the prices of imported farm machines are very high and the purchasing ability of farmers in China is still lower at present. They have understood that co-operation with Chinese manufacturers to cut the selling prices, using the lower costs of Chinese labourers it is a good way to produce their farm machines in China.

Chinese manufacturer are also interested in co-operation with foreign farm machinery companies to produce advanced farm machines in China and to improve the technical performance, quality and reliability and management system.

Foreign-funded agricultural machinery ventures are the important part of China's agricultural machinery industry.

There are some forms of co-operation:

(1) Joint ventures;
(2) Wholly foreign-funded ventures;
(3) SKD or CKD;
(4) OEM.

Finally, I want to stress that foreign farm machinery companies have advantages of high technologies, but their products must satisfy the practical needs of Chinese users, including the market selling prices. China is a big potential market for foreign agricultural machinery companies. There are bright prospects for international co-operation in China.

Table 8 - Foreign-invested agri machinery enterprises in China (1994-2004).

No.	Date of establishment	Name of ventures	Major products	Chinese partner	Foreign partner	Total investment (mil.US$)	Foreign partner accounted for %
01	Sep.1994	Yarman (China) Agricultural Machinery Co Ltd	Rice combines		Yarman Farm Machinery Co	30.0	100%
02	May 12, 1997	Deere-Jiamusi Combine Harvester Co.Ltd	Combine Harvesters	Jiamusi Combine Factory	John Deere Co	29.9	60%
03	Sep. 8, 1998	Kubota (Suzhou) Agricult. Machinery Co	Rice combines		Kubota Farm Machinery Co		100%
04	Mar. 18, 1999	Harbin-New Holland Beidahuang Tractor Co Lts	Tractors (100-180 Hp)		New Holland		70%
05	Aug. 8, 2000	Deere-Tianjin Tractor Co Ltd	Tractors (80-130 Hp)	Tianjin Tractor Plant	John Deere		51%
06	Apr. 9, 2001	Shanghai-New Holland Farm Machinery Co Ltd	Tractors (100 Hp & less)	Shanghai Tractor Co	New Holland	75.8	60%
07	Dec. 5, 2001		Tractors (80-120 Hp)	First Tractor Co Ltd	Valtra		
08	June 2004	Iseki Farm Machinery (Changzhou) Co Ltd	Rice combines Transplanters		Japanese Iseki Farm Mach. Co	US$ 4.2	100%
09			Grain driers		Jap. Kaneko Farm Mach Co		
10					Korean		

DISCUSSION SESSION 1

The following Club Members participated at the discussion:
(*in alphabetical order*)

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