Agricultural Mechanization Status and Context in China

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UNAPCAEM and FAO Join Roundtable on Sustainable Agricultural Mechanization in Asia, Bankok, Thailand, 2011

Brief

Agricultural Mechanization in China?

◆ Development of Agricultural Mechanization in China was ever very bad, and is now very quickly; argued whether China need Mechanization, now stop such argument;

◆ Talking and worrying about on which way we should develop AM, and how to make Mechanization more efficiency.
Brief

SAMS ? (practically)

Main part of sustainable agriculture = CA

Then:
Main SAMS = CA Mechanization

◆ CA developed quickly, but still meet many problems
Two parts

Part 1
Agricultural Mechanization in China

Part 2
Sustainable Agricultural Mechanization in China (Mechanized CA)

AM in China
Government

- Ministry of AM: before 1990s
- Department of AM, MOA: after 1990s

<table>
<thead>
<tr>
<th>Level</th>
<th>Government</th>
<th>University/School</th>
<th>Research institute</th>
<th>Test station</th>
<th>Extension station</th>
</tr>
</thead>
<tbody>
<tr>
<td>Country</td>
<td>Department of AM, MOA</td>
<td>CAU</td>
<td>CAAMS</td>
<td>Test station</td>
<td>Extension station</td>
</tr>
<tr>
<td>Province</td>
<td>Bureau of AM</td>
<td>Provincial AU</td>
<td>Provincial institute</td>
<td>Provincial test station</td>
<td>Provincial extension station</td>
</tr>
<tr>
<td>County</td>
<td>Bureau of AM</td>
<td>Some: School</td>
<td>Some: institute</td>
<td>Few</td>
<td>Extension station</td>
</tr>
<tr>
<td>Town</td>
<td>AM technician</td>
<td>Some: Farmer school</td>
<td></td>
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</tbody>
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Development History

(一) 起步阶段 (1949~1980年)
Starting Stage (1949-1980)

1. 行政推动
   Administrative promotion

2. 国家投入
   Government input

3. 快速发展
   Rapid development
(二) 体制转换阶段(1981~1995年)
System-transforming stage (1981-1995)

1. 调整发展战略方针
   Strategies and policies of development were adjusted

2. 改革农机所有制
   Ownership system of agricultural implements was reformed.

3. 小型农机具快速增长
   Increased availability of small agricultural implements.

(三) 市场导向阶段(1996~2003年)

1. 农机跨区作业迅速发展
   Rapid development of Cross-region cooperation and sharing of agricultural machinery.

2. 农机社会化服务领域扩大
   Socialized services of agricultural machinery were expanded

3. 国家多方面扶持农业机械化
   Agricultural mechanization was supported by the State through various means
Achievements of AM in China

1. **Agricultural Mechanization Promotion Law** was carried out.

2. **Farming machinery purchase subsidy policy**

3. Agricultural mechanization processes are guided by the concept of scientific development.
The Gross of AM Improved Significantly

The total mechanical power of agricultural machinery (×10^8 kW)

1.2 2.7 4.5 8.75

The total mechanical power of agricultural machinery (×10^8 kW)

193 683 1195 2101

Tractor (× 10^4 sets)
The Gross of AM Improved Significantly

- **Combine harvester (×10⁴)**
  - 1978: 1.9
  - 1988: 3.5
  - 1998: 18.26
  - 2009: 85.84

Rapid growth

The Level of AM Improved

- **Mechanical harvesting**
  - 1978: 5.37%
  - 1988: 11.6%
  - 1998: 24.67%
  - 2009: 63.06%

- **Mechanical sowing**
  - 1978: 8.8%
  - 1988: 24.67%
  - 1998: 41.03%
  - 2009: 65.99%

- **Mechanical plowing**
  - 1978: 15.07%
  - 1988: 40.9%
  - 1998: 46.69%
  - 2009: 65.99%
• 小麦 wheat: Mechanization >85%。
• 玉米 corn: Sowing >75%。
  Harvesting >25%。
• 水稻 Rice: Sowing >20%。
  Harvesting >60%。

The Production Capacity Enhanced

农机工业产值：2009年是1980年的32倍。
Gross industrial output in 2009 was 32 times higher than 1980.
• International AM companies from North America, South America, Europe, Asia entered China market
Socialized Service Organizations Expanded

- Large Farm Owners (Crop)
- Mechanization cooperatives
- Agricultural Mechanization Associations
- Big farmer (Fish, animal)
- Big farmer (using various agricultural machinery)
- Agricultural Mechanization corporations

Mechanization service organizations

Law of the Peoples Republic of China on Promotion of Agricultural Mechanization was carried out from November 1, 2004.

Polices

- 科研开发
  Scientific research
- 质量保障
  Quality Assurance
- 推广使用
  Technology dissemination
- 社会化服务
  Social service
WHY AM SO FAST IN CHINA?

Four Wheels Driven

1、Labor 劳动力
2、Benefit 农机作业服务利益驱动
3、Technical Progress 工业技术进步
4、Policy 政策的推动

Future

Rapid Speed of Development

High efficiency and quality

Widen Field

Development Trends

Farm machinery and agronomy is consistently harmonizing
High-power? multi-purpose

High-tech, intelligence, precision

Future demand

A resource-conserving and environmental friendly: CA

Cash crops
288 hp
CA in China

16-20cm
8-10cm

Hard Pan

Stubble Burning
Runoff

Wind Erosion/Dust Storm
Fuel consumption: 21 million tractors, 0.86 million harvesters. Fuel?

Example: 120 million ha farm land; averagely 60 L diesel/ha for plowing. So, only plowing needs 7200 million L diesel !!!!!!!

Problems from None CA

- Soil degradation
- Water Erosion
- Wind Erosion
- Greenhouse Gas
- High input
- Stubble Burning
- Decline of Underground Water Level
- Too much fuel consumption
- Hard Pan
- ..............................
5 Zones

North East

Black Soil Degradation

In the past, Common: >30cm:

Now:
About 25%: 20-30cm
About 12%: <20cm
About 3%: lost all black soil

SOM go down
North West

No farming without irrigation:

Agro Pastoral Zone

Strong wind, dry, degraded soil

In Hailaer, Before using CA, Spring, some young rape seedling are killed by erosion; after CA, nearly none was killed
Loess Plateau

Erosion, Yellow River Drought of 10 years.

Two Crops Area

With Less than 600mm rain, to grow 2 crops a year.

Too much irrigation, make ground water level go down quickly, 1 m/year in somewhere

To catch time for sowing, have to burn stubble

Too much input
Two Crops Area

Underground Funnel
1m/year
Deep Well

Development of CT in China

Try No Tillage
Application in Paddy Area
Experiment of CT
MOA Extend CT
Beijing Planned to Cover all with CT
10 years
National Plan of CT Approved
10 years

www.unapcaem.org
Development of CT in China

CA and No Till seeders are included in Annual Report of Agricultural Mechanization by MOA
Introduction of CTRC

Who is CTRC?

• Only and leading organization on CT/CA in China
• Main support to MOA and all provinces on CT/CA
Tasks

- Yields
- Cost
- Others
- Wind erosion
- Water erosion
- Soil moisture
- Weeds control
- GHG Emission

Machine Development
Conservation Agriculture

Series No/minimum till Seeders

- Hand Seeder

Only about US$25
◆ Seeder for 2 wheels tractor

◆ Seeders for 4 wheels tractors without driven anti-blockage system
Seeders for 4 wheels tractors with driven anti-blockage system

Started from 1997, 1 Ph.D student graduated in 2001

1. Prove the benefits of CA in China

- 1960s, no-till study in China. 20 years, fail
- 1991, restart with Conservation tillage (CT), succeed. Used in most Northern China provinces.
- The first CA field still exist, No.1 in China
2. Prove the impact of CA on wind erosion controlling
3. Prove the impact of CA on Water erosion controlling

Rainfall simulating

Runoff Measurement
4. CO2 Flux

Double Cropping Area

Single cropping area

North of China

Study Sites

www.unapcsem.org
5. Controlled Traffic/PRB

- Save fuel
- Save Water
• Three Times of National Science and Technology Progress Award

• More than 60 patents

• More than 100 papers

Sustainable Agricultural Mechanization?

What Can Agri Mech make sustainable?

To agricultural machines:
  increase efficiency, reduce machines number, reduce fuel consumption;
  increase technology, reduce operations, reduce lower tech machines;

To agriculture and soil:
  reduce soil disturbance and hard pan;
  reduce move out of stubble;
  reduce use of resources;
  reduce use of chemicals;

Yields: must be increased in Asia!!!!

That’s mechanised CA !!!!!
Constraints?

• AM: efficiency with small land? The way for development............
• CA: 10 years ago, constrains were: few persons accepted. Present constraints are: firstly, lack of economic al well operated no till seeders; then, traditional idea of plowing even CA has been widely known.............

Thanks

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