



中國農業大學
China Agricultural University



Conservation Agriculture (CA) Machines

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China Conservation Tillage Network

<http://www.cn-ct.net>

最新会议

▶ 亚洲保护性耕作政策与战略构思专家研讨会在京召开

2013年11月20日，亚洲保护性耕作政策与战略构思专家研讨会在京召开，欢迎报名参加。……

注册参加会议

参会人员登录/投递摘要



示范应用

▶ 保护性耕作面积与免耕播种机使用量逐年变化趋势图

▶ 成本和收益的逐年对比图

重要新闻



新疆博乐市保护性耕作工作推进会顺利召开

2019年10月13日，由博乐市人民政府组织的保护性耕作工作推进会在博乐市以西粮食主产区顺利召开。推进会向博尔塔拉蒙古自治州粮食主产区农业、农机、粮农展示了玉米免耕精量播种与水肥 [\[查看详情\]](#)

- ▶ 我校主办黑土地保护重大科技行动研讨会 2019-10-22
- ▶ 新疆博乐市保护性耕作工作推进会顺利召开 2019-10-14
- ▶ 内蒙古黑土地保护性耕作技术论坛 在乌兰浩特成功举办 2019-10-13
- ▶ 中国农业机械化协会保护性耕作专业委员会筹备会成功举行 2019-09-26
- ▶ 农业部办公厅关于印发《保护性耕作项目实施规范》《保护性耕作关键 2019-09-02
- ▶ 一场黑土地上的耕作革命——东北黑土地保护高端论坛侧记|观察 2019-08-26
- ▶ 胡春华强调：加快推广东北黑土地保护有效治理模式 2019-08-24
- ▶ 秸秆还田PK秸秆打捆，谁赢？农业农村部给出权威数据！ 2019-07-23
- ▶ 保耕一周行|德邦大为（佳木斯）公司之行 2019-07-20
- ▶ 保耕一周行|青岛市莱西和平度保护性耕作地块之行 2019-07-20
- ▶ 保耕一周行|河北农哈哈有限公司之行 2019-07-20

Email

密码

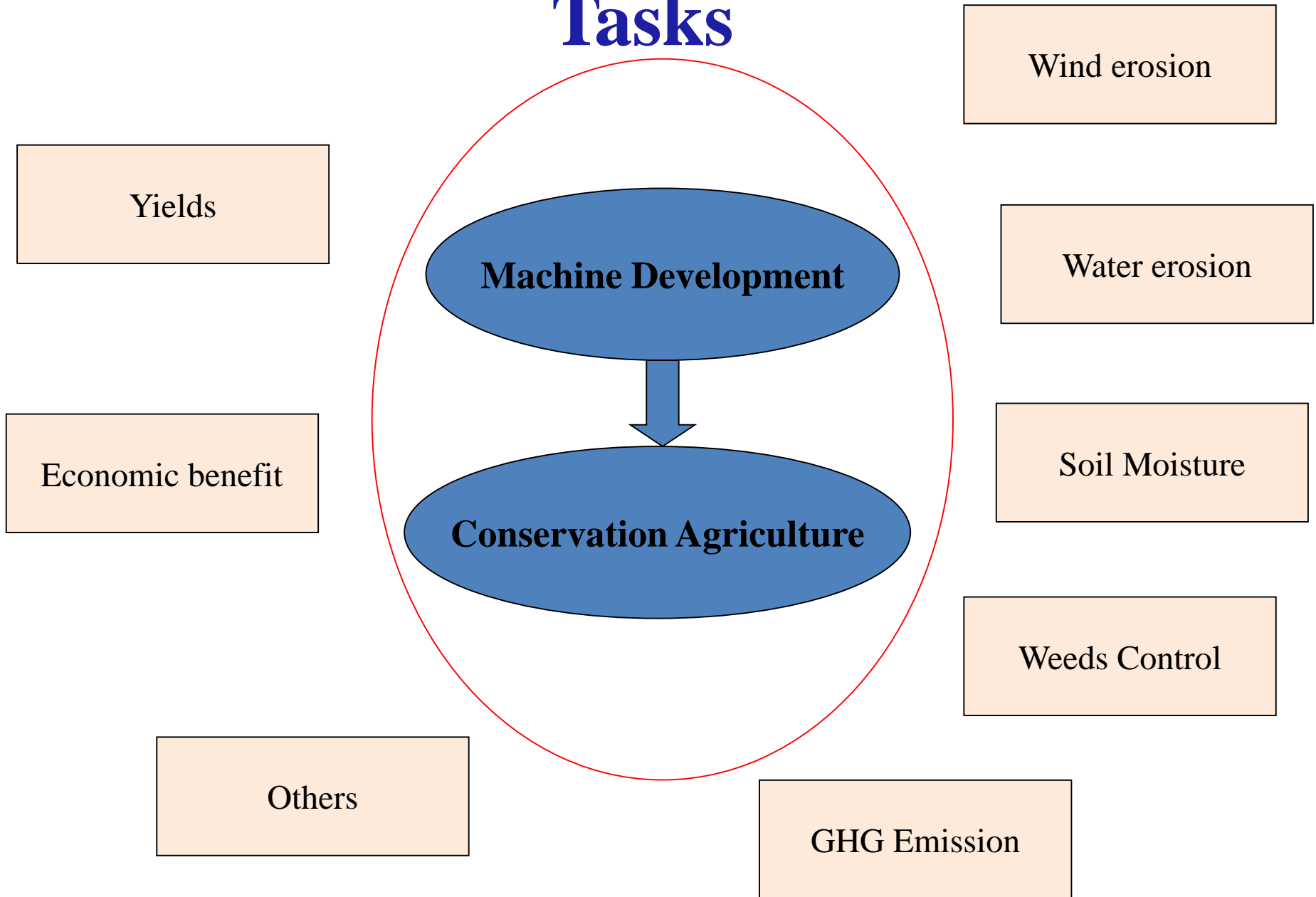
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注册

友情链接



Tasks





Main Principles of CA

1



Minimum tillage and soil disturbance

2



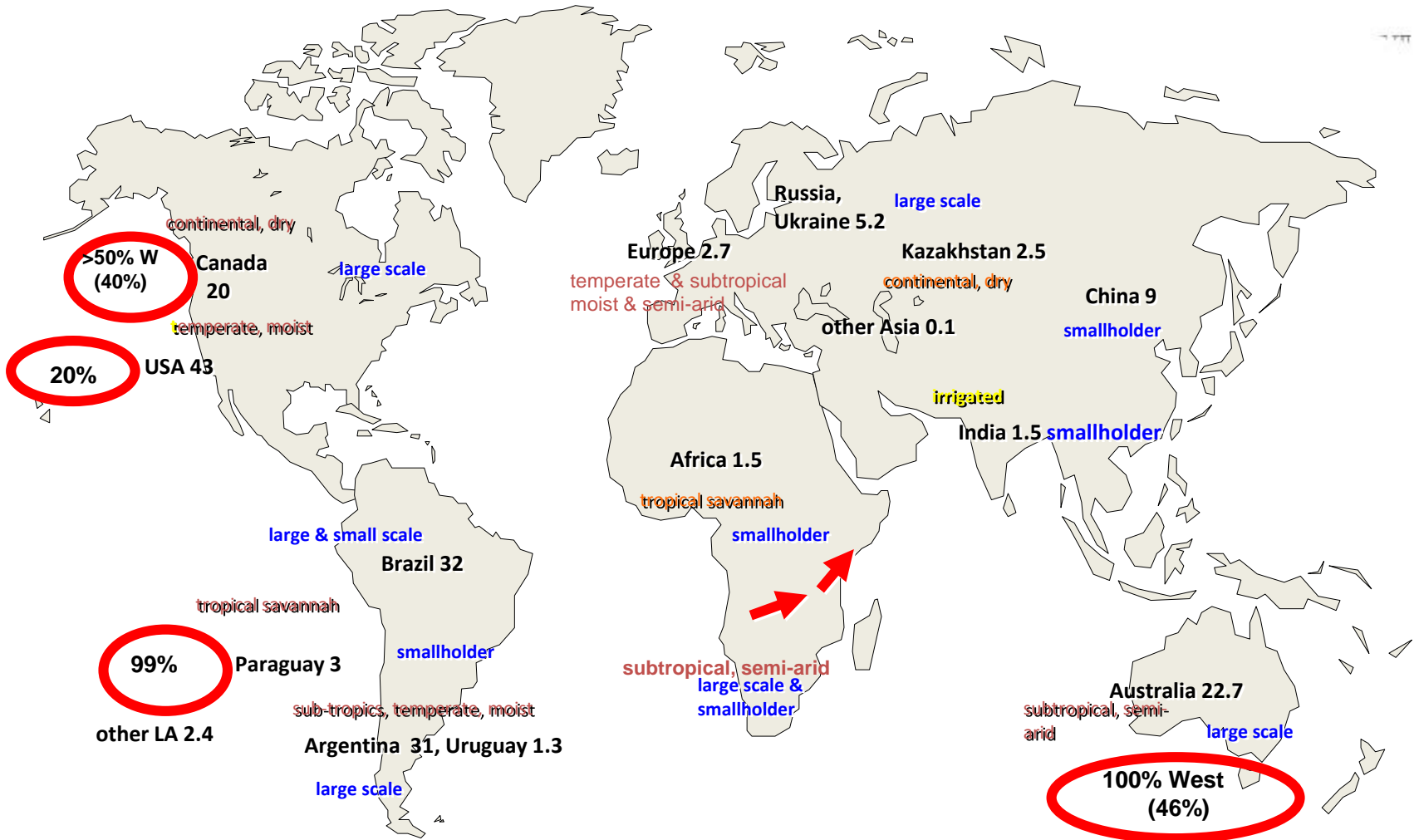
Permanent soil cover with crop residues and live mulches

3



Crop rotation and intercropping

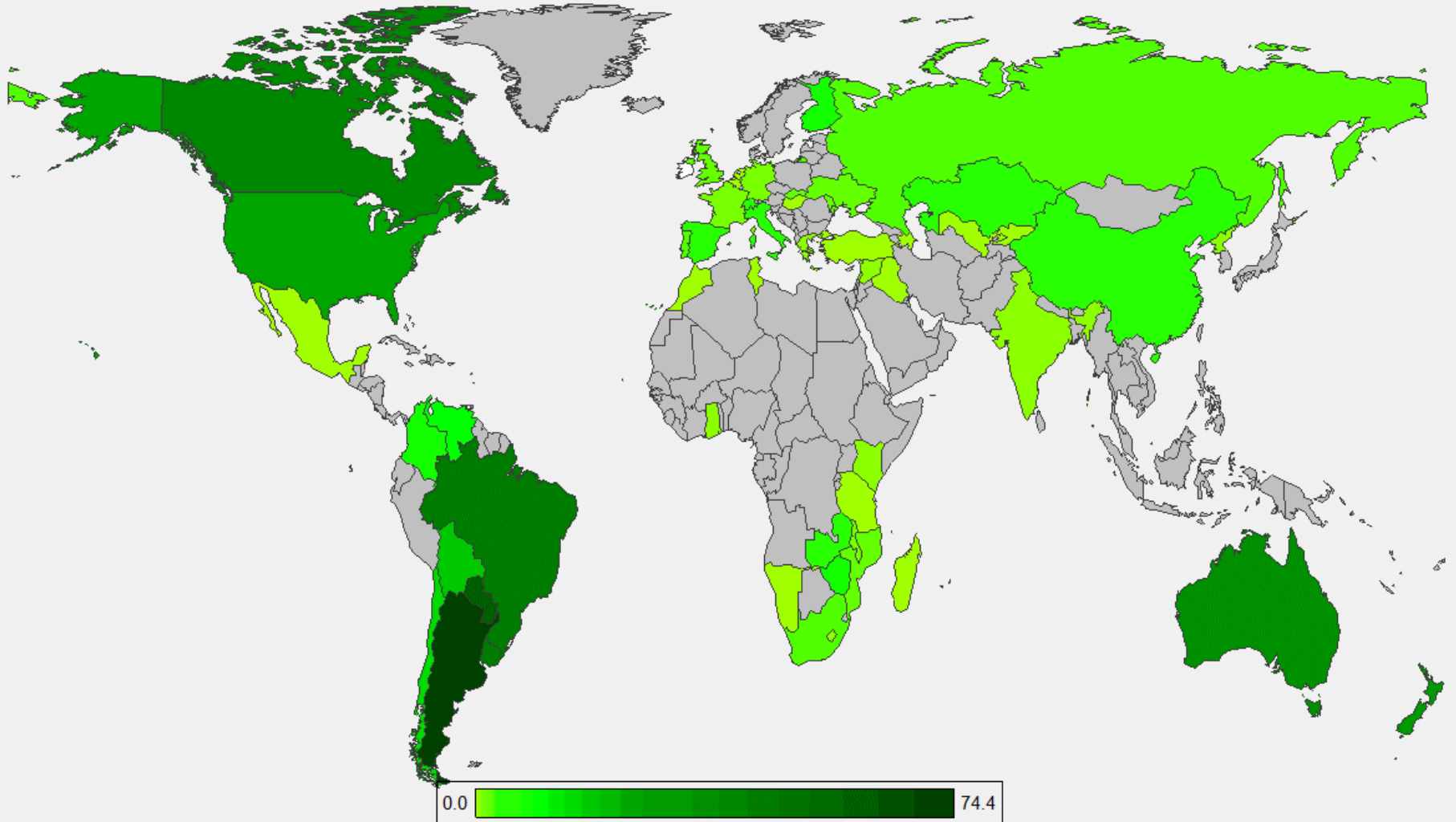
CA globally 180 Million ha (2015/16) (12.5% of annual cropland)



Distribution of CA area



中國農業大學
China Agricultural University



Source: FAO

China (2017)



中國農業大學
China Agricultural University

Total area of crop land	149 Mha
Conservation agriculture (CA):	7.6 Mha
Percentage of CA	5.1%

ARTICLE



Global spread of Conservation Agriculture

A. Kassam^a, T. Friedrich^b and R. Derpsch^c

^aSchool of Agriculture, Policy and Development, University of Reading, UK; ^bFood and Agriculture Organization (FAO) of the United Nations, La Paz, Bolivia; ^cInternational Consultant for Conservation Agriculture/No-till, Asunción, Paraguay

ABSTRACT

Conservation Agriculture (CA) comprises the practical application of three interlinked principles, namely: no or minimum mechanical soil disturbance, biomass mulch soil cover and crop species diversification, in conjunction with other complementary good agricultural practices of integrated crop and production management. In 2015/16, CA was practised globally on about 180 M ha of cropland, corresponding to about 12.5% of the total global cropland. In 2008/09, the spread of CA was reported to be about 106 M ha. This change constitutes an increase of some 69% globally since 2008/09. In 2015/16, CA adoption was reported by 78 countries, an increase in adoption by 42 more countries since 2008/09, respectively. The average annual rate of global expansion of CA cropland area since 2008/2009 has been some 10.5 M ha. The largest extents of adoption are in South and North America, followed by Australia and New Zealand, Asia, Russia and Ukraine, Europe and Africa.

KEYWORDS

No-till; mulch; crop diversification; sustainability; adoption; policy



• Benefits

- Increase crop yields
- Decrease production cost
- Improve soil property
- Reduce soil erosion (water/wind)
-



Avoid straw burning



Improve soil property



Dust and run-off reduction





Machine is the key
for large area adoption
of CA

CA machines

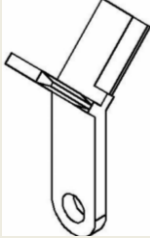
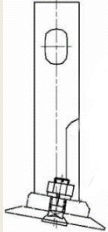
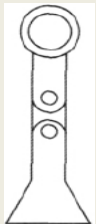
- ◆ **Straw chopping machine**
- ◆ **Reduced tillage machine**
- ◆ **No/minimum-tillage seeder**

1.1 The chopping blade



Type	Figure	Description	Advantage	Disadvantage
Hammer		Suit for hard crop straw (maize, cotton); usually made of high strength and wear-resistant cast steel	Good chopping quality; long operating life	High fuel consumption
Straight		Suit for soft crop straw (wheat, rice); usually work with stationary blade; sharp cutting edge	Good chopping quality; low fuel consumption	Poor pick up ability
Bent		Suit for hard crop straw (maize, sorghum); blade shape is usually L or Y type;	Good pick up ability; low fuel consumption	Low blade strength
V-L		Suit for maize; a V-bending section is added on L shaped blade; barycenter locates in the same plane with blade handle	Good chopping quality; high work efficiency	Complex shape; high machining requirements

1.1 The chopping blade

Type	Figure	Description	Advantage	Disadvantage
Y		Suit for hard crop straw (maize, sorghum); Similar to Y type blade; barycenter locates on symmetric line of blade	Good symmetry of the shape; big inertia moment	Short edge line; large mass
T		Suit for maize; chopping straw and shredding stubble simultaneously; three parts of blade fixed together	More cutting edge; big inertia moment	Complex structure; inconvenient installation
Three-section linked		Suit for maize and wheat; Chopping straw and shredding stubble simultaneously; three parts of blade hinged together	Good chopping quality; high work efficiency	High working resistance; short operating life



1.2 The chopping machine



Powered by tractor



Powered by harvester

Features:

- ◆ High speed rotation of knife: 2000r/min;
- ◆ Straw was cut, teared and rubbed to segments or fibers
- ◆ The chopped straw is spread to the field by the airflow and centrifugal force
- ◆

CA machines

- ◆ **Straw chopping machine**
- ◆ **Reduced tillage machine**
- ◆ **No/minimum-tillage seeder**

2. Reduced tillage machine



2.1 Subsoiler

2.2 Shallow tillage machine

2.3 Strip tillage machine

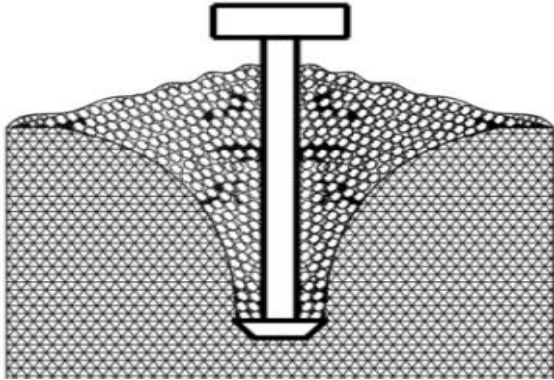
2.1 Subsoiler



Classification :

1. Chisel subsoiler
2. Omni-directional subsoiler
3. Vibrating subsoiler

1. Chisel subsoiler



Features:

- ◆ Shank compressed, lifted and cut soil
- ◆ Subsoiling depth: 30~50cm
- ◆ Shank spacing: 40~80cm
- ◆ Simple
- ◆

1. Chisel subsoiler

Chisel with wing subsoiler



Features:

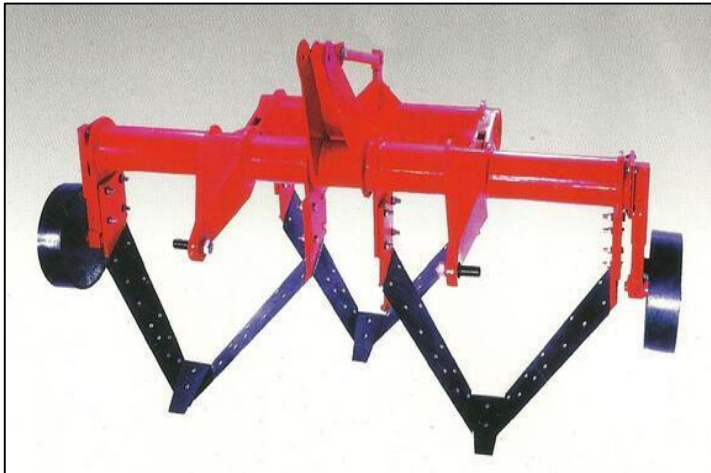
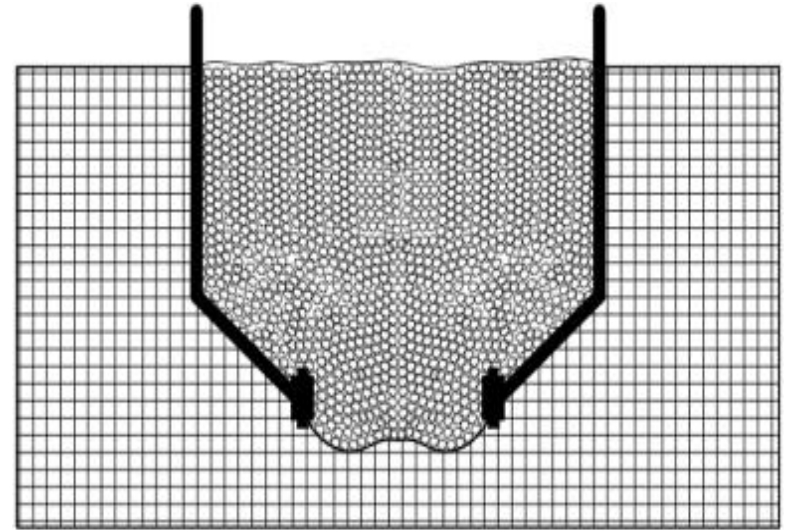
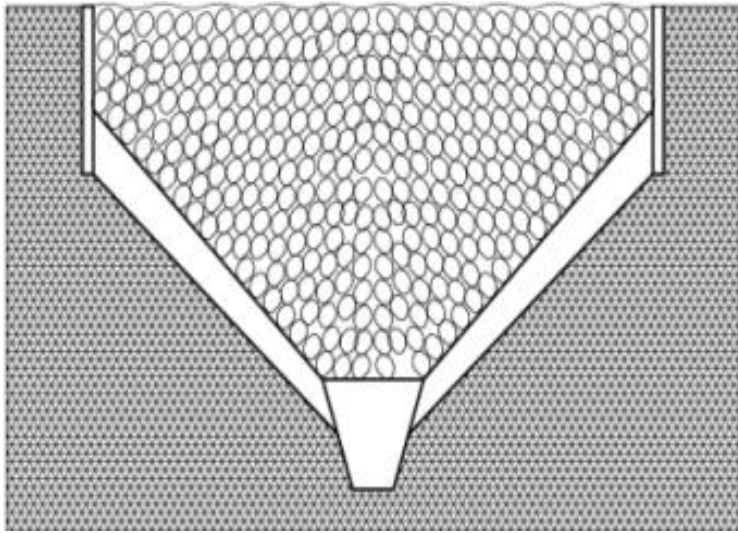
- ◆ Increase loosening range
- ◆ Higher loosening soil coefficient
- ◆



Disadvantages:

- ◆ Increase power consumption

2. Omni-directional subsoiler



V-type



Side bended type

2. Omni-directional subsoiler



Features:

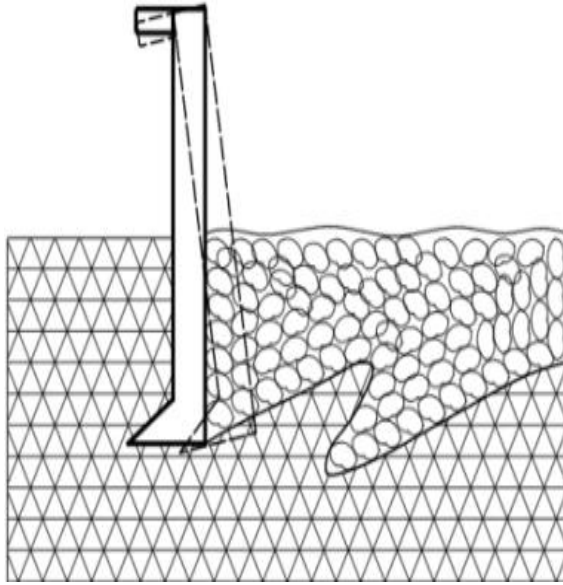
- ◆ Soil loosening coefficient: ≥ 0.77
- ◆ Wider loosening range
- ◆ Flat soil surface after subsoiling (with roller)
- ◆



Disadvantages:

- ◆ Higher power consumption
- ◆ Poor passibility when straw mulching and much weed in the soil
- ◆ Unsuitable in intertillage stage

3. Vibrating subsoiler



Classification

- ◆ Self-excited vibrating subsoiler
- ◆ Forced-excited vibrating subsoiler

Chisel subsoiler



excitation source



vibrating subsoiling

Omni-directional subsoiler

Reduce traction resistance by 6.9-17%

3.1 Self-excited vibrating subsoiler



Excitation source of **spring**



Excitation source of **hydraulic**

3.2 Forced-excited vibrating subsoiler



Features:

- ◆ Significantly reduce traction resistance
- ◆ Power excitation source form tractor

Main Composition:

Eccentric shaft, eccentric bearing, cross connector, connecting plate and supporting rotating shaft



Disadvantages:

- ◆ Higher power consumption
- ◆ Effect the life of subsoiler
- ◆ Partly compressed broken soil by vibration

2.2 Shallow Tillage machine



Main Structure:

Multi-beam structure, chisel/shovel spring tooth harrow or shallow tillage shovel

Working depth: 5-10 cm



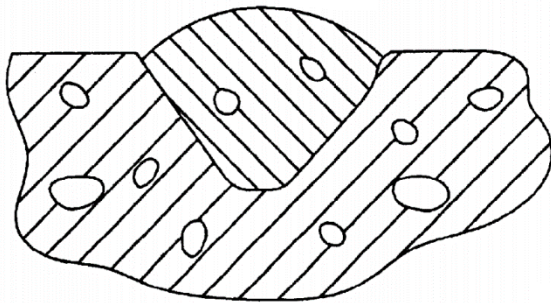
Function:

- Loosens and flat surface soil to obtain a better seedbed and reduce ditch resistance
- Adjustment of surface straw coverage
- Better weeding function

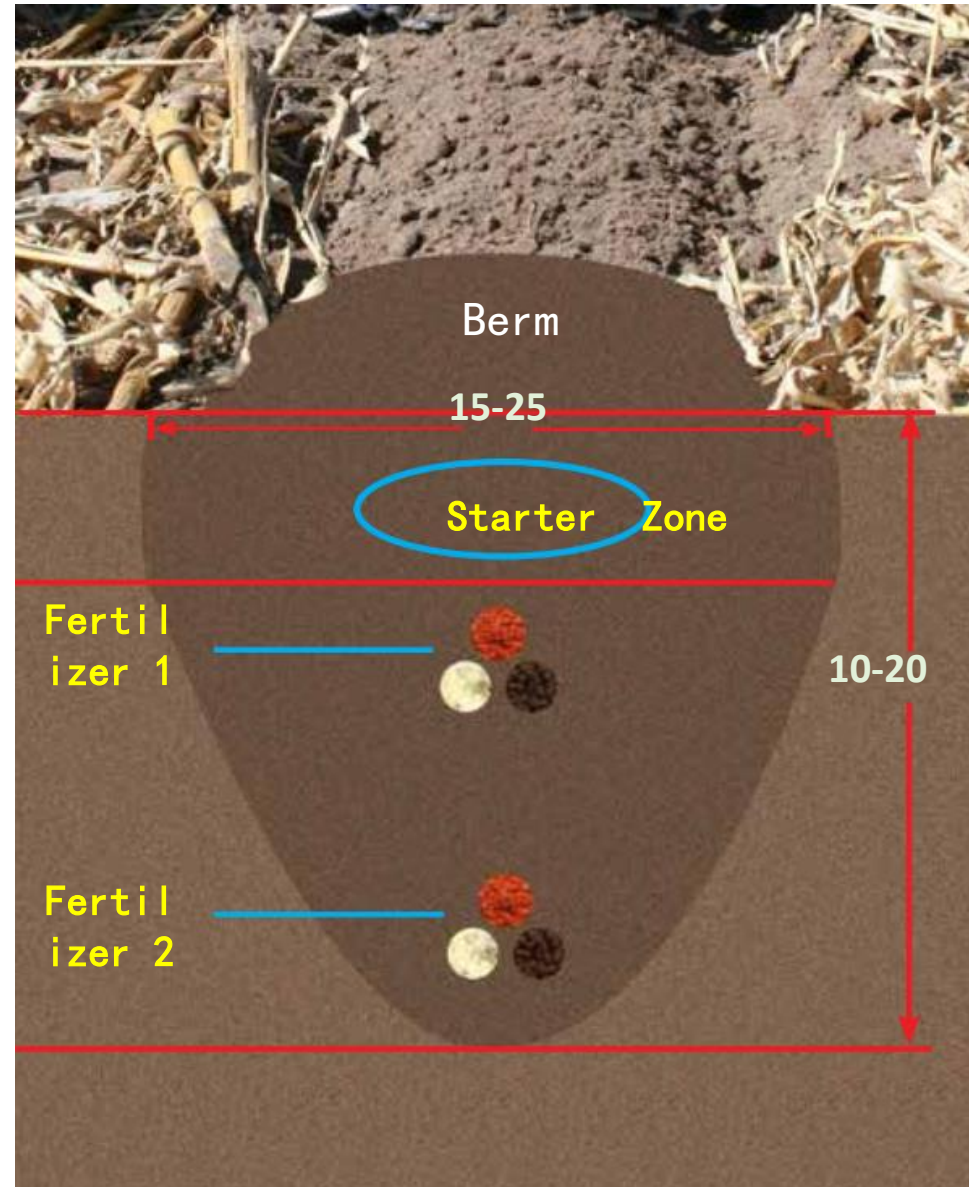


2.3 Strip Tillage machine

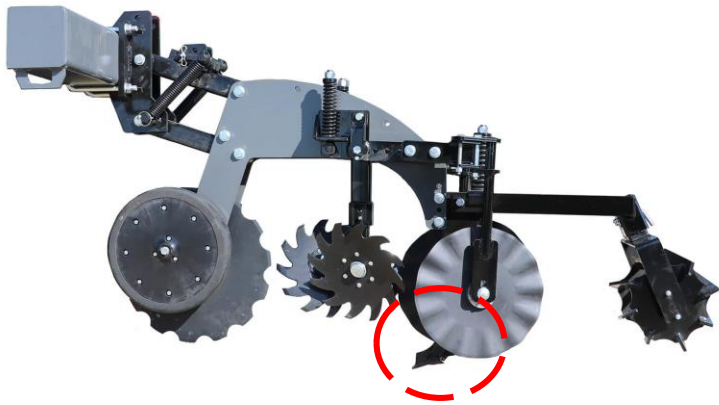
- Only tillage in seed row
- 20-50% soil was distributed
- Tillage width :15-25cm;
- Tillage depth :10-20cm;
- No-till in row space and straw mulching
- Fertilization in seed row



Surface shape after tillage



Classification of strip tillage machine

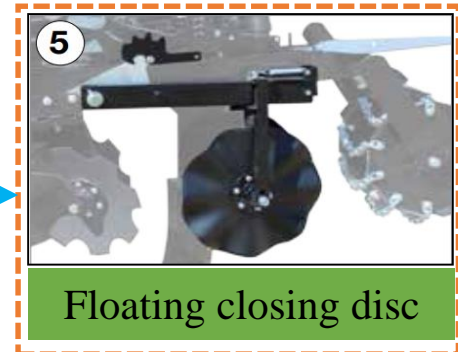
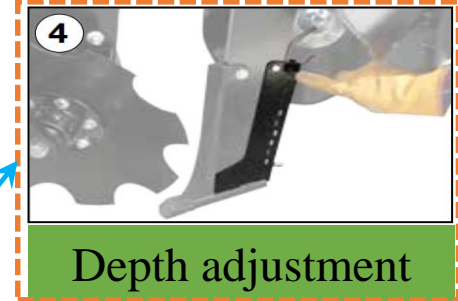
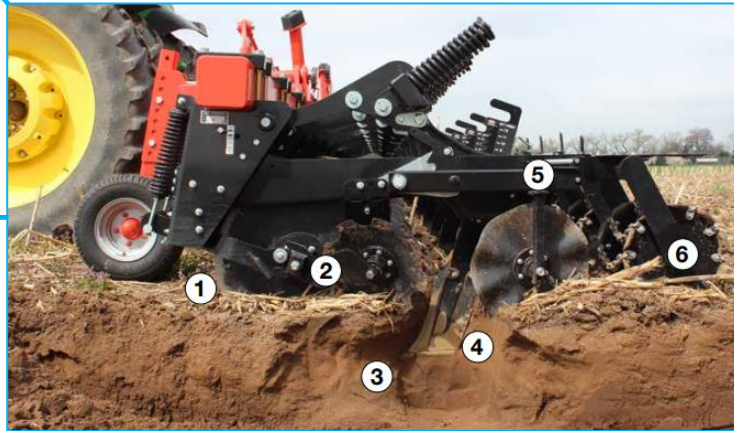


Chisel shovel type

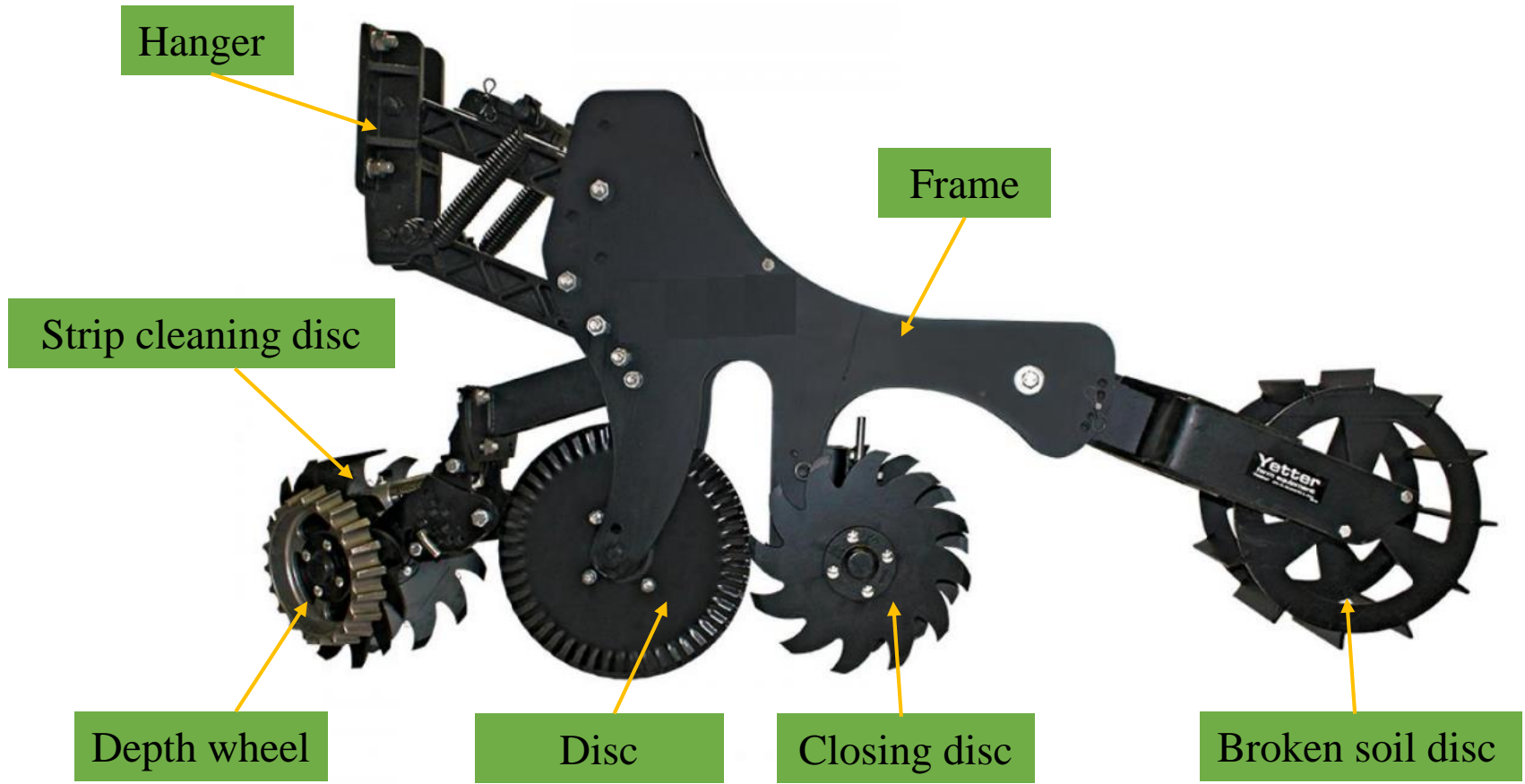


Disc type

Chisel shovel type



Disc type



CA machines

- ◆ **Straw chopping machine**
- ◆ **Reduced tillage machine**
- ◆ **No/minimum-tillage seeder**

No-till seeding condition



**No-till, heavy residues cover, uneven.
Great challenge !!**

Key technology for no-till seeder



Residue
Handling

Three main principles of residue handling for no-till seeder

1. Residue **slips** from Tine Opener
2. Residue **cut** by Disc whose line speed equals to tractor
3. Residues are moved, picked up, chopped by highly moving components which are **driven** by PTO

Type 1

Residue slips from Tine Opener

- **High**
- **Wide**
- **Simple**
-



High-clearance

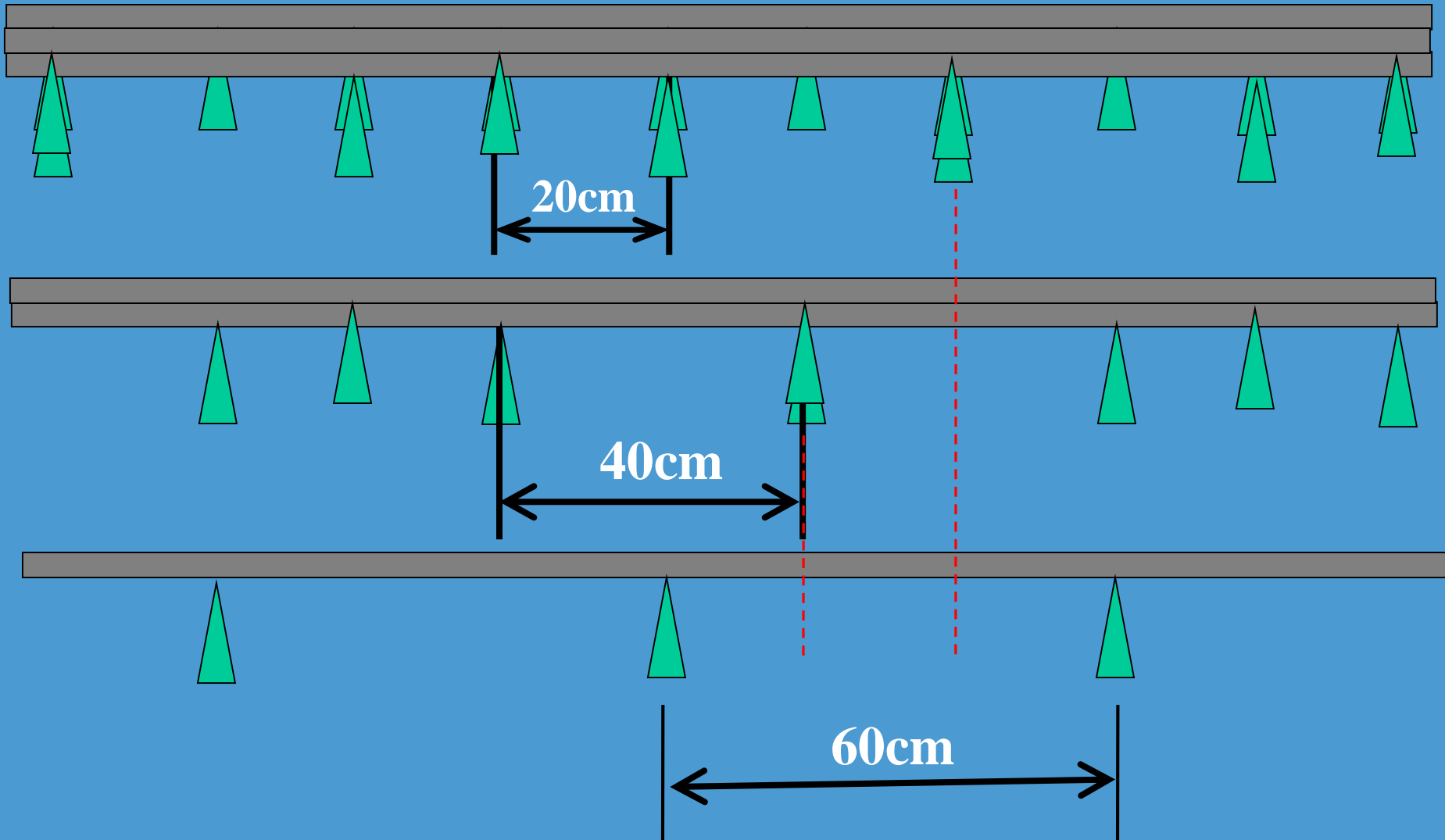


Traditional
Seeder

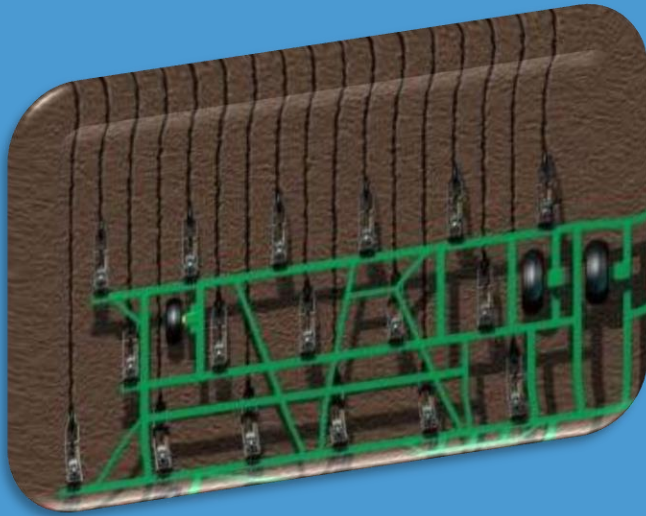


No-Till Seeder

Wider row space



Wider row space



Wider row space



Simpler ground components



Additional components to push away residues



Avoiding residues rows ---by Guiding System



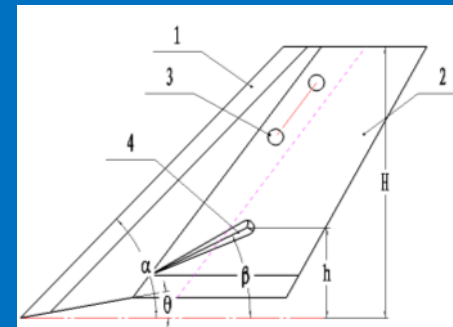
By experience

Chinese Beidou Navigation System



Some words to these seeders

- It is easy for Tine Opener to open furrow;
- Also easy for Tine Opener to become stubble collector, then blocked.
- A little bit more soil disturbance as compared to Disc Opener



Problems? Blockage



Type 2

Residue cut by Disc Opener



High Speed, Cut residues by machine weight

Speed and Force







China Made No-Till Seeders

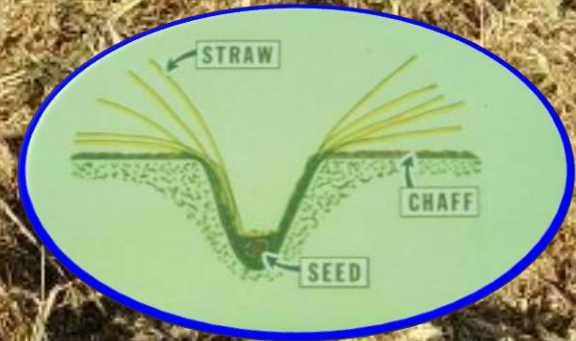


Some words to these seeders

- Soil disturbance is lowest, it is even difficult to find the furrow after sowing
- Need heavy weight to give enough pressure to disc;
- Need big tractor to draw the seeder to run faster to make disc rotate quickly;
- Not easy to make the disc

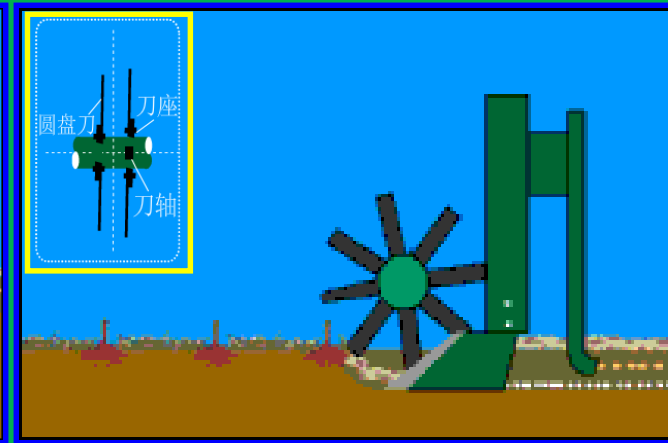
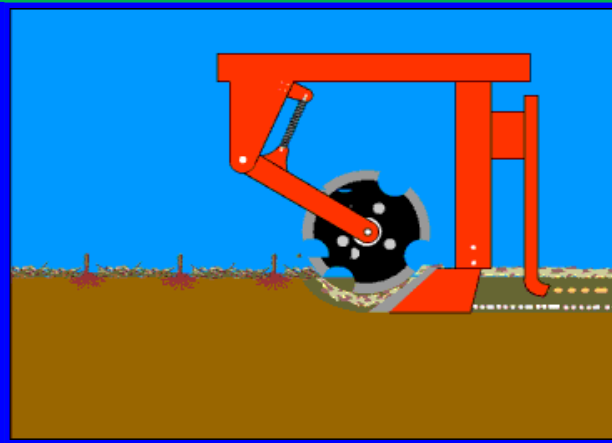
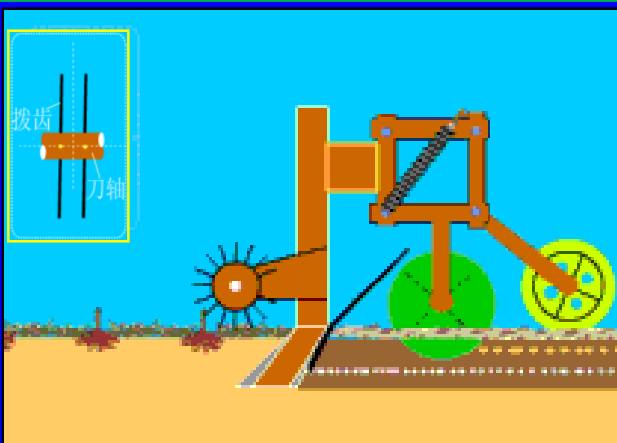
Problem?

Seeds planted on residues

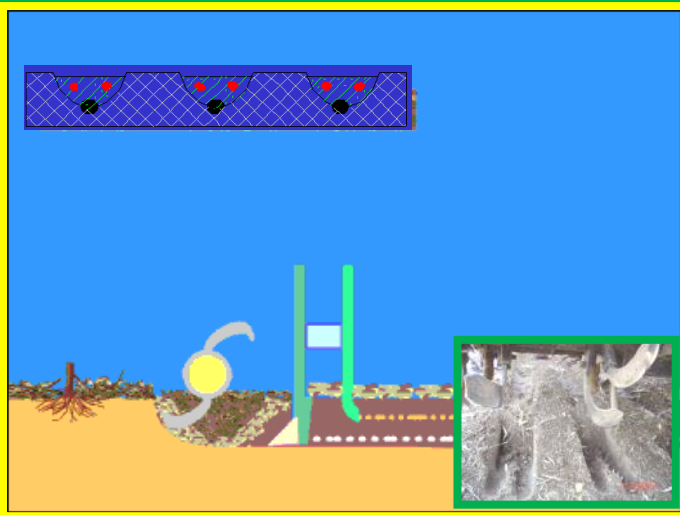


Type 3

Residues handled by powered components



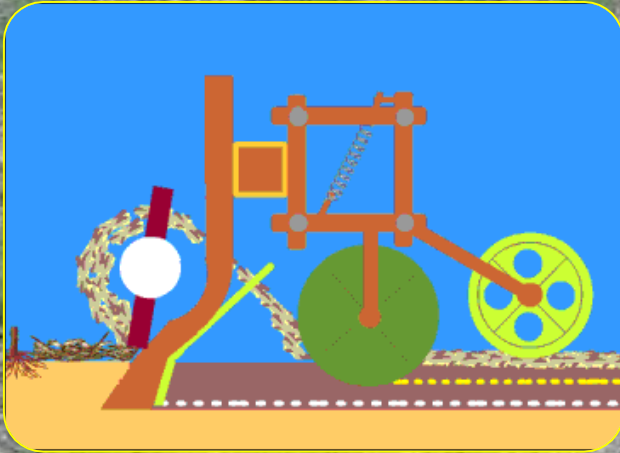
(1) Strip-till seeding



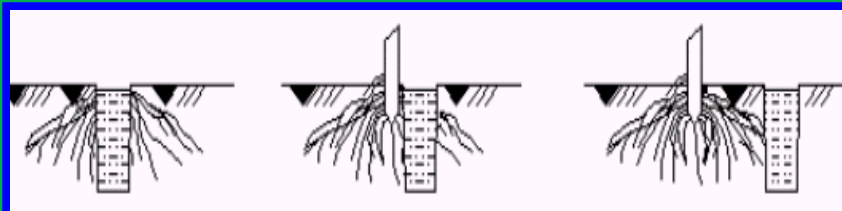
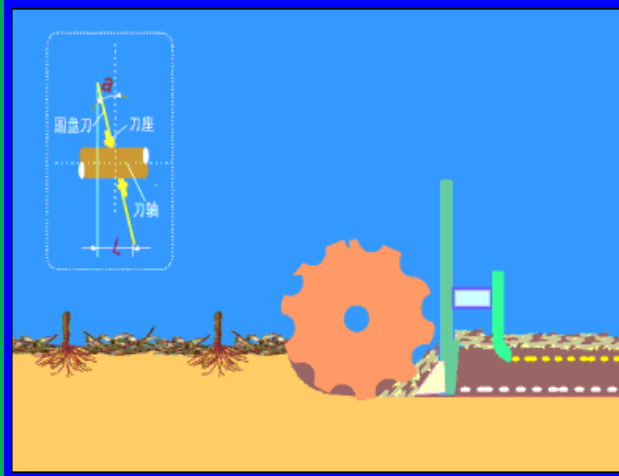
Rice transplanting after strip-till



(2) Strip-chop seeding



(3) Driven oblique disc



a. Middle

b. Side

c. None



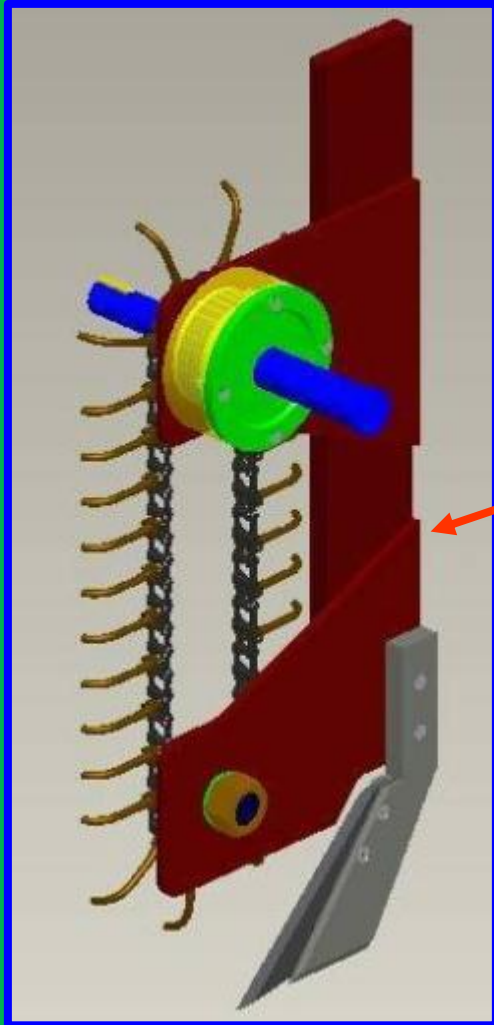
(4) Driven straight disc— embedded in tine opener



(5) Driven residue-throwing finger



(6) Driven chain with tooth



(7) Residue picked, chopped and thrown back of seeder, Happy seeder



(8) Residue Strip-chopped



(9) Residue picked, chopped and thrown aside of seeder



No/minimum-till seeders powered by 2 wheels tractor



Some words to these seeders

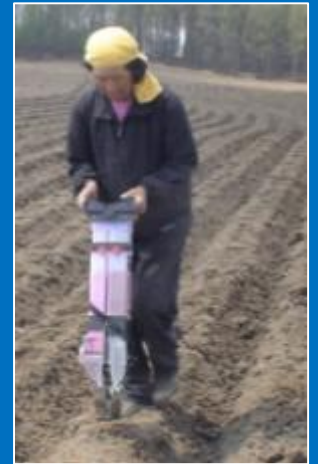
- Can be used in all condition, especially heavy stubble;
- Need more power to drive the powered components;
- A little bit more soil disturbance

Manual and animal-traction no-till seeder



Pushed or pulled

Jab Planter



Hand Hoe Seeder/Li Seeder





Vietnam



**Premier
Tanzania**



**East
Timor**

Development of small/medium size no-till and minimum-till seeders in Asia: A review

He Jin, Zhang Zhiqiang, Li Hongwen*, Wang Qingjie

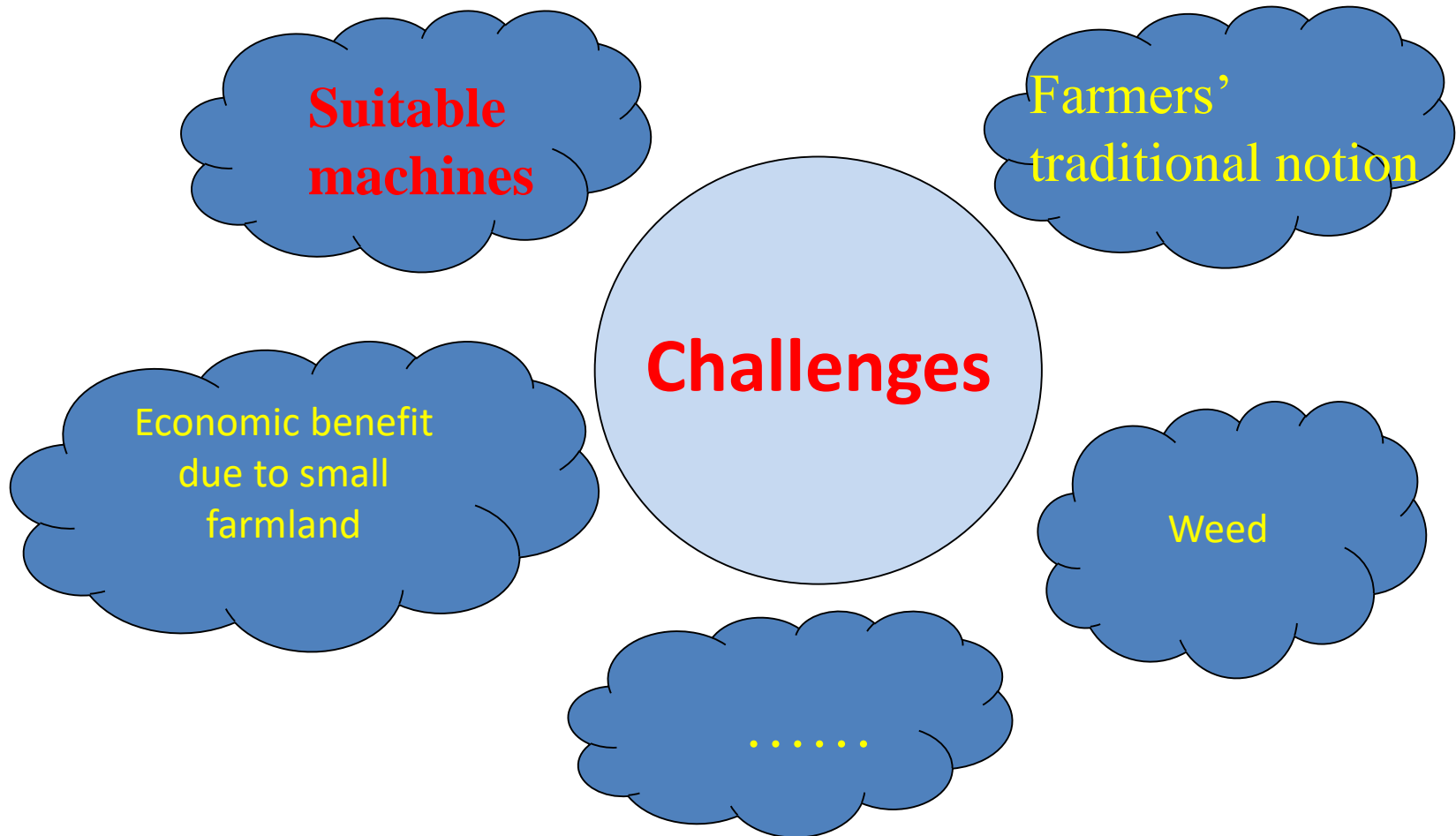
(College of Engineering, China Agricultural University, Beijing 100083, China)

Abstract: The benefits of conservation agriculture (CA), have been widely recognized and CA has been widely adopted in many parts of the world. However, there are some factors that limit the widespread adoption of CA in Asia. The most prominent factor appears to be the lack of suitable CA seeders for small to medium sized land-holding (SLH) farmers. This paper summarizes the small to medium no-till and minimum-till seeders currently available in Asia, and classifies these seeders into four types: manually operated units, animal traction seeders, two-wheel tractor and four-wheel tractor driven seeders. Detailed characteristics have been provided for some typical CA seeders and comparisons were made as to their suitability under particular working conditions. Typically manual and animal traction seeders are confined to small farms and hilly areas, while the larger CA seeders suited to four-wheel tractors are used on larger acreages. To ensure seeding performance on most four-wheel tractor CA seeders, two types of anti-blocking mechanisms (passive and active anti-blocking) have been fitted. Finally, the paper proposes a future direction and development of CA seeders for small/medium size farms in Asia, and also suggests changes in policy support, improvement of anti-blocking mechanisms, suitability for various crops, geographical zones and the contribution of development by public private partnerships to advance the adoption of CA seeders.

Keywords: conservation agriculture (CA), conservation tillage, no-till, minimum-till, seeder, tractor, anti-blockage, Asia

DOI: 10.3965/j.ijabe.20140704.001

Challenge and Outlook



Central Document No.1

- **2005:** Reform traditional tillage methods and develop **conservation agriculture**
- **2006:** Continue to implement **conservation agriculture** demonstration projects
- **2007:** Pilot project to promote subsidies for **no-tillage** cultivation technology
- **2008:** Continue to implement **conservation agriculture** projects
- **2009:** Vigorously carry out **conservation agriculture**
- **2010:** Promote **conservation agriculture** techniques
- **2011:** Using **conservation agriculture** techniques
- **2012:** Actively promote **conservation agriculture** techniques
- **2013:** Continue to implement soil organic matter enhancement **subsidies**
- **2014:** Promote mechanized **straw retention** technology
- **2015:** Carry out **straw resource** utilization
- **2017:** Encourage local government to **increase integrated straw management** and improve the subsidy mechanism for **straw diversification**
- **2018:** Promote **integrated straw management**



Accelerating the sustainable agriculture development

Policy priorities for CA in China

- *National policy and financial support*
- *Locally applicable scientific research*
- *Better extension and training for farmers*
- *International cooperation and communication*
- *.....*

A special book on CA ----by World Bank Institute

Exchanging Experience with Conservation Agriculture Towards Climate Resilience

Authors:

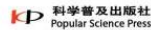
LI Hongwen, XIE Mei, HE Jin

Assisted by:

HUAN Yu

Art drawing:

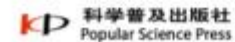
JIANG Heping



THE WORLD BANK
IBRD • IDA



Conservation agriculture - a story from China



Conservation Agriculture ---A story from China

Welcome south-south knowledge sharing delegation



2



3



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Conservation Tillage Research Centre, MOA



Thanks !