



# **Research Status and Development Trend of Rice and Wheat Mechanized Harvesting**

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# Content

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- **I. Overview of Rice and Wheat Production Mechanization in China**
- **II. Key Technologies and Equipment for Rice and Wheat Mechanized Harvesting**
- **III. Development Trend of Rice and Wheat Combine Harvester**

A decorative graphic consisting of a dark olive-green horizontal bar with rounded ends and a blue border. The bar is styled to look like a scroll, with blue circular accents at the top and bottom corners. The text is centered within the bar in a white, bold, serif font. Below the bar, there is a blurred image of a green field of crops.

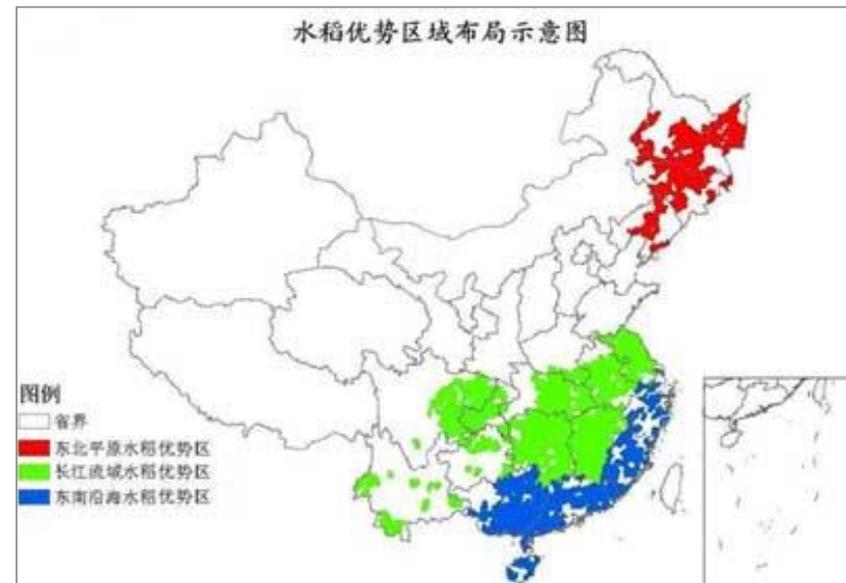
# **Overview of rice and wheat Production Mechanization in China**

# Rice planting situation in China

Rice is the **third largest food crop** and about 50% of the world take it as main food.

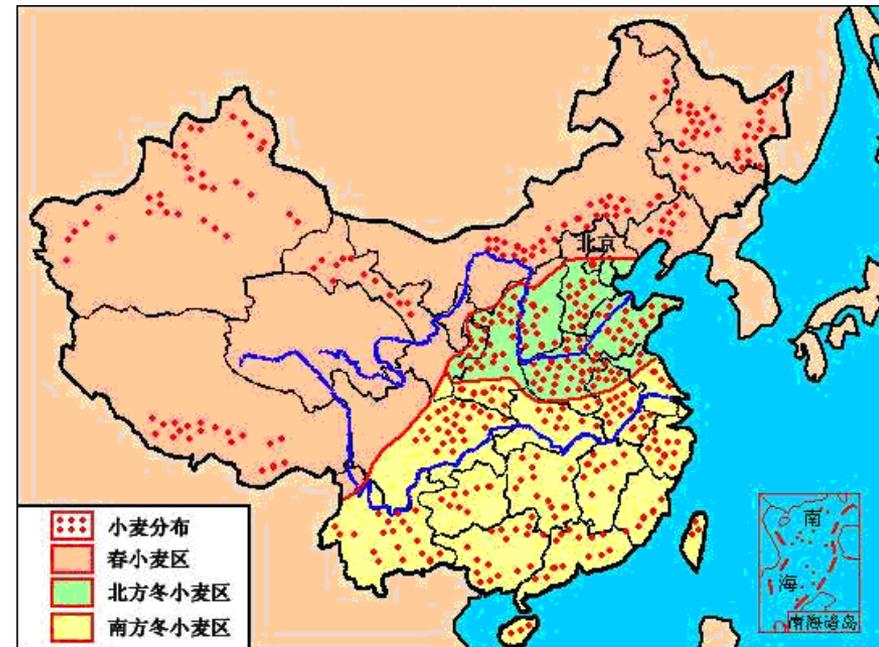
- ◆ In China
  - rice planting area : **74 million acres**
  - total yield exceeds **200 million tons**
- ◆ Three major rice planting areas
  - The Northeast plain
  - Yangtze river basin
  - Southeast Coast

## Rice planting distribution in China



# Wheat planting situation in China

- ◆ Wheat is the **second** food crop in China
- ◆ planting area : **24 million acres**
- ◆ Five major wheat planting areas
  - Huanghai
  - Middle and lower reaches of the Yangtze River
  - Southwest
  - Southeast
  - Northeast



Wheat planting distribution in China

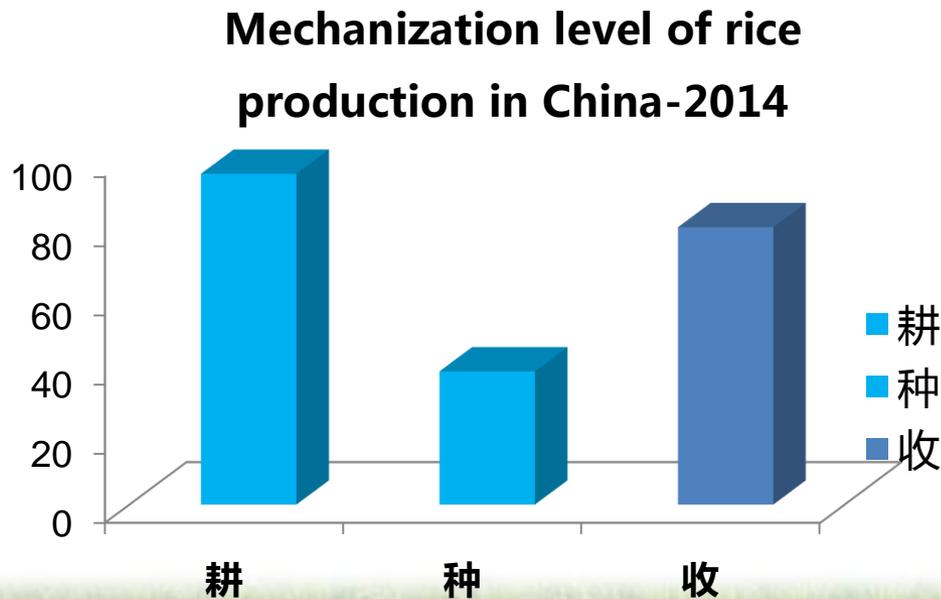
# Machinery system of rice and wheat

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- ◆ **Rice and wheat machinery system refers to the machines and tools involved in the whole process from ploughing, sowing and harvest.**
- ◆ **According to different planting methods, direct seeding machinery or seedling/transplanting machinery is selected.**
- ◆ **Harvester is relatively mature technology, including full-feed and semi-feed combine harvesters, as well as segmentation harvesting.**

# Mechanization level of rice production in China

Mechanization level of rice production in China-2014 ( % )		
Ploughing	Sowing	Harvest
95.57	38.53	80.15



The mechanization level of rice production has reached 74% (2014)

# Mechanization level of wheat production in China

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- ◆ The mechanization level of wheat production has reached 94%
- ◆ Wheat is the most mechanized crop in China

## Increase of wheat production Mechanization level from 2006 to 2014

	Tillage ( % )	Sowing ( % )	Harvesting ( % )	Comprehensive ( % )
2006	80.21	78.98	78.32	79.27
2014	≈100	86.98	95.08	94.6
Annual growth rate	2.47	1	2.09	1.92

A decorative scroll graphic with a dark olive green background and a blue border. The scroll is unrolled in the center, with the ends curling upwards. The text is centered within the unrolled portion.

# **Key technologies and equipment of rice harvest**



# The main form and performance of harvester

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## ◆ Harvesting method:

Two-stage harvester、combine harvester

## ◆ Combine harvester:

Head-feeding combine harvester、 Full-feeding combine harvester



**Two-stage  
harvester**



**Head-feeding  
combine harvester**



**Full-feeding  
combine harvester**

# Two-stage harvesting

## Rice windrower



## Rice binder



## Rice thresher



# Head-feeding rice combine harvester



**2 rows (0.9m)**



**4rows (1.5m)**



**5 rows (1.8m)**



**6 rows (2.0m)**



# Full-feeding rice combine harvester

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## Crawler rice combine (working width 2.0m-3.2m)



## Wheeled rice combine (working with 3.0m-6.2m)

# Key technologies and equipment of rice harvest

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- ◆ Rice and wheat generally use the same combine harvester
- ◆ The main working parts of combine harvester including
  - Header
  - Thresher and separation device
  - Cleaning device
  - Straw chopper device
- ◆ Work process
  - video 1: LEXION 600 Crop Flow Gutfluss – 2013**
- ◆ advanced technologies
  - video 2: 2016 John Deere S-Series Combines**

# Advanced technology of header

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The function of the header is to cut the crop and transport the crop to the threshing device. It consists of reels, cutters, dividers, conveyors, etc.



**Video 3: 600 Series Flex Draper Platform**

# Advanced technology of header



**Header height profile**



**Adjustable floor length**



**hydraulic drive**



**Slope adjustment**

# Advanced technology of header

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## Flexible header



**video 5: John Deere 600FD HydraFlex™ in Action**

# Threshing device

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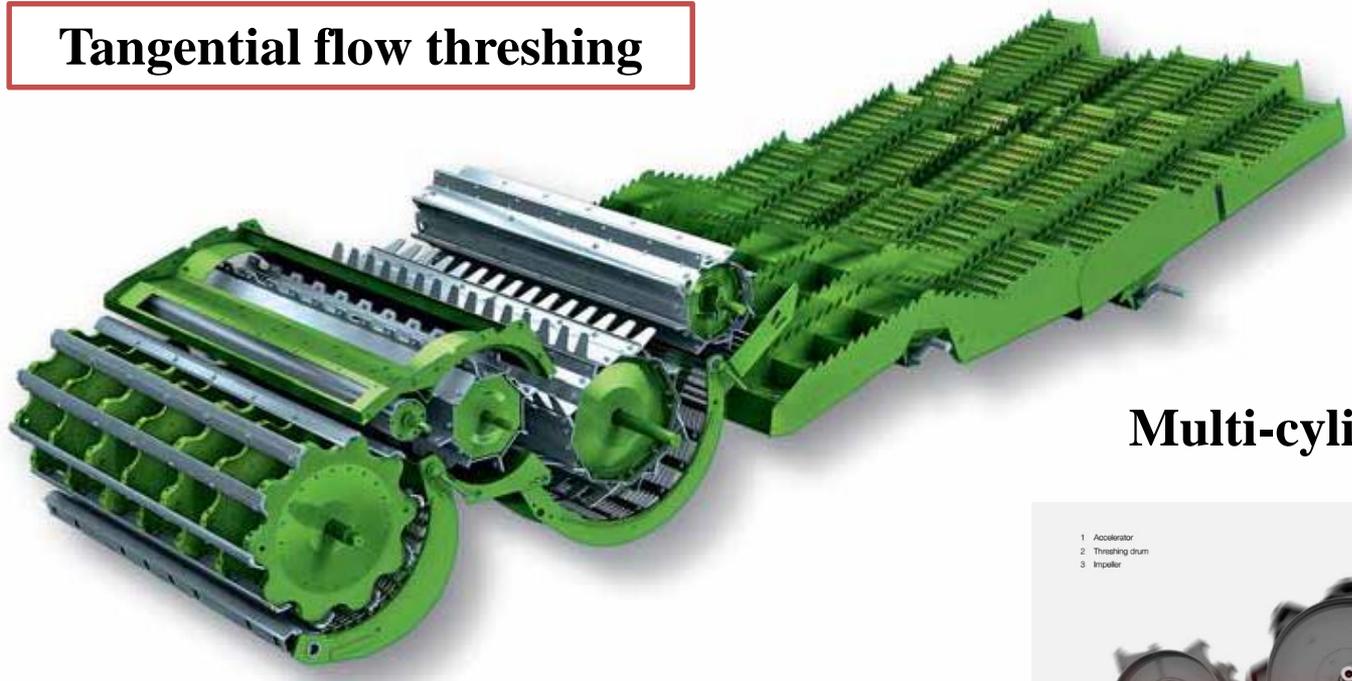
**The combine threshing unit/system is the most important assembly from the point of view of working processes and the power requirement**

**video 6 : Threshing and Separating**

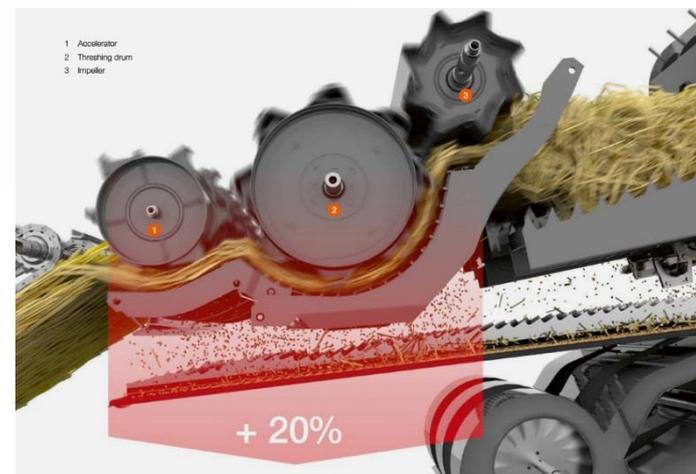


# Advanced technology of threshing device

## Tangential flow threshing



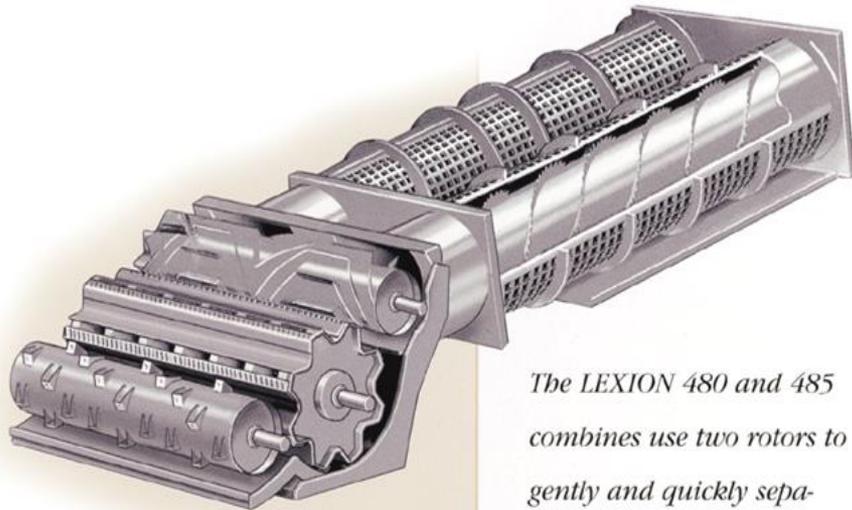
## Multi-cylinder threshing



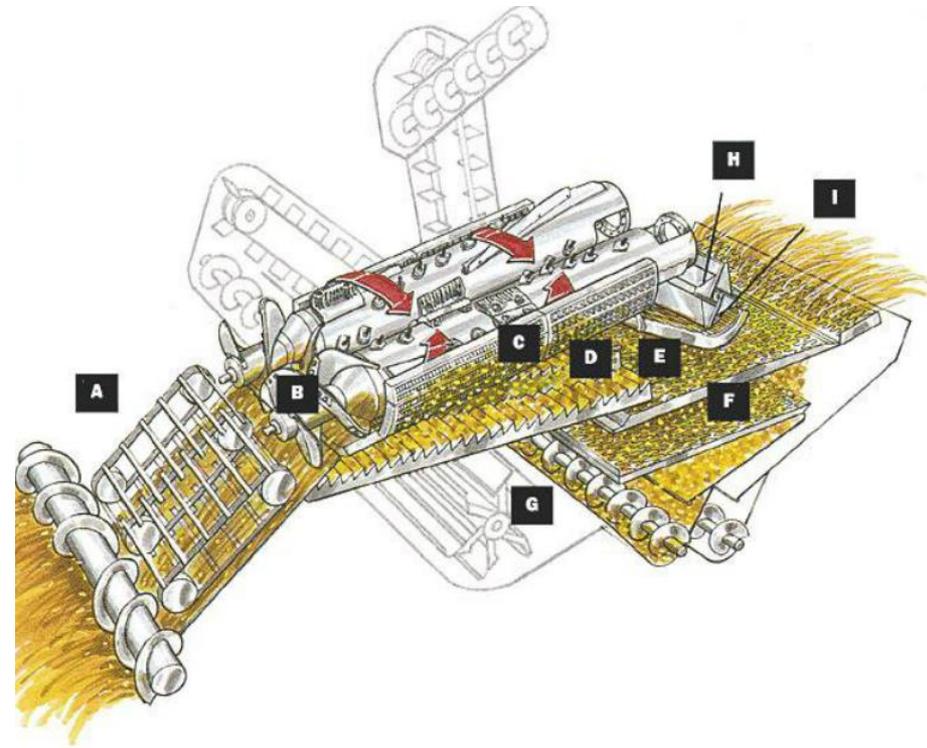
**Video 7: Combine Harvesting Animation (MCS)**

# Advanced technology of threshing device

□ Purpose: Improve threshing efficiency



*The LEXION 480 and 485 combines use two rotors to gently and quickly separate grain.*



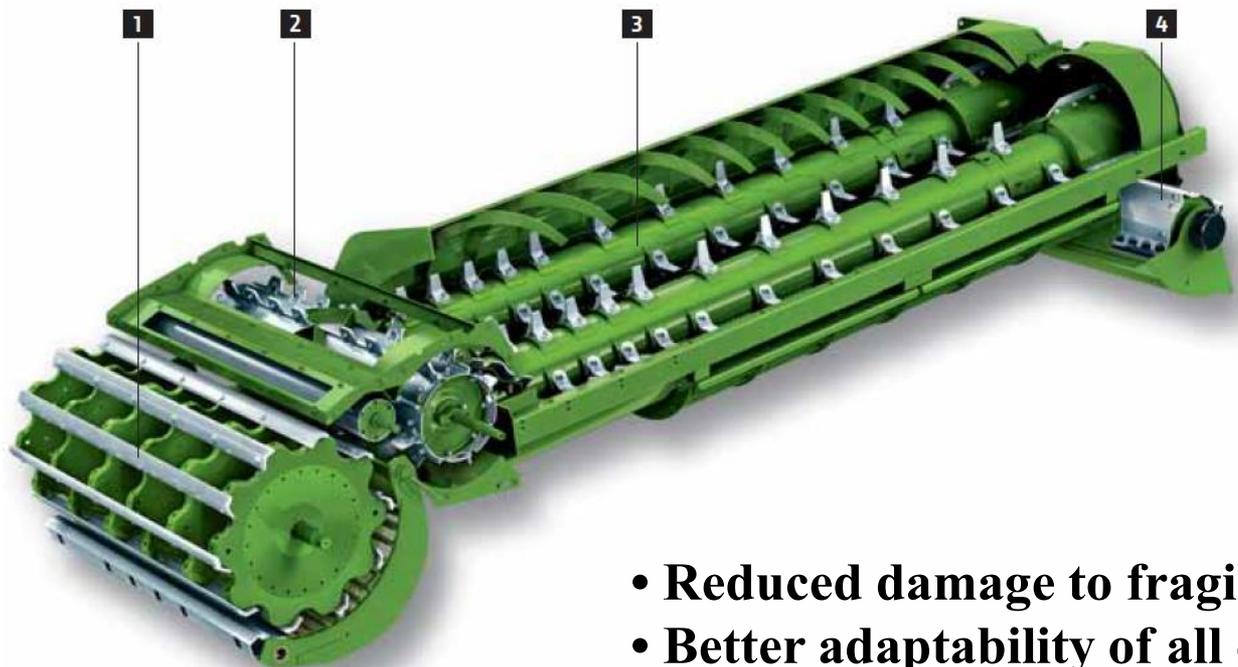
**Double roller threshing**

**Video 8 CTS System**

# Advanced technology of threshing device

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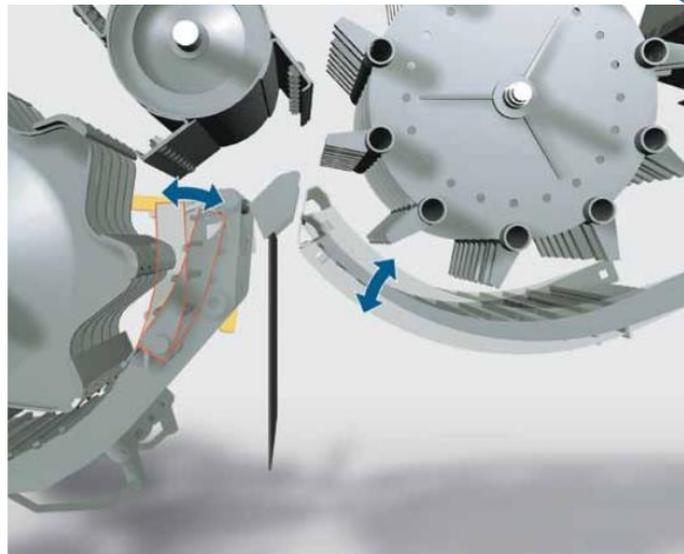
## Tangential-longitudinal-axial



- Reduced damage to fragile grains
- Better adaptability of all crop processing
- Low level of grain losses

**Video 9: CLAAS TUCANO 500 hibrid cséplőrendszer**

# Advanced technology of threshing device



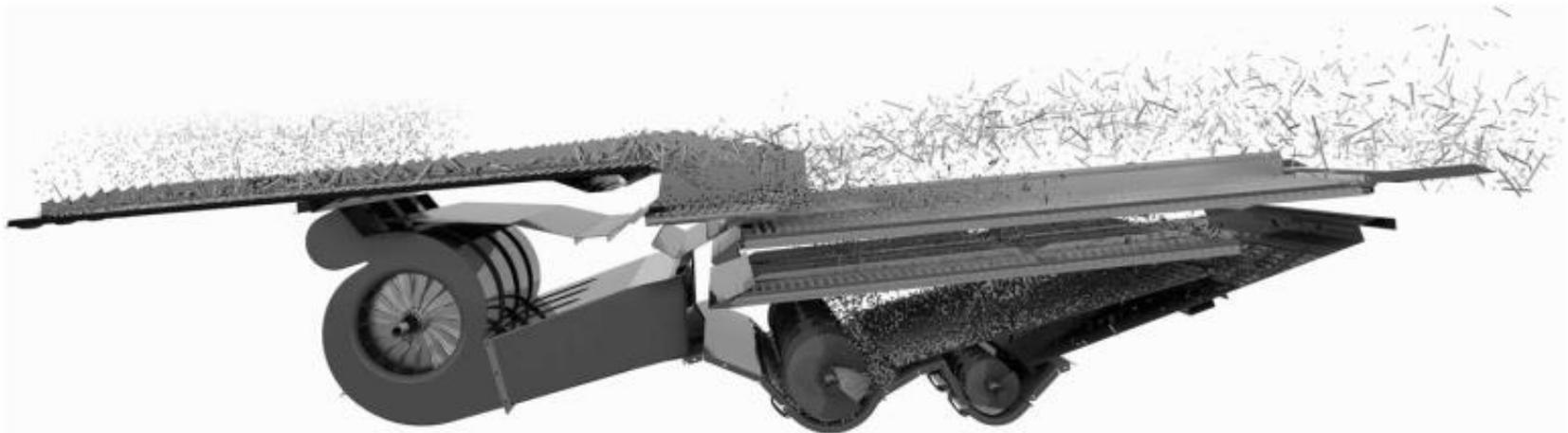
**Concave adjuster**

**Video 10: John Deere T670 Combine -  
Concave Booster Bar**

# Advanced technology of cleaning device

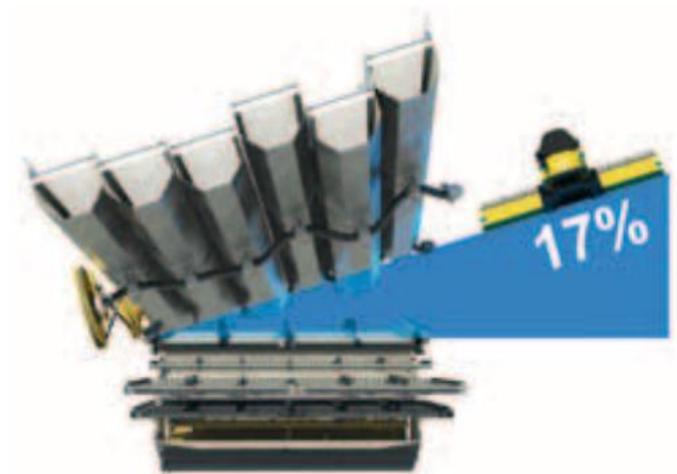
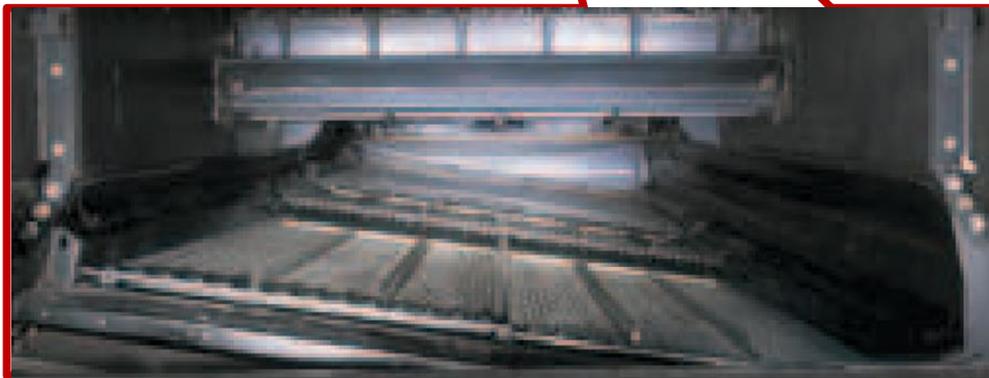
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The *cleaning shoe*, necessary to both conventional and rotary combines, is usually composed of a receiving element (preparation floor), a grain pan, a chaffer, a sieve, and a blower system



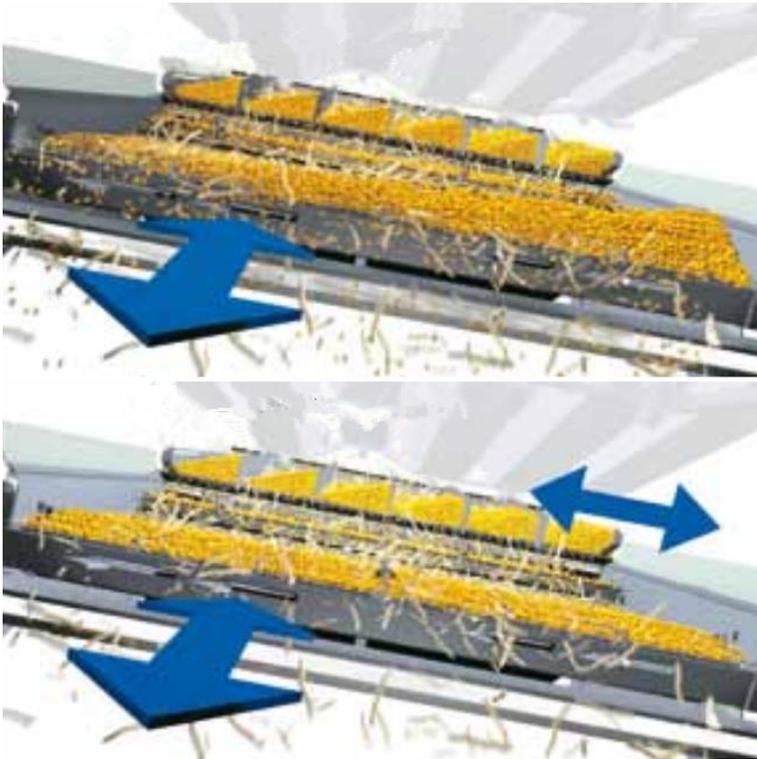
# Advanced technology of cleaning device

## ◆ Self-balancing sieve

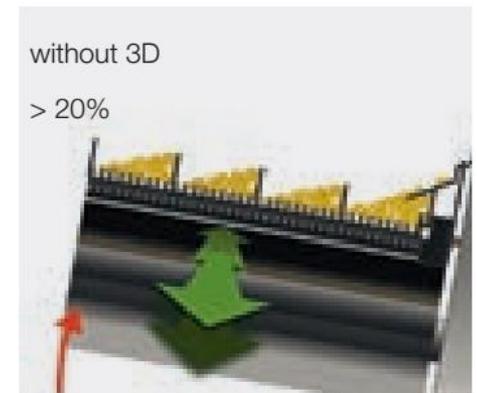
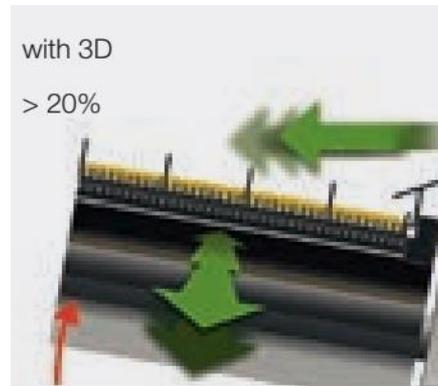


# Advanced technology of cleaning device

## ◆ 3D cleaning technology



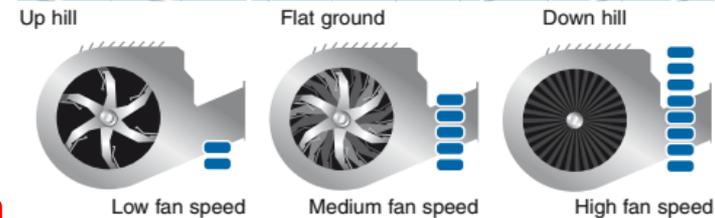
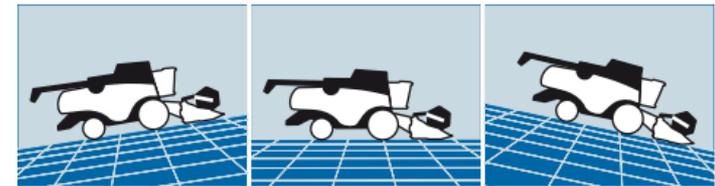
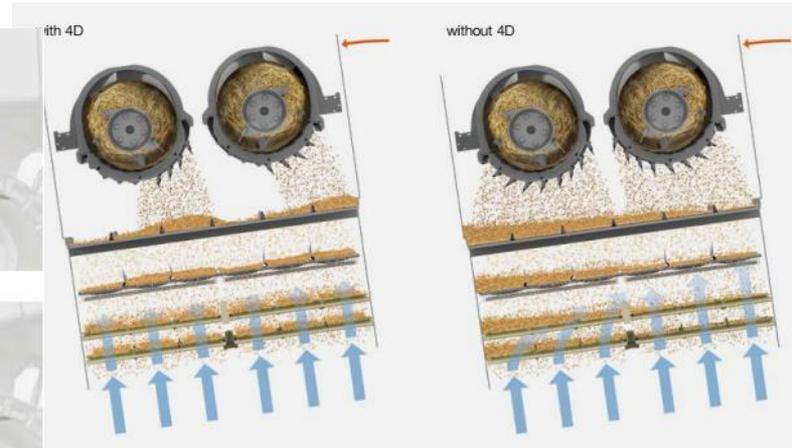
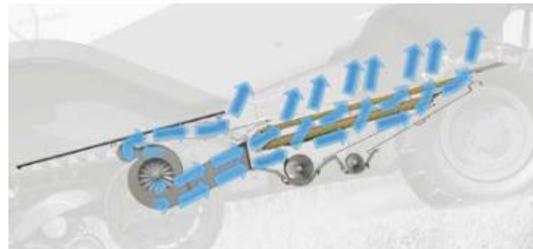
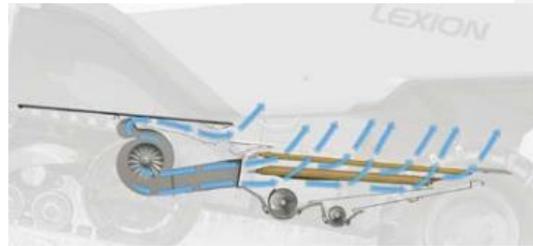
## ◆ double-sided vibration mechanism



**Video 11: CLAAS 3D Sieve**

# Advanced technology of cleaning device

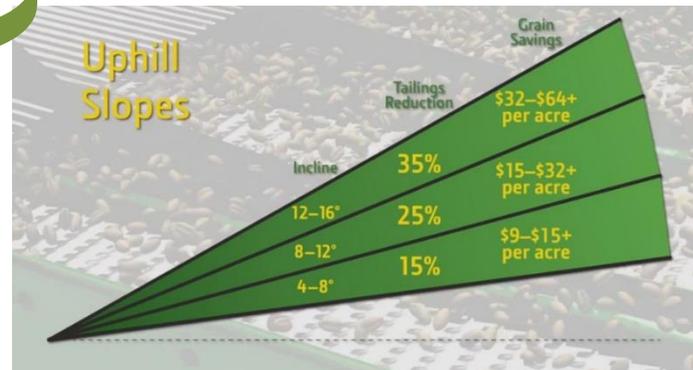
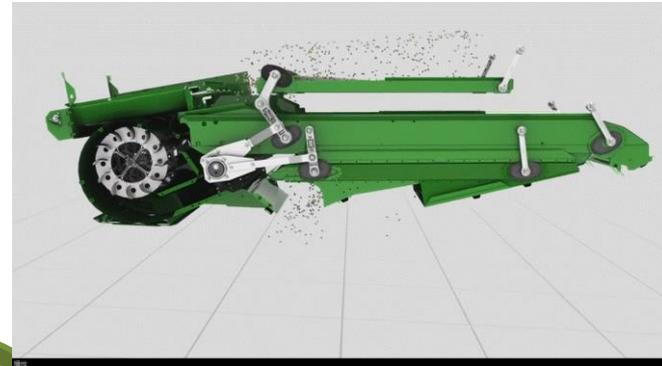
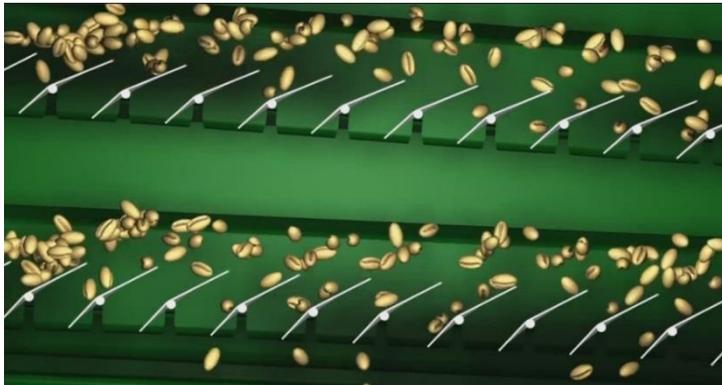
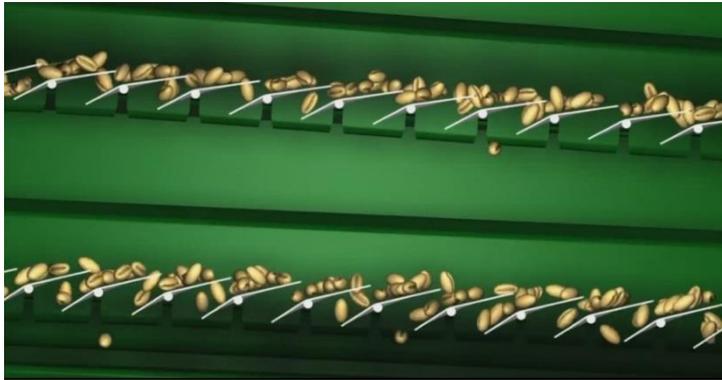
## ◆ 4D cleaning technology



**Video 12: CLAAS LEXION 4D-cleaning system**

# Advanced technology of cleaning device

## Screen opening automatic adjustment technology



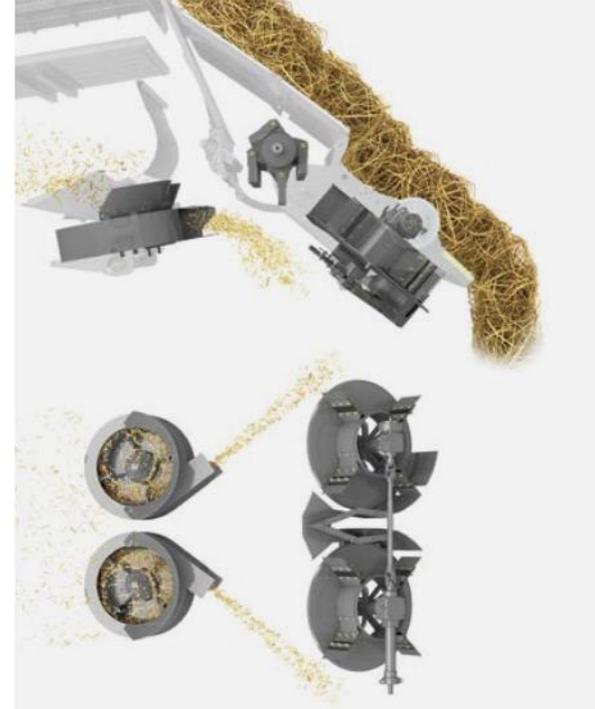
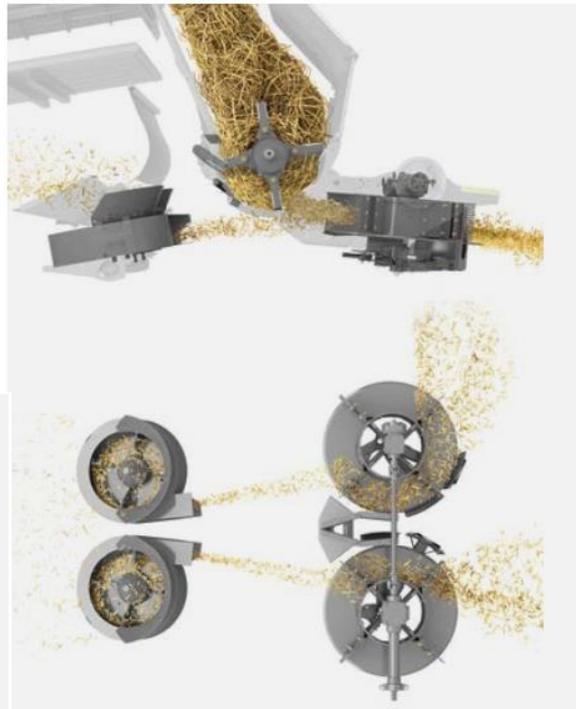
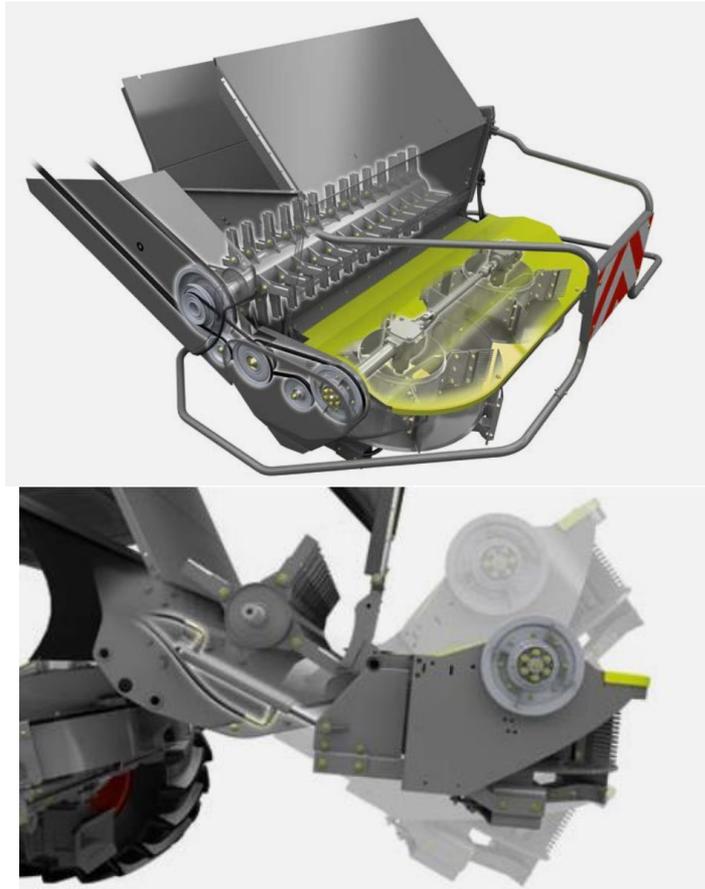
**Video 13: Cleaning Shoe**

**Video 14: TUCANO cleaning system - 2016**

# Advanced technology of Scrapping device

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## Straw chopper device



**Video 15: CLAAS LEXION - Straw Management 2014**

**Video 16: CLAAS LEXION SPECIAL CUT - 2016 – en**

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## **Development trend of combine harvester**

# Development trend of combine harvester

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**Large and efficient**

The power of combine harvesters has reached more than 770 horsepower. The main model is about 300 horsepower, with the maximum width of 24 meters, and 9-12 meters generally.

- ◆ **Large feed:** John Deere 8kg/s
- ◆ **Large cutting width Header:** CASE 25 meters
- ◆ **High-efficiency threshing cleaning device**

# Large and efficient

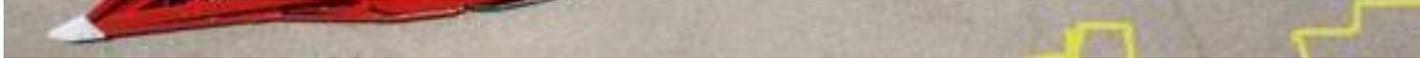
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**CLAAS harvester with a cutting width of 9 meters**

# Large and efficient

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# Large and efficient

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# Large and efficient

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# Development trend of combine harvester

**Intelligent**

**computer, automatic control  
and information technology**

## (1) Combine Harvester Performance Detection System

The system detects the whole harvesting process including the cutting, feeding, threshing and cleaning Device of the combine harvester

- ◆ cutter vibration frequency;
- ◆ reel speed;
- ◆ torque and speed of the threshing roller;
- ◆ fan speed and vibration frequency of the vibrating screen.
- ◆ engine speed and operation speed of the combine harvester.

# Intelligent

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## **(2) Combine Harvester Electrical Power-on Self-inspection System**

The automatic fault diagnosis of the electrical system can help the combine harvester operator to identify the fault and handle it in time.

## **(3) Combine Harvester Yield Monitoring System**

When the intelligent yield monitoring system is in operation, a group of sensors measure the grain quality or flow per unit time, grain moisture content, machine forward speed, draper platform height, and lifting speed of the grain hoist in real time and transmit digital or analog signals to the control display terminal at the same time to calculate grain yield per unit area.

# Intelligent

## **(4) Measurement of the Entrainment Loss in Combine Harvester**

- ◆ Traditional detection method: By installing “Force-electricity” sensor at the straw outlet
- ◆ Image detection method: The grain images on the platform are collected by the CCD image detection regularly and sent to the processor for analysis to finally obtain the entrainment data.

## **(5) Combine Harvester Threshing Roller Monitoring System**

The effect of threshing has a direct impact on the performance of cleaning and separation devices

# Intelligent

## **(6) Combine Harvester Draper Platform Monitoring System**

- ◆ Digital camera is used to capture images, identify lodged crop automatically and control the height of the harvester draper platform according to the lodging height;
- ◆ The reel speed is controlled automatically.

## **(7) Measurement of Combine Harvester Cleaning Loss**

The amount of grain is detected through the different impact signals of grain and impurities on the sensor.

## **(8) Combine Harvester Drive System**

Combine harvester will develop towards electric and hydraulic drive in the future.

# Intelligent

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**Multiple electronic display screens in the cab to keep track of the machine working and operating status at any time**

# Intelligent

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**Convenient one-lever  
operating system**

# Intelligent

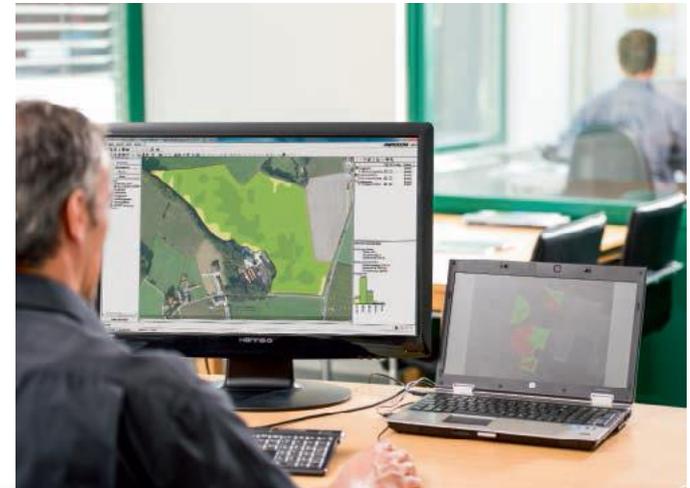


**One-lever  
operating system**

**Management system -  
Yield map**



**Automatic navigation system**



[www.nriam.com](http://www.nriam.com)

# Intelligent



**Threshing roller  
protection device,  
overload protection  
device**

# Intelligent

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**Accurate cutting height of John Deere Combine Harvester**

# Development trend of combine harvester

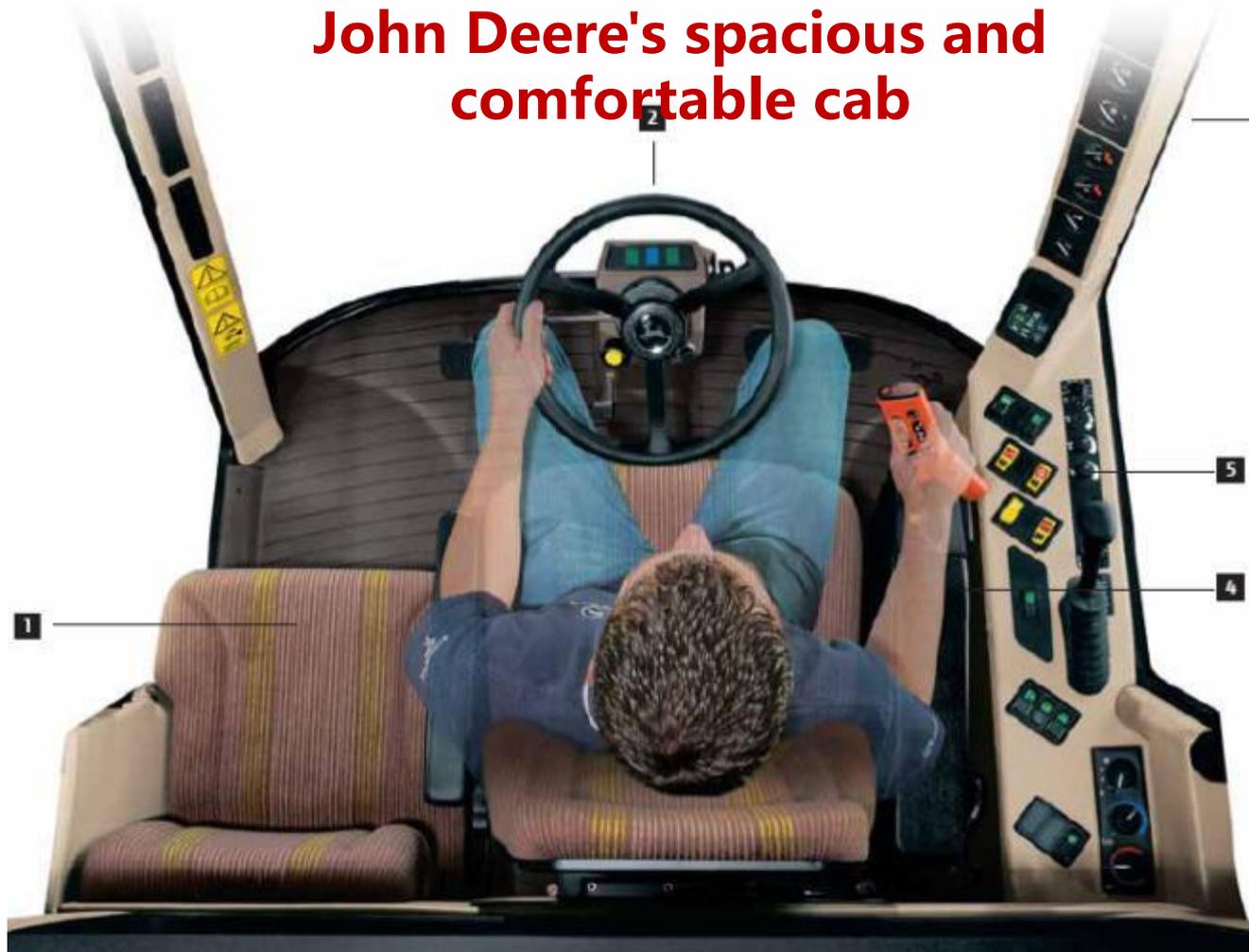
Comfortable

Equipped with closed, soundproof, shock-absorbing, and environmental parameter adjustable cab, where the driver can know the position, walking route, working state and operation quality of the harvester through the screen in real time, which has greatly improved operator's operating conditions and reduced the degree of fatigue.



# Comfortable

**John Deere's spacious and comfortable cab**



# Development trend of combine harvester

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## Universal

Modular design technology is widely used in modern combine harvesters. Firstly, the chassis is designed as a platform with high universality. The corresponding draper platform is selected according to the characteristics of the harvested crop. The threshing and cleaning devices meet the requirements of different crops generally through adjusting parameters.

# Universal

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**CLAAS Harvester implements harvesting of a variety of crops through different draper platforms and detached parts**



**Rape combine harvester**



**Rice harvester**



**Soybean harvester**



**Corn harvester**



**Pickup machine**

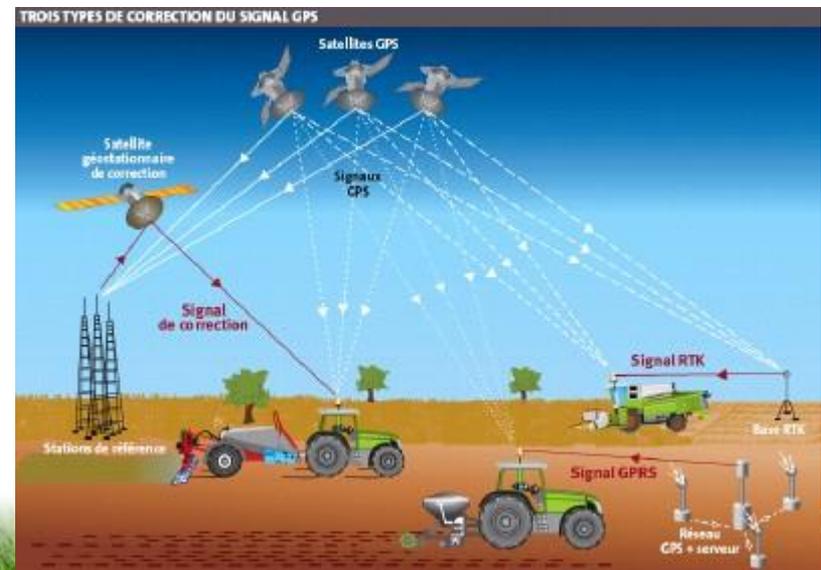
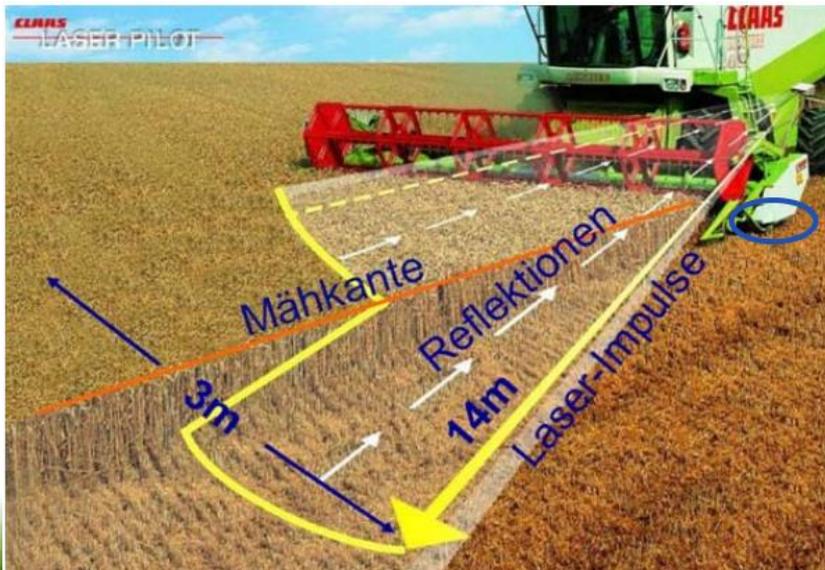


**Grass harvester**

# Automatic navigation

- ◆ Harvesting according to the optimized path
- ◆ Reduce the area of duplicated areas and missing areas
- ◆ Improve the quality and efficiency of agricultural machinery in the field
- ◆ Reduce the labor intensity of the driver
- ◆ remote control and Agricultural Machine Network

Automatic  
navigation



# Automatic navigation

## Based on Navigation positioning system

- Crop growth and yield detection
- Multi-machine cooperative navigation technology
- Obstacle detection and Active obstacle avoidance



谢谢!

Thank You!

