



China Agriculture
Research System
现代农业产业技术体系



National System for Layer
Production Technology
国家蛋鸡产业技术体系

Chinese Egg Industry and Research Trends

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Egg Industry in China

- **Top egg producer in the world, 28.8 million tons in 2014, representing 40% of world total production**
- **One Keyword: Diversity**
 - Genetic Diversity
 - Product Diversity
 - Production Diversity

Genetic Diversity

- **Commercial Hybrid Layers**

- Brown Egg Layers
- White Egg Layers
- Pink (Light Brown) Egg Layers



- **Indigenous Chickens**



- **Egg-type Ducks**



Chicken breeds in Jiangxi Province



Baier



Kangle



Chongrenma



Lingkun



Silkie



Ningdusanhuang



Yuganwugu



Dongxiang Blue

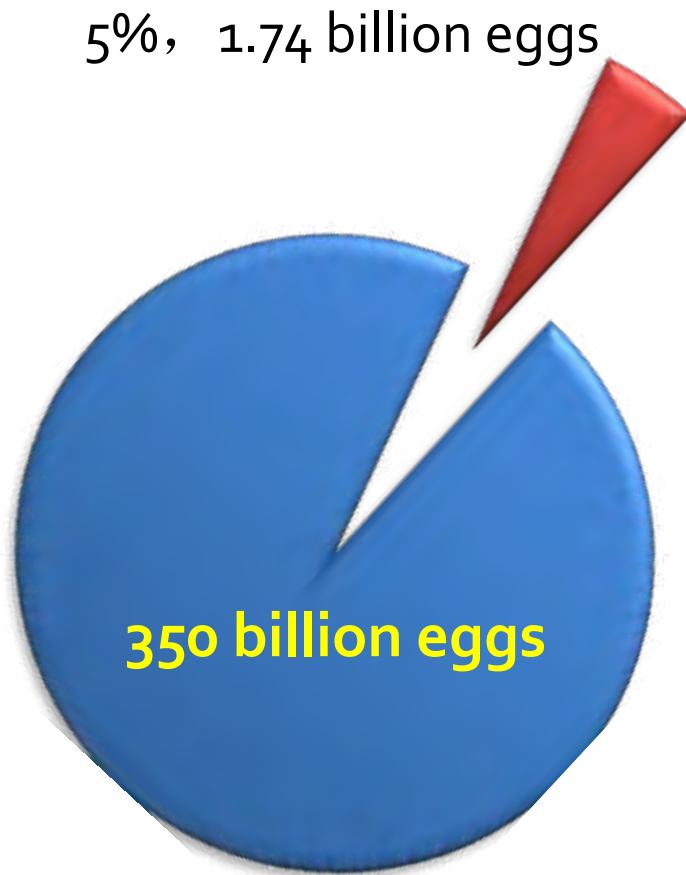
Diversity in Egg Products



Diversity in Egg Products

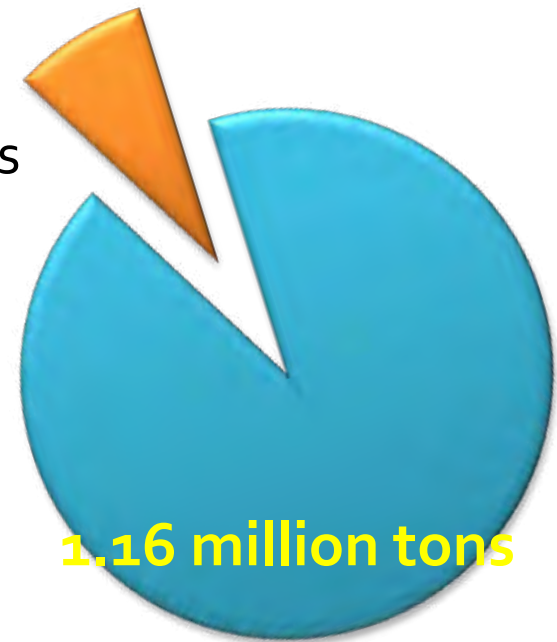
Chicken Eggs

- **Brown Eggs:** 60%
- **Pink (Light Brown) Eggs:** 38%
 - **Normal Size (>58g):** 30%
 - **Smaller Size (40~55g):** 8%
- **White Eggs:** 1%
- **Blue Eggs:** 1%



Percentage of egg products in total egg output

8.2%,
95,000 tons



Percentage of pasteurization eggs
In total egg products

**Fresh egg consumption
dominates;
Very few egg processing
plant to produce egg
products.**

From Egg to Egg Products



■ Packing

■ Grading

■ Processing



Diversity in Production Systems

- From backyard to modern farms



Survey of Current Status of Chinese Egg Industry in 2013



9 Leading Provinces:

- Hebei
- Henan
- Shandong
- Jiangsu
- Hubei
- Liaoning
- Heilongjiang
- Anhui
- Sichuan

Survey Data

- **Time: Jun ~ July, 2013**
- **Comprehensive** survey in 36 typical counties of 9 provinces
- 20,132 farms were investigated. Among them, 18,909 were valid samples
- The total capacity was 114 million hens, and the actual number of stocking hens was 102 million, representing nearly 10% of total hens in China.

Data of 9 Sample Provinces

Province	Cities	No. of Farms	Average Size (hen/farm)
Jiangsu	Yancheng	5788	4372
Hebei	Shijiazhuang	3735	3957
	Handan		
Hubei	Huanggang	3243	6508
	Xinxiang		
Henan	Nanyang	1439	5710
	Jinan		
Shandong	Qingdao	1384	7724
Anhui	Shuzhou	1073	7438
Heilongjiang	Haerbin	984	5097
Liaoning	Anshan	831	5822
Sichuan	Leshan	432	10018*
Total		18909	5409

Farm Scale of Laying Hens in 2013

Scale <i>Hens/Farm</i>	No. of Farms	%	No. of Hens Housed (x1000)	%	No. of Laying Cages (x1000)	%	Percent Cages not in use
<2000	2814	14.88	3,590.5	3.51	4,890.6	4.27	26.58
2000~4999	9386	49.64	28,075.0	27.44	32,973.4	28.82	14.86
5000~9999	4311	22.80	26,530.0	25.93	28,997.4	25.34	8.51
10,000~49,999	2285	12.08	35,711.0	34.91	38,595.7	33.73	7.47
50,000~99,999	92	0.49	5,805.3	5.67	6,237.3	5.45	6.93
>100,000	21	0.11	2,570.0	2.51	2,716.5	2.37	5.39
Total	18,909	100.0	102,28	100.0	11,441	100.0	10.60

Housing system

- Most layer farms use open or semi-open layer house



开放式鸡舍



半开放式鸡舍



半开放式鸡舍



半开放式鸡舍

Housing system

➤ Use of close house are more and more common.



Housing system

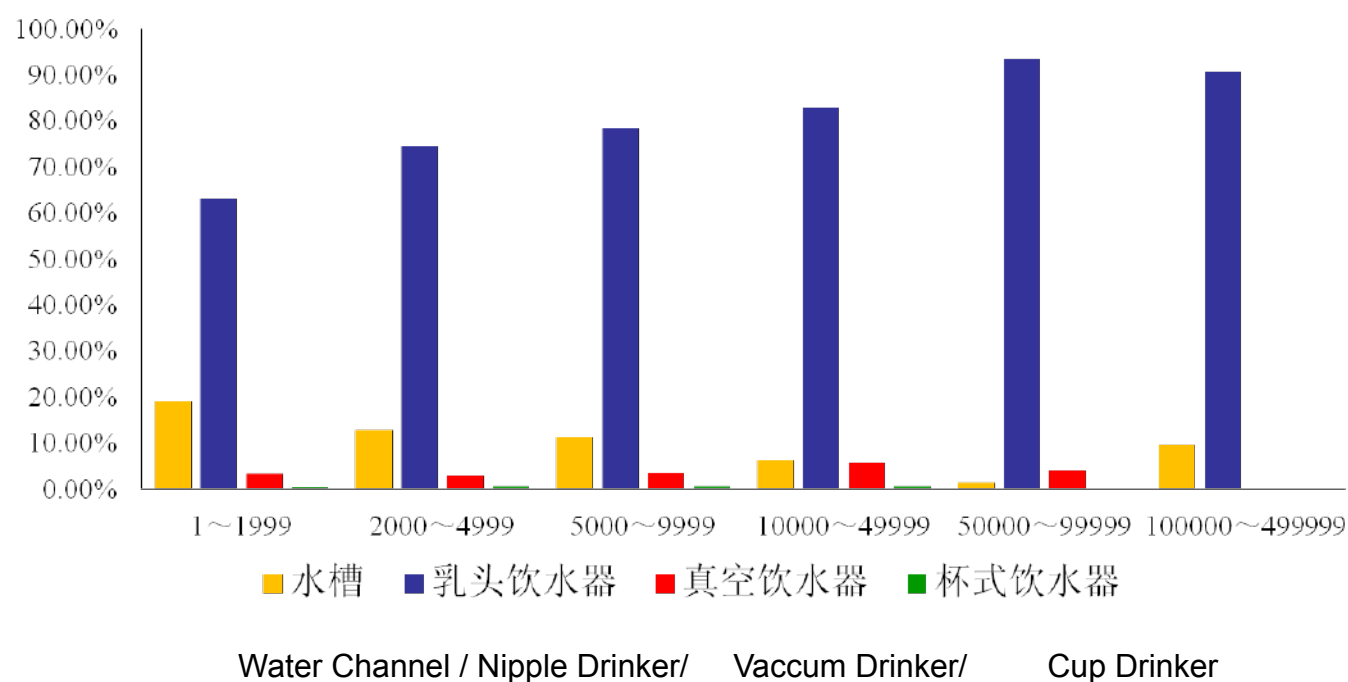
- Stair cage is a major housing system
- Use of vertical cages with manure belt is increasing
- The animal welfare is not an important issue yet

Scale (hen)	Percent in Stair Cages
<2,000	92.54
2,000~4,999	87.17
5,000~9,999	87.68
10,000~49,999	92.89
50,000~99,999	91.37
>100,000	95.17



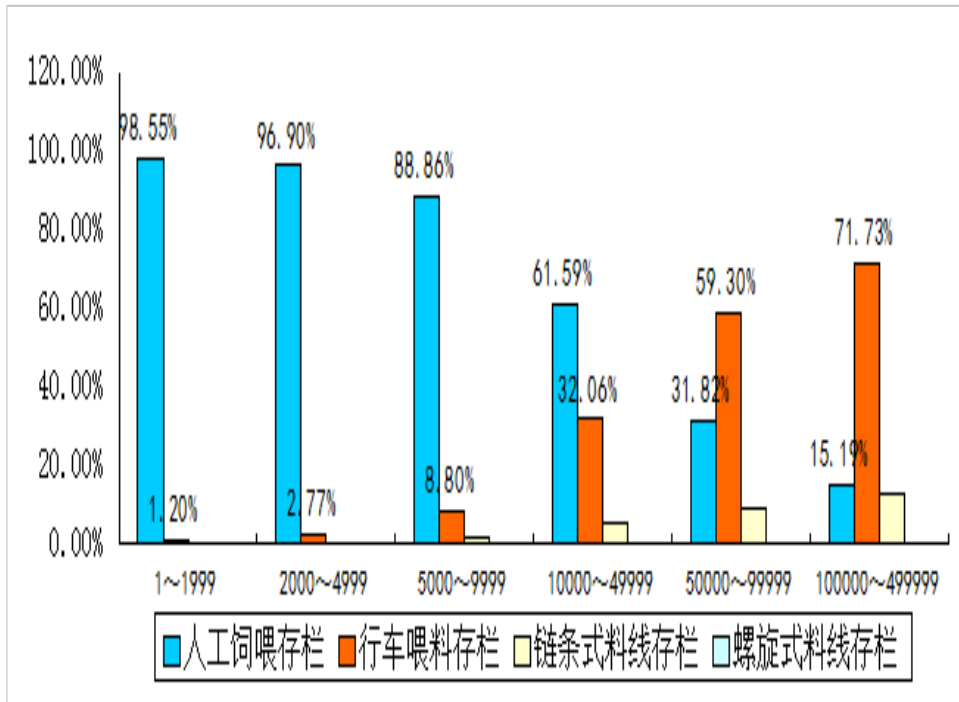
Drinking Water

Nipple drinker is a major way to supply clean water, while 17.76% farms still use water channel



Feeding System

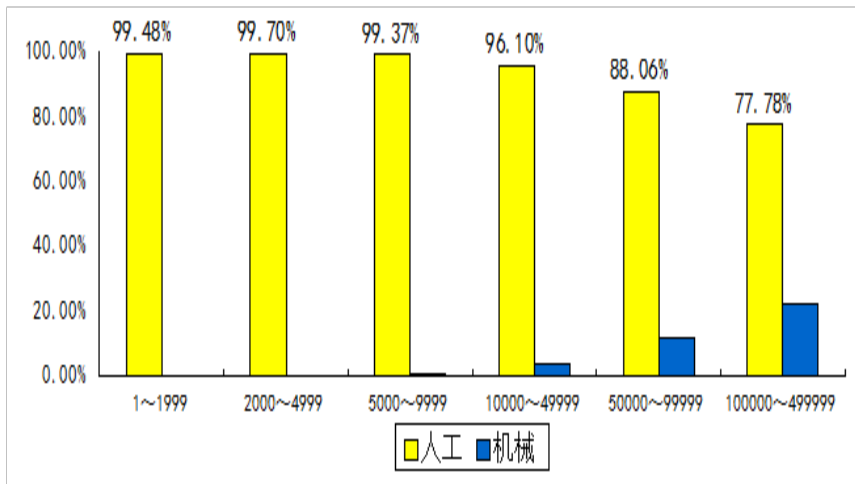
Feed is supplied mainly by labor,
while more cart feeding is used in larger farms.



Egg Collection

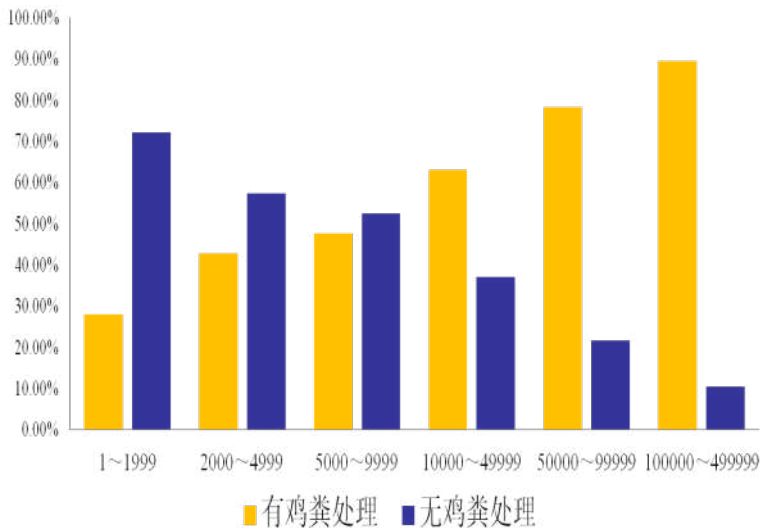
Most eggs are collected by hands,

Automatic egg collection systems are used in large farms.



Manure Processing

- More manure processing in larger farms: fertilizer



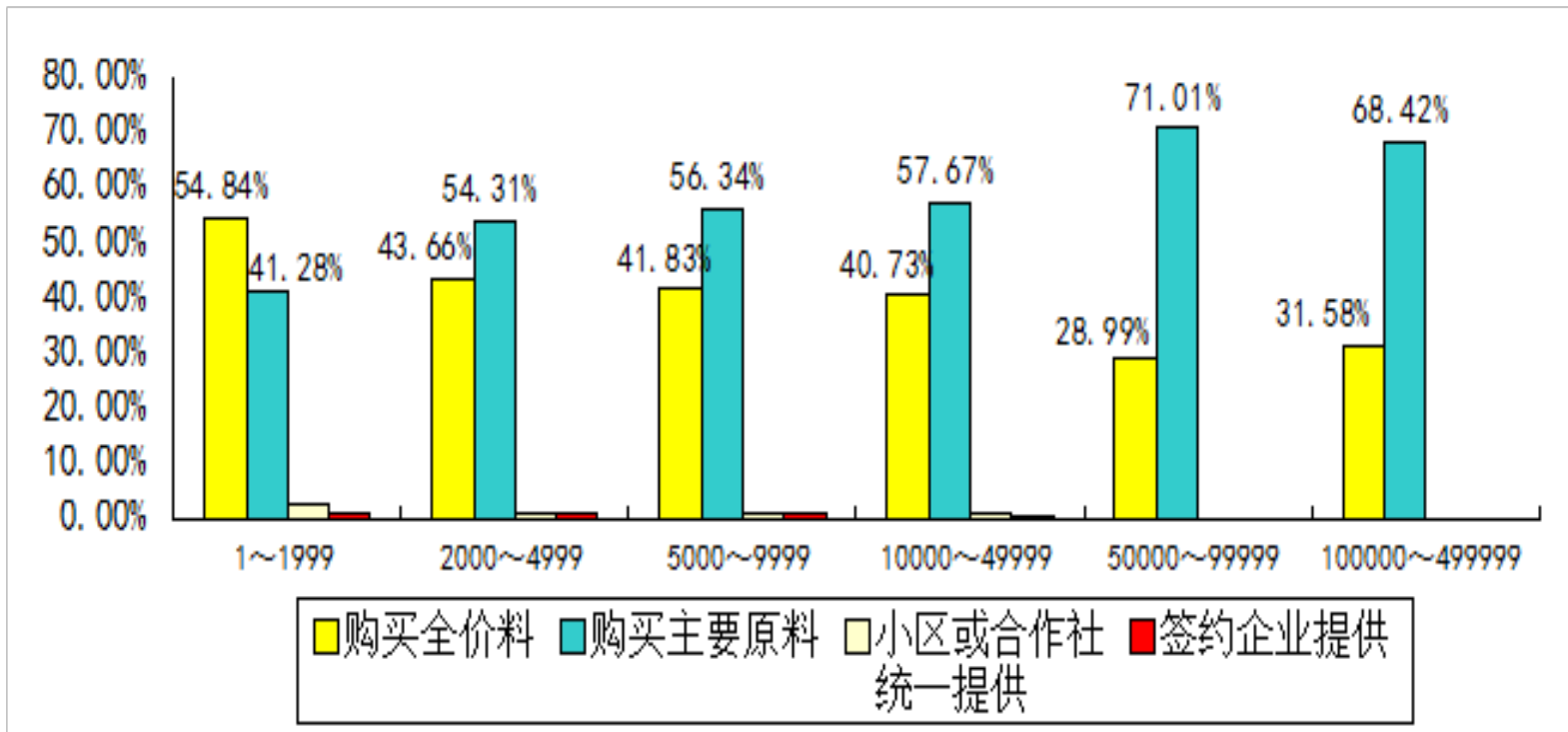
• 生产车间



Feed supply

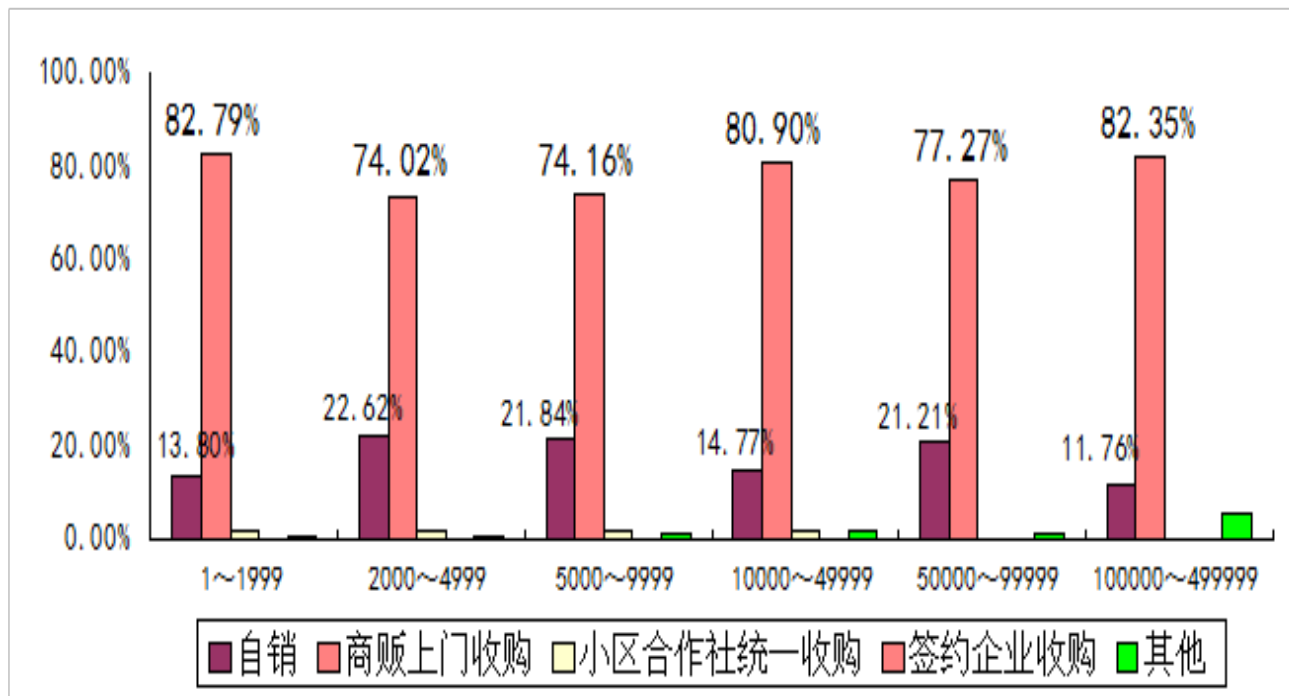
The bigger the scale, the more farms with their own feedmills:

- Safety of egg products
- Reducing production costs.



Egg marketing

- Marketing by dealer is the major way of egg sales;
- Own brands are developing fast.



Managers' Age

Age of farm managers is mainly between 40~60.

Scale	No. Farms	Under 30		30~40		40~50		50~60	
		户数	%	户数	%	户数	%	户数	%
<2000	2674	44	1.65	303	11.33	975	36.46	1063	39.75
2000~4999	8716	200	2.29	1440	16.52	3975	45.61	2591	29.73
5000~9999	4037	138	3.42	777	19.25	1940	48.06	985	24.40
10k~50k	2145	77	3.59	400	18.65	1082	50.44	497	23.17
50k~100k	82	1	1.22	15	18.29	41	50.00	18	21.95
>100k	20	0	0.00	2	10.00	11	55.00	4	20.00

Educational Background of Managers

The bigger the scale is, the better managers' educational background are. In general, the educational background is not quite good.

Scale	No.	Under High School		High School		College	
		No	%	No	%	No	%
<2000	2569	2058	80.11	499	19.42	12	0.47
2000~4999	8505	6651	78.20	1815	21.34	39	0.46
5000~9999	3976	2879	72.41	1041	26.18	56	1.41
10k~50k	2133	1319	61.84	742	34.79	72	3.38
50k~100k	81	30	37.04	30	37.04	20	24.69
>100k	20	4	20.00	12	60.00	4	20.00

Trends of Egg Industry in China

◆ Standardizing egg industry:

- ◆ Ministry of Agriculture of the People's Republic of China (MOA) is encouraging standardized and scale-up production system
- ◆ MOA is implementing “National Genetic Improvement Program of Layers (2012-2020)”
- ◆ The State Council has issued “Regulation on Pollution Prevention of Large-scale Livestock Production”

◆ Challenges:

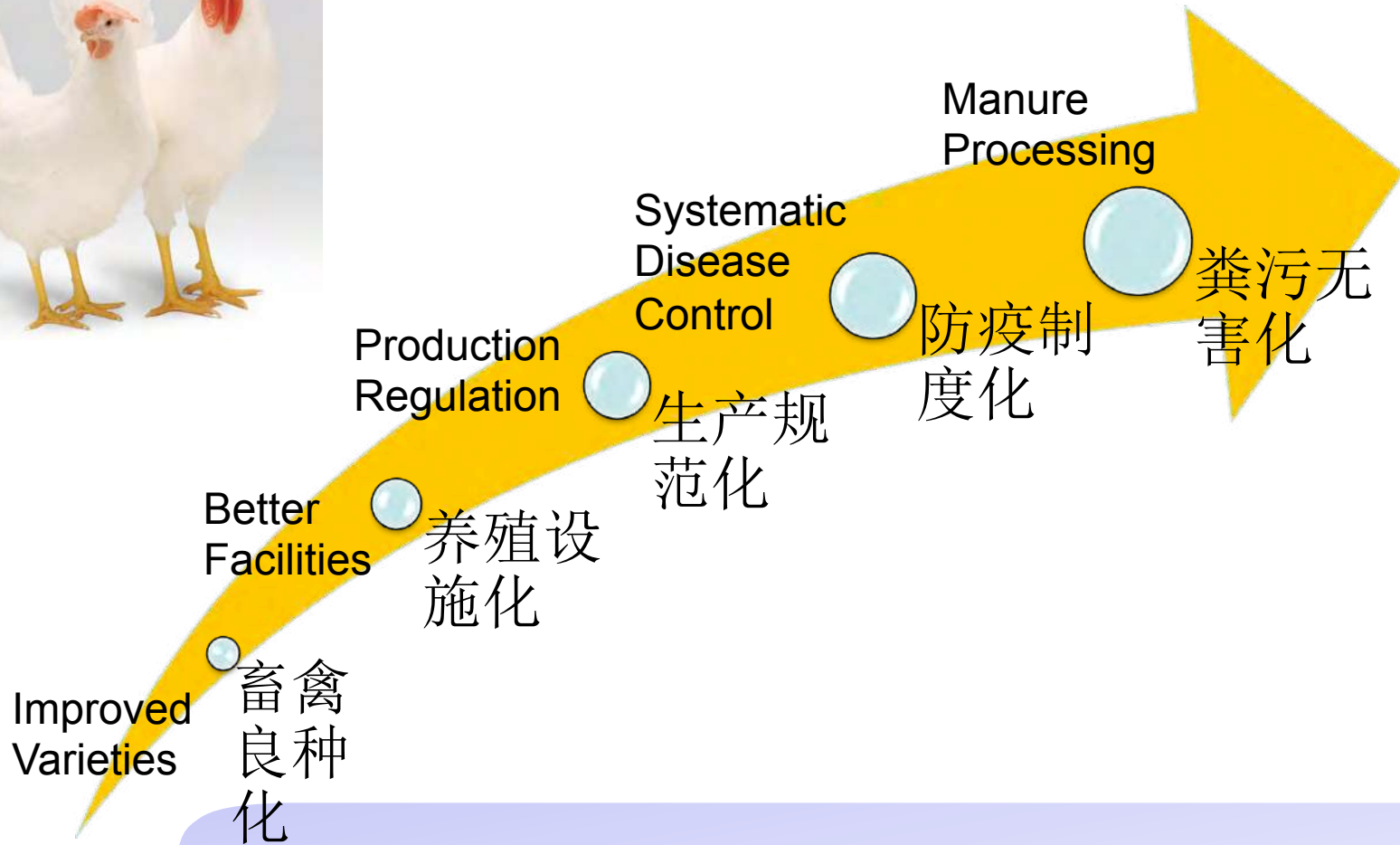
- ◆ Diversified industrial structure
- ◆ Inaccurate data
- ◆ Over production: especially of breeder
- ◆ Diseases threats: avian flu

Standardized and Scale-up Production of Layers

Standardization and scale-up are development direction of poultry production in China.

- Changing from dispersed and small-scale production to standardized and large-scale farms.
- The urgency and importance of achieving standardized management of poultry production has been recognized in many regions.





Promote Standardized Poultry Production

China Agricultural Research System for Layers

- National System for Layer Production Technology (NSLPT)
- Established in 2008 to promote the research innovation and technology transfer to the egg industry
- There are 6 research divisions with 26 top research scientists in China, working together to develop egg production technology
 - Division of Genetics and Breeding: 6 Scientists
 - Division of Disease Control: 6 Scientists
 - Division of Nutrition and Feed: 5 Scientists
 - Division of Production and Environment Control: 5 Scientists
 - Division of Egg Processing and Quality Test: 3 Scientists
 - Division of Economics: 1 Scientist



Experimental Stations

- Industry-based
- Collaborated closely with scientists for innovations related to egg industry
- Base for technology transfer
- 25 stations now, covering 17 provinces across the country

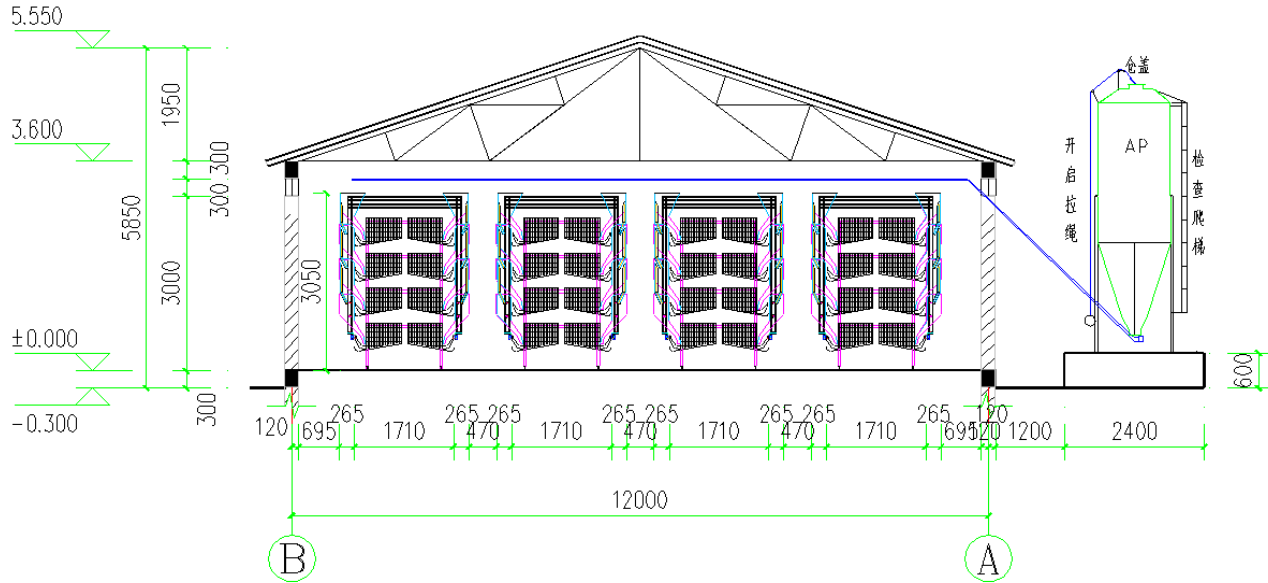
Key projects for 2011-2015

	Project
1	Comprehensive Technology for Standardized Layer Production System
2	Development of New Varieties and Breeding Technology
Genetic Improvement in Layers	
1	Genetic Improvement in Layers
2	Control of Main Virus Diseases in Layers
3	Eradication of <i>Salmonella</i> in Layers and Eggs
4	Development of Efficient and Environment-friendly Feeds
5	Processing and Utilization of Farm Wastes
6	Processing, Detection and Grading of Clean Quality Eggs
7	Production, Marketing and Industry Policies

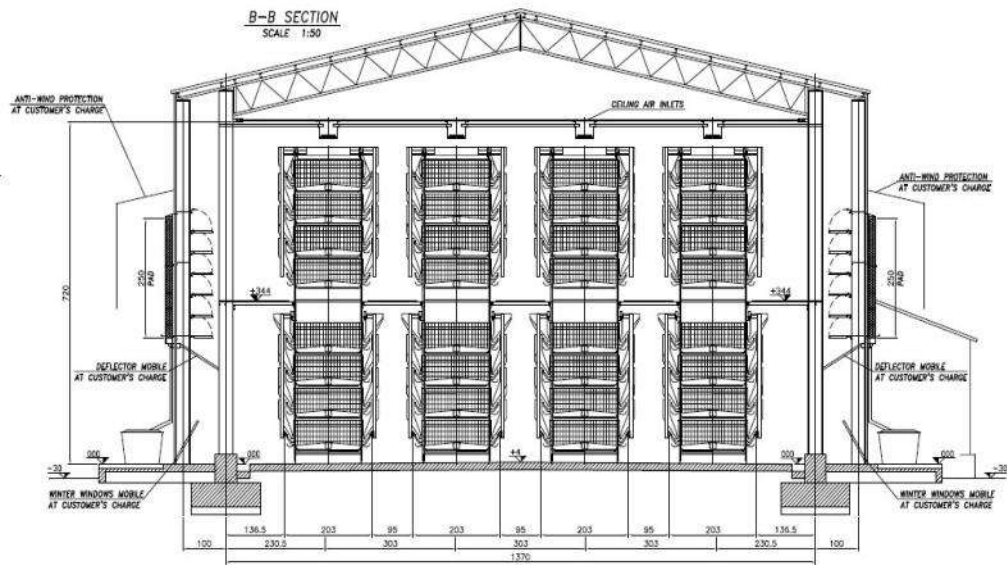
Major Modes of Standardized Layer Production

1. Large-scale and automatic production mode
2. Family farm mode





House Design of 4-Tier Cages with 30,000~50,000 Hens



House Design of 8-Tier Cages with 100,000 Hen Capacity

Family Farm Mode

- 5,000~20,000 hen per house, and 10,000~50,000 hen in a whole farm
- Fully enclosed house
- Three or four tiers cages: stair or vertical
- Artificial lighting, fan-curtain ventilation, automatic light control, drinking, and manure cleaning system
- Most manure applied to field, only few manure was processed to organic fertilizer
- Egg processing and brand establishment with cooperation in a region

Three or Four Tiers of Cage



Manure belt is used in newly built or reconstructed houses, which could reduce the pollution and improve the manure value.

From Functional Gene to New Varieties

- **A single dominant gene O for blue eggshell**



白壳蛋

褐壳蛋

绿壳蛋

- **Two Approaches to identify the O gene**

- Genetic : Linkage analysis

- Genomic: GWAS

Expression

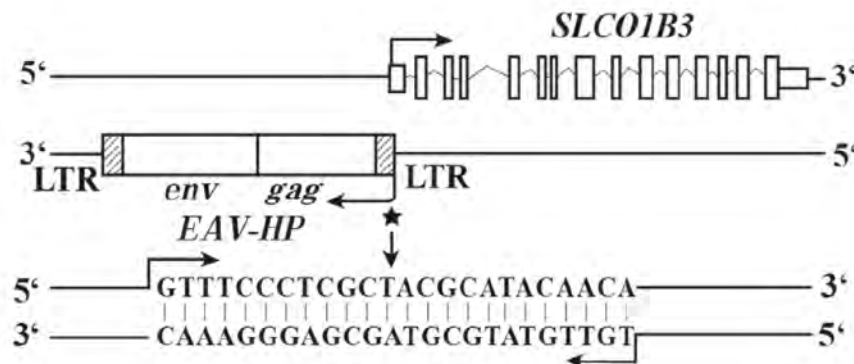
Sequencing

An *EAV-HP* Insertion in 5' Flanking Region of *SLCO1B3* Causes Blue Eggshell in the Chicken

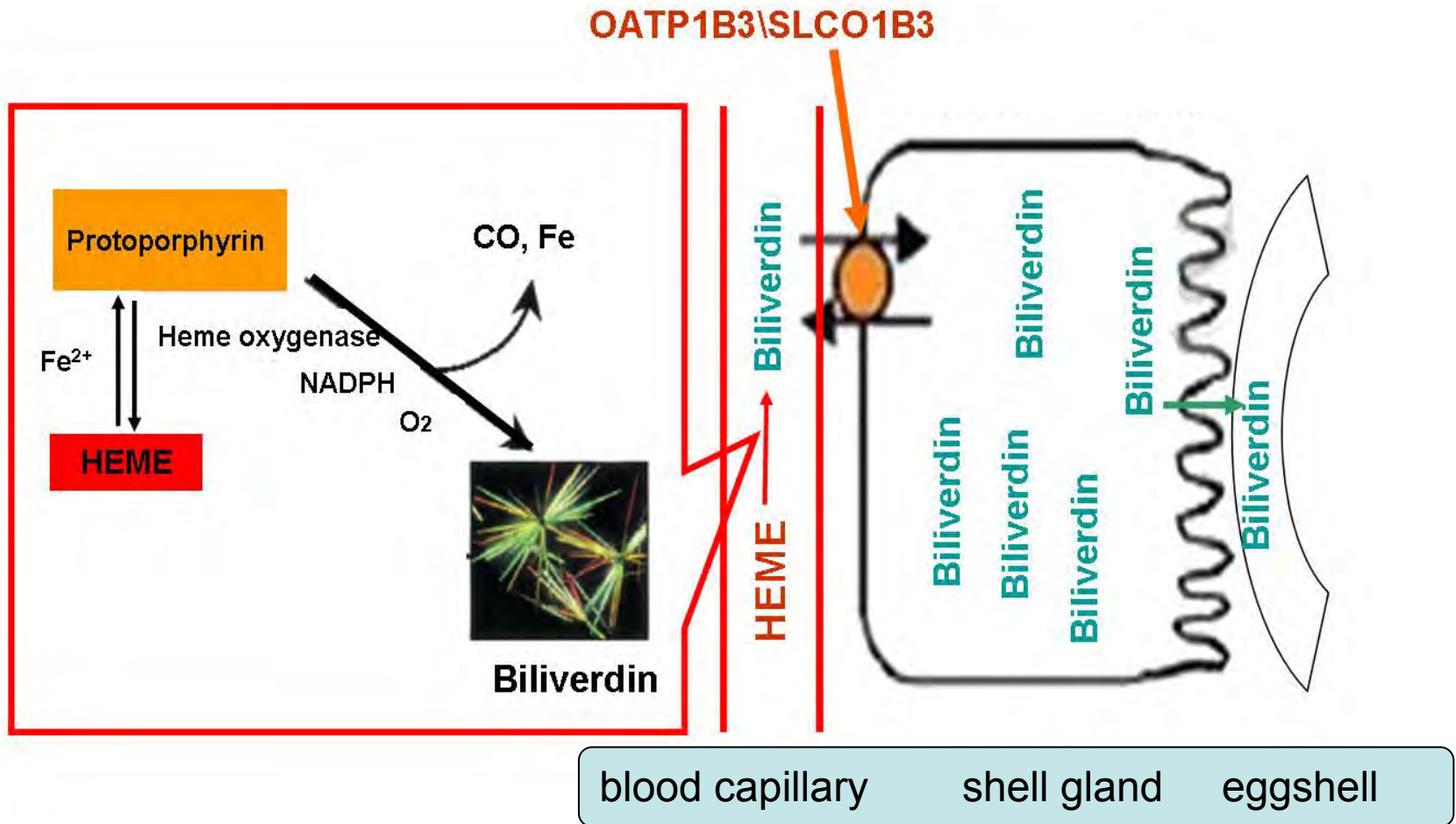
Zhepeng Wang¹, Lujiang Qu¹, Junfeng Yao¹, Xiaolin Yang, Guangqi Li, Yuanyuan Zhang, Junying Li, Xiaotong Wang, Jirong Bai, Guiyun Xu, Xuemei Deng*, Ning Yang*, Changxin Wu

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- With resequencing, we found an extra 24bp at the upstream of *SLCO1B3* mRNA and a 4.2kb *EAV-HP* insertion at 5'flanking region of *SLCO1B3* in blue eggshell chicken
- The *EAV-HP* insertion could promote the expression of *SLCO1B3*.

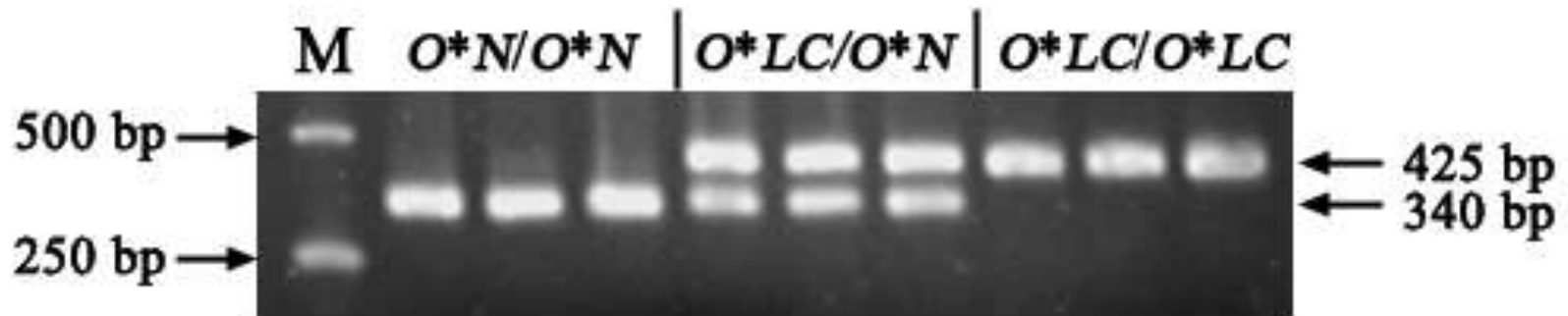


Mechanism of *SLCO1B3* in Forming Blue Eggshell



Application of the blue eggshell molecular marker for chicken breeding

➤ Diagnostic genotyping test of EAV-HP insertion



➤ Direct Selection for blue eggshell by using the molecular marker

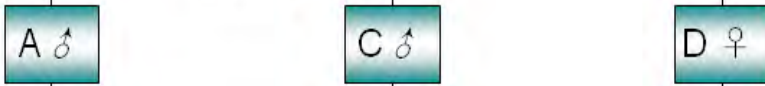
- Male
- Female
- Fixation of O gene in the population

Two Patterns of Crossbreeding

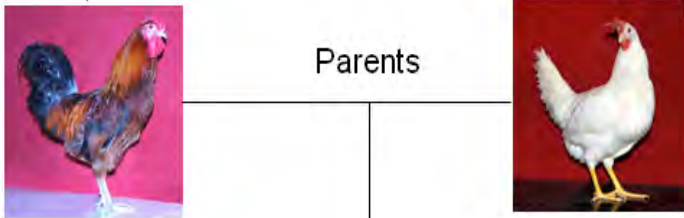
Pure Line



Grandparents



Parents



A

CD

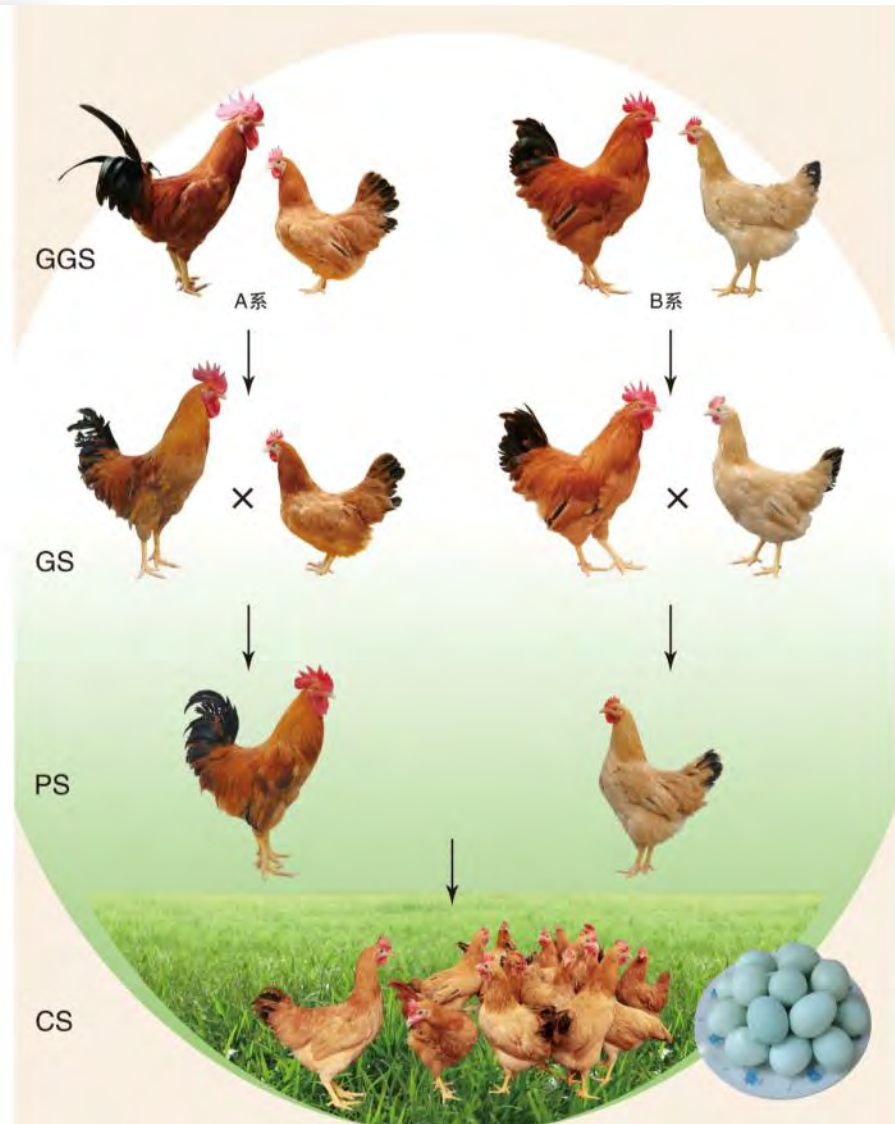
Commercials



ACD

ACD

ACD



Dwarf Layers: CAU-3

- Application of dwarf gene (*dw*)
- Commercialized and extended widely as efficient layers



- Three-way cross
- BW~1500g
- FC~90g/day,
- FCR<2.0



The XXV World's Poultry Congress (WPC2016)

- To be held from the 5th to 9th September, 2016
- Welcome to Beijing!





谢谢!
Thanks!

