CHINA: Henan Green Agriculture Fund Project

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Senior Agriculture Economist

WORLD BANK GROUP
Agriculture
The Food System is PART of the Climate Change Problem TODAY

Agriculture is the largest contributor of non-CO₂ GHGs.

- Land Use Change ~11% of total emissions
- Agriculture ~13% of total emissions

Food systems emissions contribute 19-29% of total GHG emissions.

IPCC 2014, CCAFS 2017
The majority of modeling studies agree that climate change impacts on crop yields will be negative from the 2030s onwards. Nearly half of projections beyond 2050 indicate yield decreases greater than 10%.

### Projected Yield Change (%)

<table>
<thead>
<tr>
<th>Change (%)</th>
<th>2010-2029</th>
<th>2030-2049</th>
<th>2050-2069</th>
<th>2070-2089</th>
<th>2090-2109</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; -50</td>
<td>25</td>
<td>25</td>
<td>25</td>
<td>25</td>
<td>25</td>
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<tr>
<td>-5 -10</td>
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<td>-10 -25</td>
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<td>-25 -50</td>
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<tr>
<td>&gt; 50</td>
<td>25</td>
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</tr>
</tbody>
</table>
The livestock sector is a large contributor to climate change in China. Enteric fermentation and livestock manure management contribute to 40 percent of Agriculture related GHG emissions in China.
Green Agriculture Finance in China and Challenges

Green Credit
$1.2 trillion

Green Agriculture
$8.9 billion

Green Bonds
$89.3 billion

- Structural barriers to increase access to agriculture finance apply to green agriculture finance as well
- Risks in agriculture and economic incentives are inequitably dispersed along the value chains
- Asymmetrical power and information in the value chains imposes higher coordination costs for small holders
- Segmented offering by the green financial system for agriculture is inefficient as agriculture requires comprehensive (and often in customized bundles), technology solutions with coordinated effort of lead firms and small producers
Green agriculture financing along the technology life cycle

Protocol for identification of green agriculture technologies, scientific validation of green impacts (GHG coefficients) and bundling them into green solutions for agriculture enterprises

Unified definition: Climate change mitigation and adaptation, pollution prevention and control, resource use efficiency, food safety, etc.
• **Unified definition of green agriculture**: will include climate change mitigation and adaptation, pollution prevention and control, resource use efficiency, etc.

• **Investment focus: value chain approach** to support investment opportunities in key high-risk livestock and crops

• **Sustainable finance approach**: the fund will **play rain maker** role adopting market driven approach and aligning financial incentives of investors, lenders and enterprises with social and environmental impacts

• **Leverage commercial capital**: local financial institutions and social capital will be **leveraged even while fund** will create attractive incentives for them by taking higher investment risks.

• **Align with national green agriculture programs and green finance policy**: the fund will **blend appropriately incentives and support measures** available under national green agriculture programs

• **Complementary investments in research, development and innovations**: fund will coordinate with research institutions and make complementary investments to **develop high impact ‘green’ technologies and solutions**.

• **Developing institutional capacity and governance systems**: Embedding **ESG** into core investment philosophy, **robust monitoring, reporting and verification (MRV) systems**, third-party verification systems and scientific validation of green impacts.
The Project Development Objective is to demonstrate the viability of financing green agriculture investments and foster the innovation and adoption of green agriculture standards and technologies in Henan.

- Henan Agriculture Development Finance and Investment Company (SOE) established a Fund of Funds - Green Agriculture Fund (GAF).
- The fund will also create sub-funds raising investments from private sector and local governments.
- Professional Fund Management Company
- EQUATOR Principles
- Green Bonds to refinance green agriculture portfolio
Thanks for your attention:
Clarifications and Discussions welcome
**Position**

- A large financial conglomerate with assets portfolio of 200 billion RMB
- A major institutional investor and financier in the development of a strong modern agriculture in Henan Province
- An important vehicle for expanded financial services
- Comprehensive investment and financing functions and instruments

**Four Platforms**

- The platform for implementing the national Rural Revitalization Strategy
- The platform to promote industrial transformation, upgrading & development
- The platform for partnership with financial institutions and leverage social resources
- The platform for state-owned capital to invest and operate projects in agriculture sector
• Henan Agricultural Development Fund Investment Co., Ltd. was established on December 16, 2009, managing an asset portfolio of 100 billion yuan (US$ 15.5 billion).

• The company is the fund business vehicle of Henan Agricultural Comprehensive Development Company and the trustee of the government fund.

• It aims to invest in enterprises with high growth potential and related to Henan and enterprises in other fields supported by the government.

• Main focus areas cover modern agriculture, advanced manufacturing, scientific and technological innovation enterprises, small and medium-sized enterprises, culture, industrial agglomeration areas, etc.

• Up to now, the company has entrusted and independently established 24 funds, with a total scale of 99.882.5 billion yuan.
### Henan Green Agriculture Fund Project

**Launch (2021)**
- Inception on the Green Agricultural Fund (GAF)
- Embedding ESG in investment cycle
- Measurement systems
- Innovation Challenge Platform
- Financial sector collaborations

**Focus (2022-2023)**
- Focus value chains and geographies
- Target high impact technology solutions
- Partnerships with local governments
- Partnership with private sector

**Benchmark (2024)**
- ESG systems
- Green Impacts
- Portfolio quality

**Scale (2025-2026)**
- Portfolio expansion
- Portfolio refinancing - Green Bonds

**Widescale (2026+)**
- System-wide impacts
- Lessons for global replication
Why did we launch the project with the Innovation Challenge?

◆ Tech/Solution Platform
Develop a platform to attract the best technologies and solutions in the world and in China

◆ Green Agriculture Ecosystems
Create an ecosystem that brings unique value to our clients and partners

◆ Knowledge Sharing Platform
Create a knowledge sharing platform for the green innovators, academic institutions, and enterprises

◆ Pipeline Building
Identify potential pipeline projects both in early stage and growth stage and prepare them for high impact green investment
Innovation Challenge Platform

Bring together China's green agro-ecosystem partners

Vision of the Innovation Challenge Platform

Through innovation Challenge, green agricultural technologies with promotional value will be selected around the world to attract commercial investment and support the extension and application of start-up technologies.

Technical & industry organization

- Chinese Academy of Agricultural Sciences
- China Agricultural University
- Henan Academy of Agricultural Sciences
- Beijing IoT Association
- TA Grants
- Venture Capital investment
- Debt instruments

International organizations and Corporate Foundations

- IFC, FAO, Swiss Agency for Development and Cooperation, Syngenta Foundation

Investors in agriculture

- Social capital (including various financial institutions), guarantee, insurance, microfinance and other agricultural related financial services

$6 million Innovation Challenge Fund
Improving Resource Use Efficiency
Improve the efficiency of resource and energy inputs and outputs; Improve crop field management and whole process management of breeding; Reduce post harvest loss and waste; Promote the reuse and recycling of resources.

Reducing GHG Emission
Reduce greenhouse gas (GHG) emissions from agricultural activities through circular economy, carbon and nitrogen management and the production and utilization of renewable energy.

Reducing Agriculture Pollution
Prevent and reduce non-point source pollution; Reduce pollution in breeding process; Reduce soil loss from farming; Reduce animal feces and the fatality rate of livestock and poultry; Reduce ineffective crop waste.

Increasing Climate Resilience
Improve the capacity of regional agriculture to cope with and recover from the impacts of climate change. To enhance the resilience of agricultural systems and reduce vulnerability.

Enhancing Food Safety
Reduce the loss of food quality caused by harmful microorganisms, toxins and chemical pollutants; Develop food processing technology to improve the safety of immediately-edible fruits and vegetables.
1. Call for Proposals
Open solicitation is organized and applicants from universities, research institutions, financial institutions and enterprises may submit their proposals through online and offline channels.

2. Road Show
Organize roadshow to our clients and potential innovators

3. Proposal evaluation
Experts in relevant fields were employed to carry two rounds of evaluation and score according to pre-defined evaluation criteria and select the winning projects.

4. Final Selection
The finalists are invited for roadshow presentation, and the winners are provided with opportunities to interact directly with interested investors.
Methodologies

- A set of assessment criteria which consist of 6 elements were prepared in line with international practices and experience.
- A group of experts with diverse professional backgrounds are invited to go through two rounds of review and evaluation processes.
- Shortlisted projects were selected according to their scores and invited for virtual interviews.
- 6 schemes finally stood out and won the innovation technology award, and 10 schemes won the innovation demonstration award.

**Assessment Criteria**
Henan Green Agricultural Fund Innovation Challenge

- Problem Statement & Value Proposition
- Value Creation
- Impacts
- Alternatives/Benchmark
- Maturity and Finance
- Entrepreneurs (and the Founding Partners)

**Total Score:** 100
Outcome of the 1\textsuperscript{st} Innovation Challenge

➢ **A considerable number of submissions**
Collected 72 green agriculture innovation submissions that covering a variety of areas with relatively good quality

➢ **Shortlisted innovations through competitive assessment**
15 innovations were shortlisted from the submissions based on two rounds of technical reviews and interview processes by a group of technical and financial experts.

➢ **Innovation candidate preparation**
The innovation proposals not entered the final will be included in innovation inventory as the candidate for future follow-up and pipeline appraisal and preparation.

➢ **Green Agriculture Ecosystems**
Through the implementation of 1\textsuperscript{st} Innovation Challenge, the team has set up an initial network of research institution, commercial and technical partners.
How do we go from there

**Screening & Targeting**
- 72 application proposals
- 16 shortlisted innovation and on-site exhibitions
- 10 companies won the innovation demonstration Award
- 6 companies won the Innovation Technology Award

**Follow up on Financing Opportunities**
- Mobilizing grant to support the development of business models and investment case
- Connecting the winning teams with venture capital, financial institutions, guarantee insurance, microfinance and other agricultural related financing opportunities

**Application and Replication**
- Prioritize support to projects that meet green standards, such as resource utilization of livestock and poultry breeding waste, water-saving irrigation, clothing and medicine reduction and harm control in Henan Province

**Demonstration Effect**
- Leverage social capital to jointly support green agriculture in Henan Province, use world bank loan project to promote demonstration of the innovation technologies.

**Greater Green Impact**
- Build a green agricultural industrial chain, promote the high-quality green development of agriculture in Henan, and accelerate the transformation of agriculture in the Province.
If you want to get more details, please contact us:
E-mail: gafpmo@hnntgroup.com
Biofeed Technology - A Road to Green Development in Animal Husbandry

Dr. Liu Shijie

Biofeed (Beijing) Biotechnology Co., Ltd.
September 16, 2021
I. Company profile

II. Biofeed

III. Technical advantages of biofeed

IV. Green benefits

V. Challenges
Biofeed is the only designated transformation platform for the industrialization of scientific and technological achievements of the National Engineering Research Center of Biological Feed, relying on the technology of the Feed Research Institute Chinese Academy of Agricultural Sciences and other organizations, and is a platform enterprise driven by “technology + capital”.
There are 52 full-time R&D staff, among whom 65% are masters and doctors, with an average age of 35 years old. The company has more than 50 independent intellectual property rights. Besides, it is a national high-tech enterprise, a high-tech enterprise in Zhongguancun, a pilot enterprise of intellectual property rights in Beijing, a company with national intellectual property management system certification, and a credit enterprise in Beijing.
Biofeed

The use of feed ingredients and additives is allowed by the feed ingredients catalog and feed additives species catalog of the Ministry of Agriculture and other relevant national regulations. The feed products are developed through bioengineering technologies, including fermentation engineering, enzyme engineering, protein engineering and genetic engineering are collectively known as fermented feed, enzymatic feed, synergically fermented feed with microbes and enzymes and biofeed additives.

-- National Engineering Research Center of Biological Feed (Group Standard T/CSWSL 001-2018 “Classification of Biofeed Products”)

Biofeed as the fourth generation of feed in China provides technological solutions for industry transformation and upgrading
<table>
<thead>
<tr>
<th>Traditional feed technology</th>
<th>Biofeed technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical and chemical applications</td>
<td><em>in vitro</em> predigestion and gut microbial modulation</td>
</tr>
<tr>
<td>Single point technology</td>
<td>Multi-factor synergy such as &quot;microorganism + nutrition&quot;</td>
</tr>
<tr>
<td>American-style formula</td>
<td>Formula system with Chinese characteristics</td>
</tr>
<tr>
<td>Animal nutrition</td>
<td>Eco-circulation breeding mode</td>
</tr>
</tbody>
</table>

**Technology Leap**

**Pioneering the fourth generation of feed in China - “live” feed**
## Advantages of biofeed

### Better production performance

<table>
<thead>
<tr>
<th>Species</th>
<th>Item</th>
<th>Data interval</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Egg laying rate</td>
<td>6.62%</td>
</tr>
<tr>
<td></td>
<td>Average egg weight</td>
<td>2.26</td>
</tr>
<tr>
<td></td>
<td>Feed-to-egg ratio</td>
<td>0.04</td>
</tr>
<tr>
<td></td>
<td>Survival rate</td>
<td>3%</td>
</tr>
<tr>
<td></td>
<td>Feed intake</td>
<td>4.46%-17.02%</td>
</tr>
<tr>
<td></td>
<td>Daily weight gain</td>
<td>7.89%-27.3%</td>
</tr>
<tr>
<td></td>
<td>Feed-to-weight ratio</td>
<td>5.87%</td>
</tr>
<tr>
<td></td>
<td>Slaughter rate</td>
<td>3.37%-8.33%</td>
</tr>
<tr>
<td></td>
<td>Net meat rate</td>
<td>11.43%</td>
</tr>
<tr>
<td></td>
<td>Milk yield</td>
<td>11.4%-11.5%</td>
</tr>
<tr>
<td></td>
<td>Eye muscle area</td>
<td>7.02%-12.71%</td>
</tr>
<tr>
<td></td>
<td>Daily weight gain</td>
<td>67.5-88.8 g</td>
</tr>
<tr>
<td></td>
<td>Feed-to-meat ratio</td>
<td>0.16</td>
</tr>
<tr>
<td></td>
<td>Specific growth rate</td>
<td>0.37</td>
</tr>
<tr>
<td></td>
<td>Mortality rate</td>
<td>50%</td>
</tr>
<tr>
<td></td>
<td>Feed efficiency</td>
<td>1.2%</td>
</tr>
<tr>
<td></td>
<td>Growth rate</td>
<td>38.96%</td>
</tr>
<tr>
<td></td>
<td>Weight gain</td>
<td>26.42%</td>
</tr>
<tr>
<td></td>
<td>Specific growth rate</td>
<td>17.86%</td>
</tr>
</tbody>
</table>

### Better quality of livestock products

<table>
<thead>
<tr>
<th>Species</th>
<th>Product</th>
<th>Indicator</th>
<th>Data interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Egg</td>
<td>Breakage rate</td>
<td></td>
<td>0.1%</td>
</tr>
<tr>
<td></td>
<td>Content of total flavonoids, etc.</td>
<td>Increased content of total flavonoids, lecithin and linoleic acid in eggs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yolk color</td>
<td>Improved Roche yolk ratio of raw and cooked yolks</td>
<td></td>
</tr>
<tr>
<td>Chicken</td>
<td>Heavy metals (lead, cadmium)</td>
<td>Decreased by 27.83% and 37.96%, respectively</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Inosinic acid</td>
<td>12.07%</td>
<td></td>
</tr>
<tr>
<td>Beef</td>
<td>Muscle tenderness</td>
<td>12.37%-20.20%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Oleic acid in muscle</td>
<td>6.47%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Linoleic acid</td>
<td>9.21%-17.06%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Flavor amino acid lysine</td>
<td>3.81%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Alanine</td>
<td>7.81%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Glutamic acid</td>
<td>4.98%-17.2%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Marbling score</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Interstitial fat</td>
<td>77.58%</td>
<td></td>
</tr>
<tr>
<td>Milk</td>
<td>Milk protein</td>
<td>3.11%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Milk fat</td>
<td>6.71%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lactose</td>
<td>2.92%</td>
<td></td>
</tr>
<tr>
<td>Pork</td>
<td>Antibiotic residue</td>
<td>Less than 0.1mg/kg, lower than EU standard</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Flavor amino acid</td>
<td>2.2%</td>
<td></td>
</tr>
<tr>
<td>Shellfish</td>
<td>Crude protein content</td>
<td>49%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Crude fat content</td>
<td>4%</td>
<td></td>
</tr>
</tbody>
</table>
The mode of fermented feed + liquid feeding + planting and breeding circulation

Solve three major problems

✓ Food safety
✓ Environmental protection
✓ Shortage of feed resources
山下无抗土猪，以中国珍稀基因、无抗有机营养，铸就出史家无比的无比比比。美农家必选的国猪地位不可替代不可动摇。
The liquid feed line has been applied in 12 provinces and cities in China, and the feeding volume now reaches more than 9 million pigs. It is expected to exceed 100 million pigs in the next 5 years, equivalent to the entire slaughter of Henan Province.
<table>
<thead>
<tr>
<th>Up 10%</th>
<th>Down 60%</th>
<th>Food safety</th>
<th>Planting and breeding circulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>It improves the digestibility of feed by 10%, reduces pollutant discharge and protects the ecological environment</td>
<td>It effectively reduces the content of NH₃, CO₂ and H₂S in animal building by 60% and improves the breeding environment, while addressing the overall recycling of C and N.</td>
<td>It integrates the comprehensive solution of alternative feed, improves the intestinal health of animals, without antibiotics and drug residues, and ensures the food safety of animals.</td>
<td>It makes efficient use of by-products of 2.3 billion tons agricultural and sideline products processing, reduces agricultural non-point source pollution, and builds a regional planting and breeding circulation model.</td>
</tr>
</tbody>
</table>

It improves the utilization efficiency of feed resources through **biofeed technology**, reduces non-point source pollution and harmful gas emissions, ensures food safety, truly realizes planting and breeding circulation, and ensures the green and sustainable development of animal husbandry.
**Challenges**

<table>
<thead>
<tr>
<th>One</th>
<th>Two</th>
<th>Three</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Funds:</strong> Promotion of supporting technologies and equipment</td>
<td><strong>Talent:</strong> Interdisciplinary technical talents</td>
<td><strong>Technology:</strong> In-depth study of theory; differentiated integrated technical solutions</td>
</tr>
</tbody>
</table>

Increasing the feed utilization of fermentation sources, realizing the precise nutrition through liquid feeding, creating a formula system with Chinese characteristics, and truly realizing the planting and breeding circulation are the fundamental ways to stabilize food production, eliminate aquaculture pollution and solve food safety, and it is a long-term solution to realize the sustainable development of agriculture and animal husbandry, which will contribute to Chinese wisdom and provide Chinese solutions for world agriculture and animal husbandry.

Dr. Cai Huiyi  
Director  
National Engineering Research Center of Biological Feed  
September 2020
BIOFEED FOR BETTER LIFE
Climate Smart Rice Planting (CSRP) for High Yield & Less GHG Emission

Prof. Weijian Zhang   Jun Zhang
Chief Scientist of Agro-ecology and Farming System, CAAS

Institute of Crop Sciences, Chinese Academy of Agricultural Sciences (CAAS)

E-mail: zhangweijian@caas.cn;    Tel: 010-62156856    15810789930
1. Brief Introduction of ICS, CAAS

Institute of Crop Sciences, Chinese Academic Agricultural Sciences

(1) a non-profit state-owned institute established in 1957
(2) researches on crop germplasm resource, molecular biology, crop breeding, cultivation physiology and farming system
(3) National Engineering Laboratory of Crop Molecular Breeding, National Plant Transgenic Technology Research Center, etc.
2. Key Technologies of CSRP

Climate Smart Rice Planting (CSRP), is a kind of integrated rice cropping system, including climate resilient crop cultivars, new tillage to relive waterlogging, increasing oxygen in topsoil, energy-saving tillage-sowing-fertilizing machinery, and rotation with cover crop.
Necessity of producing more rice with less methane

Carbon emission challenge: China’s carbon emission peaking in 2030, emission intensity declining by 60-65% compared to that in 2005

Deng et al., 2016, The Crop Journal
Theoretical basis for balancing rice yield and CH$_4$

(Global Change Biology, 2017; 2018 Science Advances, 2019)
Impacts of soil $O_2$ content on yield & CH$_4$ emission

Soil $O_2$ can promote rice root growth and stimulate CH$_4$ oxidization. Non-flooded ploughing can produce comparable rice yield with significant reduction in GHG emission intensity in main China’s rice planting regions.
Key techniques of CSRP

- high-yielding cultivar with less CH$_4$
- Non-flooded ploughing to improve soil structure
- Water saving irrigation
- Rice ratooning technology in south China regions
3. Application of CSRP in China

Climate Smart Agriculture: Coping with Climatic Warming for Food Security
- Production Improvement Efforts
- Emission Mitigation Efforts
  - Breeding new crop variety
  - Enhancing soil quality
  - Reducing CH₄ emission
  - Reducing N₂O emission
  - Improving irrigation
  - Increasing SOC storage

Rebuilding resilience to warming
Mitigating climatic warming

Objectives: Producing more grain with less GHG emissions

Extension of climate smart rice planting in China
Producing more grain with less GHG emission in main China’s rice cropping regions

Chen et al., Nature, 2014
4. Challenges facing of CSRP

➢ Needing to change the farmers’ idea and production modes, especially small farmers (knowledge renewal)
➢ Needing demonstration for one or two years at a small scale in several sites, and then being applied in a large scale to reach the whole goals of resolving the above problems

Thanks for your attentions!
Anti-fungal and insect repellent fruit bags made from natural plant extracts that may reduce fruit damage by 50%
Traditional fungicide are mainly used to ensure the yield at present, but there are conflicts between traditional fungicide and the environment and food safety. Low-toxic fungicide are characterized by short duration of action and narrow anti-fungal spectrum.

### Key problems:

The best time to control the disease is before it can be detected.

The preventive application of fungicide requires strong efficacy and long duration, while the preventive application with new fungicide is ineffective, resulting in the dominance of traditional fungicide.

<table>
<thead>
<tr>
<th>Pesticide type</th>
<th>Duration of action</th>
<th>Stability</th>
<th>Inhibition spectrum</th>
<th>Environmental impact</th>
<th>Safety impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>New fungicide (Low toxic)</td>
<td>Short</td>
<td>Low</td>
<td>Narrow</td>
<td>Small</td>
<td>Small</td>
</tr>
<tr>
<td>Traditional fungicide</td>
<td>Long</td>
<td>High</td>
<td>Broad</td>
<td>Big</td>
<td>Big</td>
</tr>
</tbody>
</table>

**Market Pains**

- **Conflict existing between pesticide reduction and the pursuit of yield**

**Solutions**

- **Traditional fungicide**
  - Are mainly used to ensure the yield at present, but there are conflicts between traditional fungicide and the environment and food safety.
  - Are characterized by short duration of action and narrow anti-fungal spectrum.

**Technical Advantages**

- **Low-toxic fungicide**
  - Short duration of action
  - Narrow anti-fungal spectrum

**Team Introduction**

- **Market Pains**
  - **Solutions**
  - **Technical Advantages**
  - **Team Introduction**
  - **Status Quo & Planning**
  - **Technology Outlook**
  - **Challenges**
Build up a library of pathogenic fungal and a library of anti-fungal spectra against pathogens based on a wide range of plant extracts. Identify important pathogenic fungal of specific crop species and their anti-fungal drugs. Develop specific anti-fungal formula for main production areas based on pathogen spectrum library.

Develop anti-fungal formula based on microbial community diversity analysis for long-term anti-fungal purpose; regularly detect change laws based on specific primer RT-PCR technology to guide preventive application.

Study of anti-fungal spectrum based on natural extracts and a wide range of disease species

Diverse application carriers

251 kinds of pathogens

268 kinds of extracts

In-season pathogen diversity analysis

Targeted anti-fungal formula
Solving the problem: R&D based on the comprehensive green and safe input formula

The development of formula is based on:

- Isolating, identifying and preserving 251 kinds of pathogens. They are isolated from 24 kinds of fruits and vegetables including kiwifruit, strawberry, grape and blueberry, which are the core resource of the platform;

- Using 268 kinds of extracts from fruits, vegetables, spices, Chinese herbal medicines and Tibetan herbal medicines as the sources of formula, and conducting anti-fungal spectrum research on pathogens;

- Analyzing the pre-harvest planting environment and the microbial diversity on the surface of fruits and vegetables. Determining the formula for the main diseases of the year and eliminating the high-risk parks of post-harvest diseases;

- Studying the synergistic and inhibitory effects of extracts, extracts and excipients to evaluate the scientific nature of the formula;

- Using food safety, drug’s side effects, and local laws and regulations on sales terminals as safety evaluation indicators;

- Developing targeted cross-reacting antifungal formula based on biodiversity, antifungal spectrum and safety research.
Carrier landing: Application effect

**Main R&D**

- Natural plant extracts compounded with anti-fungal and insect repellent formula
- Natural plant extracts compound with mixed coexistence property
- Industrial production process of anti-bacteria and insect repellent packaging products made from natural plant extracts

**Products**

- Safe and green fruit bags with anti-fungal and insect repellent function

**Product Superiority**

- Duration up to 4 months
- Keep reducing the incidence of diseases and pests
- Improve fruit quality and merchantability
- Stabilize fruit production and reduce wastage
- Extend the storage and shelf life of fruits
- Natural and eco-friendly
- No comparable product domestic and overseas

**Government awards & projects obtained**

- One of 2017 “Top Ten” Agricultural Innovation and Entrepreneurship Projects in Chengdu (natural preservative for Kiwifruit)
- 2019 Second Prize of Sichuan Provincial Science and Technology Progress (fruit and vegetable preservation technology)
- Selected in 2020 major project reserves involving“agriculture, rural areas and rural residents” of Chengdu Municipal People’s Government (anti-bacteria fruit preservation technology and packaging made from natural plant extracts)
- Innovation Demonstration Award of 2021 the First China - World Bank Henan Green Agriculture Innovation Challenge Competition (anti-bacteria and insect repellent fruit preservation bags made from natural plant extracts)
Data on the use of anti-fungal and insect repellent fruit bags made from natural plant extracts for kiwifruits

<table>
<thead>
<tr>
<th>Kiwifruits</th>
<th>Amount of Fruits (number)</th>
<th>Amount of Products (number)</th>
<th>Unit Price (Yuan)</th>
<th>Revenues (Yuan)</th>
<th>Gross Profit Rate (%)</th>
<th>Gross Profit (Yuan)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5 billion</td>
<td>1.5 billion</td>
<td>0.06</td>
<td>90 million</td>
<td>50%</td>
<td>45 million</td>
</tr>
</tbody>
</table>

1.5 billion anti-fungal bags covers approximately 150,000 mu. If the loss is lowered by 1,000 yuan per mu, the total loss is decreased by 150 million yuan.

Estimated economic benefits like revenue and loss of using anti-fungal and insect repellent fruit bags for 8 major kinds of fruits in Henan Province

<table>
<thead>
<tr>
<th>Fruits</th>
<th>Plant Area</th>
<th>Yield</th>
<th>Output Value</th>
<th>Estimated Amount of Fruit Bags</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xixia kiwifruits/Yanshi grapes/Zhengzhou peaches/Lingbao apples/Ningling pears/Zhengzhou cherries/Xingyang persimmons/Xingyang pomegranates</td>
<td>5.29 million mu</td>
<td>10.03 million tons</td>
<td>92.6 billion yuan</td>
<td>35.5 billion</td>
</tr>
</tbody>
</table>

If the above 8 main fruit categories in Henan Province all use the functional fruit bags and the final loss rate is lowered by 6%, the reduced loss amounts to about 5.6 billion yuan, which subtracts the cost of 603 million yuan of the functional fruit bags, there is still a profit of 4.958 billion yuan.

**Increased efficiency, and less pesticide application, i.e. before bagging and before harvesting***
Team composition: business promotion + technical innovation + production management

**Founder / CEO:**
Wang Yan
Master of School of Design, Jiangnan University
Over 20 years of experience in packaging industry management, five years as vice president of university
Served as deputy secretary general of Chengdu Association of Packaging Technology
Co-founded the first domestic internet B2B platform of packaging industry and served as CEO

**Expert of preservation technology / CTO:**
Liu Ji
Senior engineer of Chengdu Academy of Agriculture and Forestry Sciences, doctor of agriculture
13 years of experience in research on the application effect and mode of pathogenic microorganism and natural inhibitors in all life cycles of fruits and vegetables
Obtained several patents for invention, and several provincial and municipal scientific research awards

**Co-founder / COO:**
Guo Lei
Bachelor degree
12 years of sales management experience in packaging industry (including four years in the management position in a listed packaging enterprise)
Served as Chief Supervisor of Chengdu Association of Packaging Technology

**Technical partner:**
Chengdu Academy of Agriculture and Forestry Sciences
Comprehensive agriculture and forestry R&D institute directly under the Chengdu Municipal People’s Government

**Production partner:**
Sichuan Tianxing Smart Packaging Co., Ltd.
NEEQ listed company of smart packaging and C2B customization
Dr. Yan Jing
Associate professor Institute of Food Processing and Safety of College of Food Science, Sichuan Agricultural University
Doctor of food science of Wageningen University & Research
Presiding over the launching project of “Academic Leaders” of Sichuan Agricultural University

Dr. Xie Yongdong
Doctor from College of Horticulture, Sichuan Agricultural University
Specializing in fruit and vegetable cultivation physiology and quality control, and fruit and vegetable storage and processing after harvest
Won the second prize of Science and Technology Progress of Sichuan Province, and mainly researched or participated in more than ten provincial and municipal scientific research projects

Dr. He Jingliu
Lecturer of Ya’an Polytechnic College, head of food processing technology, head of the school’s scientific research platform, head of the innovation team
Specializing in the research and development of agricultural products
Taking charge of several projects of Science and Technology Department of Sichuan Province

Master Lu Qiyu
Master of College of Food Science, Sichuan Agricultural University
Specializing in the anti-fungal mechanism of natural extract ingredients.
Head of Cultivation Program of Sichuan Science and Technology Innovation and Entrepreneurship Seedling Project

Team Introduction
Team Leader
Dr. Liu Ji
Existing achievements

Extracting anti-fungal and insect repellent ingredients from 268 kinds of natural plants; Isolating; identifying and preserving 251 pathogenic fungi and bacteria from different fruit varieties;

Developing special facilities and techniques such as coating and bagmaking;

Making “anti-fungal and insect repellent fruit bags” into real product;

No pesticide residues detected by the EU’s 242 pesticide residue tests in all bags.

5-year plan

To build a production base in Henan Province, with a construction period of 5 years;

To achieve an annual output of 10 billion anti-fungal and insect repellent fruit bag;

To cover about 100,000 hectare orchard garden in Henan and surrounding provinces;

The value of reduced loss is amounted to about 1.4 billion yuan;

Reduce the use of fungicides or insecticides in the orchard at least once per year.
Path for the development of more products and services

- **Product:** Functional fruit labels
- **Product:** Functional fruit bags
- **Product:** Protective film for tree trunk and leaf
- **BiobARRIER technology**
- **Anti-fungal spectrum library**
- **Pathogenic bacteria library**
- **Immediate prevention formula**
- **Long-term anti-fungal formula**
- **Long-term disease detection and early warning**
- **Rapid disease prediction**
- **Service:** Precise application instruction
  - **Service:** Storage resistance prediction

**Application modes**
**Application carriers**
**Core resources**
Insufficient production capacity
Since the trial sales in 2019, the product orders have been increasing by 10 times per year. At present, limited by the size of the company, it is impossible to arrange the equipment, personnel, and venues for the production of functional fruit bags at one time.

Long distance transportation of raw materials
85% of the special paper, plant extracts, food additives and other raw materials required for the product are from Henan Province. The existing Sichuan factory is facing high transportation costs of raw materials and products.

Lack of R&D funds
The research of pathogen library and anti-fungal spectrum library, which involves the isolation, identification, preservation and anti-fungal test of pathogens, requires a large number of researchers and equipment. The existing team research funds cannot support the rapid establishment of databases for multiple main producing areas and multiple types of fruits and vegetables at the same time.

The subsequent “rapid disease prediction kits” and “new synthetic fungicide” require the introduction of more advanced equipment and senior R&D personnel. The existing research conditions and salary will become the bottleneck of subsequent research and development.
As Fresh As Ever

- Integrated service supplier of fruit preservation packaging
- R&D jointly with Chengdu Academy of Agriculture and Forestry Sciences in the mode of “technical background of the research institute + enterprise application after adjustment + enterprise production and sales”
- The first one nationwide, without like products on the market
- Having laboratory with the largest volume of fruit pathogen in China
- Anti-bacteria and insect repellent fruit preservation technology friendly to the environment

Anti-fungal and insect repellent fresh preservation fruit bags made from natural plant extracts