The New Requirements and Development Trend of Apple Plant Protection in China

INTERPOMA CHINA 2019 – SHANGHAI

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1. Review of the apple IPM in CHINA

Three steps

1. From 1920s to 1950s: Initiation of scale cultivation and its plant protection

2. From 1950s to 2005: focus on the biology, epidemiology and control with limited pesticides

3. Recent 20 years: fast development of pesticides and overuse
1. Review of the apple IPM in CHINA

Initiation of scale apple cultivation

Shanxiang LI: Patriotic personage (the father-in-law of general ZHANG Aiping), for supporting the poor people, established “Shengsheng Orchard” in 1928 in Jinzhou areas, later, established “Gengyu Academy” to train the managers and technicians.
In “Gengyu Academy”, trained many students for orchard management, some of them became the leader of the research institute and national fruit farm. In that time, 70% apple products of CHINA in Liaoning province. Chairman Mao mentioned Jinzhou apple 3 times
1. Review of the apple IPM in CHINA

Initiation of apple plant protection

In the end of 1940s, Apple Canker outbroke in south of Liaoning, Yu Dafu, the headmaster of Beijing Agriculture University, the first time, organized the plant pathology team for it under the request of the local government, it is the first time;

In 1950s, Prof. CHEN Yanxi clarified the reason of low trunk nutrition of apple tree during he stayed in North-East Agriculture Academy (now the IPCAAS)

YU Dafu, Famous Plant Pathologist, Agricultural Microbiologist, Agricultural educationalist. One of the founders of plant pathology in CHINA

CHEN Yanxi, Famous Plant Pathologist, big contribution on Fruit pathology & Pathogen ecology, put forward the concept of natural ecosystems of plants
1. Review of the apple IPM in CHINA
From 1950s to 2005

In 1958, establish Research Institute of Pomology of CAAS; In 1976, establish Zhengzhou Fruit Research Institute of CAAS; Agriculture University of Hebei/Beijing/Shenyang/North-west

Based on the record: during this period, the study mainly focus on the life cycle, bio-characters, the control with limited pesticides: Bordeaux mixture, lime sulphur, aosmate, DDT, carbendazim, mancozeb etc.
1. Review of the apple IPM in CHINA

In recent 20 years

Found “National Technology System for Apple”, in all main production areas established the experiment station, more than 50 experts works on it.

During this period, pests inspection, new pesticides creation, new techniques developed, IPM system is more efficient

http://kjtg.nwsuaf.edu.cn/apple/

http://www.apple-ipm.cn/index.asp
1. Review of the apple IPM in CHINA

In recent 20 years


<table>
<thead>
<tr>
<th>登记证号</th>
<th>登记名称</th>
<th>农药类别</th>
<th>剂型</th>
<th>总含量</th>
<th>有效期至</th>
<th>生产企业</th>
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<td>可湿性粉剂</td>
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... Total pesticides products number for apple

Succession: From low efficient & large dose to high efficient & low dose/area
1. Review of the apple IPM in CHINA

1. The main achievements in the past
   1) Clarified the apple pests and diseases, and their outbreak regularity
   2) Part pests and diseases were well controlled, seldom occur now in practice
   3. Guarantee the apple fruits safety, in the end of 1990s, even >80% rot

2. Incidental problems
   1) Simplification and weakness of the orchard ecosystem
   2) Over-depend the pesticides, and very low efficiency
1. Review of the apple IPM in CHINA

<table>
<thead>
<tr>
<th>Types of pests</th>
<th>Pest /disease and their present occur state</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infect Trunk</td>
<td>Canker, Ring rot/dry rot, Longicorn, Flatheaded borer, Wooly aphid</td>
</tr>
<tr>
<td>Infect fruit</td>
<td>Ring rot, Anthracnose, Sooty blotch, Black spot, Peach fruit borer</td>
</tr>
<tr>
<td>Infect leaves</td>
<td>Alternaria leaf spot, Apple brown spot (marssonina leaf spot), Anthracnose leaf blight, Mites, Aphids, Apple rust, Leaf roller, Apple leaf miner</td>
</tr>
<tr>
<td>Infect root</td>
<td>Root diseases</td>
</tr>
<tr>
<td>Virus diseases</td>
<td>ApMV, ASSVd, ACLSV, ASPV, ASGV</td>
</tr>
</tbody>
</table>

- Still big problem
- Rarely occur now
1. Review of the apple IPM in CHINA

From “Economic daily”:

“Overwork death” of the soil. Soil function is destroyed since the long-years high production, pour into so called “nutrition”, and use of large amount of pesticides. Overuse and land capability decrease is the current situation.

-- MENG Wei, the Academician of the Chinese Academy of Engineering (CAE)

1.8 million tons of pesticides per year, but lower than 30% of effective availability, result in the soil contamination, even strengthen the resistance of the pests and diseases, it become an important problem for the environment, grain and pesticides residue of food.

-- LIN Weilun, the Academician of CAE
1. Review of the apple IPM in CHINA

Contrast of the Efficiency of Chemical Fertilizers and Pesticides between China & other countries

- 我国化肥用量占全世界的35%
- 单位面积农药用量是世界平均水平的2倍多 Pesticide dosage per unit area \( 2X \)
- 化肥农药利用率较世界平均低10-20%。
- 面源污染、酸化和农产品安全

过去20年来氮肥的过量施用导致中国土壤pH值下降0.5个单位！
2. The new request of apple IPM in CHINA

Observe from science:
Change of environments results in the new requests of the IPM subject

Observe from social development:
The deep transformation of CHINA, higher requirements have been put forward for the mode of development.
2. The new request of apple IPM in CHINA

New demands for discipline development brought by environmental changes

1. The cultivation move to higher latitude & altitude areas

1) Adequate Sunshine and Temperature difference between day and night, better for high quality fruit

2) But poor soil condition, drought, low temperature: result in the weak growth, severe trunk diseases and physiological disease

Higher demand to cultivation: soil improvement, 1) benefit for mineral elements releasing to decrease the physiological disease, 2) create loose soil structure to balance the root system and up-ground, for improving the trunk nutrition
2. The new request of apple IPM in CHINA

New demands for discipline development brought by environmental changes

2. Variation of cultivation mode/diversification of variety

1. Coexist of different cultivation mode and techniques
2. Different environment result in different pests
3. Diverse variety with different sensitivity to diseases

Technique demand: IPM system suit to each local areas
2. The new request of apple IPM in CHINA

New demands for discipline development brought by environmental changes

3. Threaten from the quarantine pests: unclear regularity, poor experience for control and techniques

1. Codling moth: occur in west and east line
2. Oriental fruit fly: threaten the mid-areas apple quality
3. Apple scab: occur in west and east line
4. Fire blight: invade risk is higher

Inter-cooperation demand: joint work to avoid the diffusion, exchange experience
2. The new request of apple IPM in CHINA

New demands for discipline development brought by environmental changes

4. Extreme climate result in severe physiological disease in local areas

- Long time drought
- Jonagold fruit dropping before harvesting
- Low temperature in winter & cold spell in later spring
- Skin crack after take away bagging
- Hailstone damage
2. The new request of apple IPM in CHINA

Idea innovation prompted by social development request

1. The national strategic demand under the big background

Five-pronged integrated development strategy: economic, political, cultural, social & ecological civilization

Green development: reen water green Hill is the silver mountain, we intensified environment protection, so, the Agricultural legislation is coming.

Higher request for pesticides selling shop: local government strengthen the registration, pesticides trade record and report.
2. The new request of apple IPM in CHINA

Idea innovation prompted by social development request

2. Demands for high quality & safe product from the consumer market

Increased spending power, diversified fruit species, excess apple yield: only high quality and safety apple can have better profit, request lower IPM investment
2. The new request of apple IPM in CHINA

Idea innovation prompted by social development request

Basic requirements to the modern apple IPM

Emphasize its “commonality”: public IPM/management/service/products, the modern apple IPM should serve to the safety of agricultural production, product quality, agriculture ecology and agriculture trade.

Faced the request of efficiency:

Less and less labor force for farm management: the modern apple IPM face the need for industrialization, professionalization and modernization
3. Development trend of apple IPM in CHINA

Experience and lessons from the disciplinary development, new demand of social and industry: prompt the re-recognition and innovation to the apple IPM

- Harm from pests
- Recognize to pests
- Pests control

- Coevolution of host & pests, ecological balance
- What is it?
- Infection characters?
- Reason of outbreak?
- Pesticides (fruit safe first)
- Green (public security)
3. Development trend of apple IPM in CHINA

Recover the orchard ecological balance, Emphasize the non-chemical methods for high quality development

1. Emphasize the fundamental function of cultivation: soil improvement and keep tree balance, create sunshine and ventilated orchard environment
3. Non–chemical green methods: physical and biological
4. Rational utilization of pesticides: based on inspection & high efficient spraying
3. Development trend of apple IPM in CHINA

Emphasize the fundamental function of cultivation in preventing the pests: good soil structure and tree management, prevent severe physiological disease and trunk diseases; shine and ventilated apple orchard decrease the occur and damage of high humidity diseases.
3. Development trend of apple IPM in CHINA

Feeding techniques for natural insect enemy: artificial diet, artificial expanding carrier, diapause adjust of insect enemy

Success application:

1) Predatory mite is used in apple orchards for controlling the apple mites;
2) Antagonistic microorganism is used for controlling the trunk diseases;
3. Development trend of apple IPM in CHINA

emphasize the physical and biological high efficient methods on controlling the key pests
3. Development trend of apple IPM in CHINA

-- emphasize and establish inspection method

In practice, many farmers just based on experience, and overuse of “insurance” pesticides

Establish the inspection system and spray the pesticides in case rich to the economic threshold

-- improve the spray instrument

1. Large amount of water, high labor cost
2. Low operate efficiency: 3 person, 1ha/day
3. High waste of pesticides
3. Development trend of apple IPM in CHINA

Informatization and mechanization of the pesticides spraying instrument: make it possible to provide socialized services

Questions:
1. Complex terrain, can rich to every plant?
2. Can the pesticides penetrate the whole canopy
3. Can the leaves back be sprayed

Research progress:
1. RTK technique insure every plant
2. Whistle stop and 4th level downward wind force
3. Spiral fly make air vortex

Fast development of Unmanned aerial vehicle (UAV) for orchard spraying
Summary

1. Clarified the infection characters and the epidemic regularity of the main pests and diseases of Apple, it provides the base for controlling on time

2. Some main pests and diseases were efficiently controlled, and now not cause severe damage any more

3. The harmful outside living beings invading aggravates the safety, it should be studied for prevention and control

4. The traditional chemical pesticides-based strategy is not suitable any more to the modern fruit industry and ecology, it should be changed to the new ecology-based strategy, and the basic research and new techniques and products should be studied

5. The modernized machine & information technology will strongly help the fruit IPM, relative instrument and techniques should be further completed
Thank you! 谢谢！