

Guizhou Rural Development Project loaned by World Bank

Pest Control and Management Plan in Guizhou Project Area

Foreign Capital Project Management Center

of Guizhou Provincial Poverty Reduction and Development Office

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Pest Control and Management Plan in Guizhou Project Area

Forward

Located in western China, Guizhou is one of the agricultural provinces belonging to economy undeveloped region. To accelerate the pace of poverty alleviation for enriching in the stricken areas, upgrading the level of rural development in Guizhou, cultivating leading industries in rural areas and promoting sustainable development for rural economy, the State Council Poverty Alleviation Office plans to use the World Bank loan to implement Poverty Alleviation and Industrial Development Demonstration Project in Poor Areas of China. Guizhou Province intends to implement this project in the project areas of Wuchuan County, Zhengnan County, Daozhen County, Sinan County, Dejiang County, Yanhe County, Yinjiang County, Shiqian County, Weining County, Nayong County and Hezhang County, involving 115 towns, 396 administrative villages with 172,722 households, focusing on development of tea, Chinese herbs, fruit trees, vegetables, potato and raise livestock industries. Of which Wuchuan County will focus on the development of Guizhou white goat and ecological tea industries, Zhengnan County will focus on the development of white tea, walnut and common bletilla tuber industries, Daozhen County will focus on the development of codonopsis pilosula, radix scrophulariae, honeysuckle, taxus chinensis and vegetables industries, Sinan County will focus on the development of fine plums, grapes, honeysuckle, codonopsis pilosula and radix pseudostellariae industries, Dejiang County will focus on the development of rhizoma gastrodiae, walnut and virus free potato industries, Yanhe County will focus on the development of walnut, hollow plums and goat industries, Yinjiang County will focus on the development of walnut, edible fungus and green shell egg chicken industries, Shiqian County will focus on the development of virus free potato, radix ophiopogonis, salvia and egg chicken industries, Weining County will focus on the development of virus free potato, egg chicken and konjak industries, Nayong County will focus on the development of tea, China grass, radix puerariae, platycodon gradiforum and glutinous rice pig industries and Hezhang County will focus on the development of konjak, virus free potato and walnut industries. The project construction contents will be closely related to the township leading agricultural industries and the characteristic agricultural products production. To ensure the smooth implementation of the project, we dispatched groups to each project areas to investigate and interview. After collecting a lot of data and according to the requirements of World Bank's Operational Policy and "Pest Management Environmental Assessment", we prepared the "pest management plan" in Guizhou project area.

Pest management plan objectives

By implementing the policy of the prevention first and comprehensive prevention, we established 10-20 demonstration bases, introduced and demonstrated IPM techniques in the project area. We provided IPM technical training for farmers,

agricultural workers and grassroots PMO staff. We extensively carried out the integrated prevention and integrated control on plant and animal pests and diseases. The comprehensive prevention and control effect reached up more than 90% and the reduction in chemical pesticide use by more than 30% and the reduction in green control core demonstration areas on the amount of chemical pesticides was more than 50%. The average mortality rate due to illness of goat and poultry had been decreased respectively by 2 percentage points and 4 percentage points compared with that prior to the implementation. Some major animal diseases, such as Goat pox, foot and mouth disease, highly pathogenic bird flu other disease has been effectively controlled and localized part has reached to the purify standards. The risk of Bruce's septicelelosis, bird flu and other key human and animal co-morbidity diseases has been effectively reduced. The imported epidemic prevention capability significantly improved. The prevention level on harmful living things and the pest prevention and control effectiveness improved and the safe use of chemical pesticides knowledge were popularized. By preparing the recommend chemicals list, through public bidding for purchasing and distributing the recommended pesticides, vaccines and veterinary drugs, strengthening the supervision on sale and use of pesticides, it ensured the demonstration area in compliance with the World Bank for the project requirements of (OP / BP 4.09) and other international convention standards. It did reduce the amount of project implementation chemical pesticide application resulted in an increase in adverse effects brought and under the premise of ensuring environmental safety and it increased farmers to achieve incomes and ensured the agricultural sustainable development.

1. Relevant state policies and regulations

1.1 National policies' principles on animal and plant protection

The Chinese government carried out a series of important policies on the agricultural plant pest control work and the aim is to control the harmful levels of plant pest at a lower level for promoting the quality of agricultural production, promoting the sustainable use of agricultural resources and protecting agricultural resources and protecting the environment. Over the years the national plant protection policy emphasizes the use the plant protection policy of "prevention first, scientific prevention and control, governance according to laws to promote health" and emphasizes the plant quarantine to prevent the spread of plant pests and diseases. It was to use biological, physical and agricultural control methods as priority. In chemical control, it was to achieve unified control time, unified professional technicians, unified professional equipment and unified the pesticide formulations for improving the control effect and efficiency, reducing control costs and protecting the health of farmers and it reduced the environmental pollution for producing food with pollution-free, green (A-level) and organic food (AA grade) and agricultural and sideline products.

1.1.1 Integrated pest management

Integrated pest management (IPM) is the core principle of the integrated pest control, the important approaches on the pest prevention and control and is also the requirement of the World Bank loan project-related operational policies of "Plants and

animals Integrated Pest Management" (OP 4.09). Since 1975, the Chinese government has adopted the Integrated Pest Management (IPM).

While implementation of integrated pest management, it should consider not only the economic benefit, but also consider the ecological balance and social security. Based on this theory, animal and plant pest control should be: prevention-oriented and based on the agronomic measures to make full use of natural pest control factors and to create unfavorable conditions for the development of the pest occurrence. According to the characteristics of different organisms and pests habits, it should strengthen the forecasting and hazard monitoring and according to different local conditions, it should rationally use the biological, physical, chemical and other measures as interactive and complementary coordinated approaches to avoid killing natural enemies of pests and avoid any pollution of the environment as far as possible. Pests should be controlled at the tolerable levels. It should utilize natural enemies of pests in priority, such as Trichogramma, Bt insecticidal agents and Beauveria bassiana, etc. to control pests and utilize some microbial agents and insect hormones for controlling defoliators. If case of the above mentioned measures could not effectively control pests, it could only use those efficient, low toxicity and low residue of chemical pesticides and veterinary drugs, while taking security application methods to reduce chemical pesticide residues in the soil or water environment.

1.1.2 Animal and Plant Quarantine

Animal and Plant Quarantine is another measure adopted by our country for avoiding plant and animal pests and diseases destroyed on crops and animals and the destruction or overspreading of weeds on crop production areas. Chinese quarantine began in the 1930s. In 1991 China implemented the "Import and Export Plant Quarantine Act". China has established more than 300 Chinese customs and quarantine agencies in landlocked and airports to prevent animal and plant pests and diseases to enter, disseminate and spread from abroad. These organizations play an important role in preventing animal and plant pests and diseases. Over the years, a lot of quarantine pests such as the Mediterranean fruit fly and fall webworm. Chinese quarantine functionality could be divided into three parts: the crop quarantine is responsible by the National Plant Quarantine Protection Station, the wood and forest quarantine is responsible by the State Department of Agriculture and the state-owned forest and seed management station and the animal quarantine is responsible by the National Animal Husbandry and Veterinary Station of the Ministry of Agriculture.

1.1.3 Food Safety and Pesticide Residues

Chinese government pays great attention on the food safety. According to the plant and animal protection policies of "prevention first and comprehensive protection and control", we will gradually adopt a protection and control approaches with biological control as main. The rapid development of green food and organic food market has begun to reduce or do not to use any chemical pesticides by prices stimulating. In order to promote the green food production and certification of green food and organic food on green safety agricultural products, China Green Food Development Center of the Ministry of Agriculture had specifically announced a "Pesticide Use Regulations" for guiding "green" food (A grade) and organic Food

(AA grade) production.

Chinese government promulgated the "Regulations on Pesticide Management" and "Vaccine and Veterinary Drug Management Regulations" and the Chinese Ministry of Agriculture issued "Safe Use of Pesticides Standard", "Safe Use of Vaccines and Veterinary Drugs Standard" to encourage the use of efficient, low toxicity and low residue pesticides, vaccines and veterinary drugs. Any pesticide, vaccine and veterinary drugs manufacturers for producing pesticides vaccine and veterinary drugs products must follow these "rules", "regulations" and "standards".

These documents clearly show that:

--There is a strict pesticide, vaccines and veterinary drugs utilization scope on the animal and plant pests and diseases protection and control in agricultural production. (Any very dangerous pesticides and significant toxicity classes such as parathion, monocrotophos and phorate are prohibited).

--Agricultural products with exceeding pesticides, vaccines and veterinary drug residues could not be allowed to enter the market for sale.

-- methods of safe use of pesticides, vaccines and veterinary drugs include: pesticides, vaccines and veterinary drugs form, safety and rational use method, the general dose and maximum dose, limits in the frequency of use in the same year, the duration from last time to the harvest time, etc.

The pesticide and veterinary drugs inspection institute of Chinese Ministry of Agriculture and the pesticide and veterinary drugs inspection institutes of varied provinces are the monitoring organizations responsible for agricultural products, pesticide residues (especially for vegetables, fruits, crops and poultry, eggs and meat foods).

1.2 Main laws, regulations and standards

State and varied provinces published and implemented a series of laws, regulations, standards, rules, specifications and guidelines and through these laws and regulation implementation, the integrated pest management (IMP) had been applied and promoted further.

1.2.1 Main laws, regulations and standards on plant pests

(1) "Agricultural Product Quality Safety Law of the People's Republic of China" (issued by the NPC Standing Committee, April 2006);

(2) "Pesticide Management Regulations of the People's Republic of China" (State Council, January 2001);

(3) "Implementation Measures on Pesticide Management Regulations" (December 2007, the Ministry of Agriculture Decree No. 9 of 2007);

(4) "Pollution-free Agricultural Products Management Approaches" (Ministry of Agriculture and State Administration of Quality Supervision, Inspection and Quarantine, April 2002);

(5) "Pesticides Safe Use Standard" GB4285-1989 (National Environmental Protection Agency, September 1986);

(6) "Pesticides Safe Use Standard" GB8321.2-1987 (National Environmental Protection Agency, September 1986);

(7) "Green Food Pesticide Use Guidelines" NY/T393-2000 (Ministry of Agriculture, March 2000);

(8) "Food Maximum Residue Limits for Pesticides" GB2763-2005;

(9) "Food Organophosphorus Pesticide Residues Determination" GB/T 5009.20-2003;

(10) "Pesticides Reasonable Use Guidelines" GB/TB8321.1-8321.8;

(11) "Plant Quarantine Regulations" (revised and issued by State Council on May 13th, 1992);

(12) "Phytosanitary Regulations Implementing Rules (Agricultural Sector)" (Ministry of Agriculture, May 1995);

(13) "Anti-virus Specification on Pesticide Storage, Transportation, Sales and Use" GB 12475-2006, (Ministry of Agriculture);

1.2.2 Main laws, regulations and standards on animal epidemic diseases

(1) "Animal Husbandry Law of the People's Republic of China" Presidential Decree of the People's Republic of China No. 45 (2006);

(2) "Animal Epidemic Prevention Law of the People's Republic of China" Presidential Decree of the People's Republic of China No. 71 (2008);

(3) "Animal Quarantine Management Measures" Ministry of Agriculture Decree of the People's Republic of China No. 6 (January 2010);

(4) "Entry and Exit Animal and Plant Quarantine Law of the People's Republic of China" Presidential Decree of the People's Republic of China No. 53 (October 1991);

(5) "Wildlife Conservation Act of the People's Republic of China" revised by the Tenth National People's Congress Standing Committee of the Eleventh Meeting (August 2004);

(6) "Veterinary Drugs Management Regulations" passed by the 45th executive meeting of the State Council (March 2004);

(7) "Major Animal Disease Emergency Treatment Regulation" the State Council Decree No. 450 (November 2005);

(8) "Veterinary Drugs Pharmacopoeia" of the People's Republic of China" Ministry of Agriculture Decree of the People's Republic of China No. 587 (2005);

(9) "Review Measures on Animal Epidemic Prevention" Ministry of Agriculture Order No. 7 of 2010 (January 2010);

(10) "Biosafety Management Approval Approach on Highly Pathogenicity Animal Microbiology Laboratory" the Ministry of Agriculture Decree No. 52 (May 2005);

(11) "Biological Safe Handling Specification on Diseased Animals and Diseased Animal Products" GB16548-2006;

(12) "Disinfect Specification on Poultry Products" GB/T16569-1996;

(13) "Pollution Free Food - Animal feed and Feed Additives Use Guidelines" NY5032-2006;

(14) "Pollution Free Food - Livestock Drinking Water Quality" NY 027-2008;

(15) "Animal Epidemic Prevention Basic Terminology" GB / T 18635-2002;

(16) "Medium and Small Intensive Farms Veterinary Epidemic Prevention Work Order" GB / T 17823-1999;

(17) "Intensive Pig Farm Epidemic Basic Requirements" GB / T 17823-2009.

1.2.3 Related regulations of Guizhou province

(1) The major biological disaster emergency prevention plans for main crops in Guizhou province (January 30, 2004)

(2) "National Pesticides List banned to use or limited to use" Transmitted by Guizhou province (2011)

2. Management institutions and mechanisms on plant pests and animal epidemic prevention in our country

2.1 Management institutions and mechanisms on plant pests

Our country has developed state level, provincial level, city (county) level pest management organizations (plant protection and plant quarantine bureaus (stations)). The plant protection station of the Ministry of Agriculture will be responsible for management, guidance and monitoring work on agricultural harmful living things protection and control and animal epidemic diseases protection and control nationwide. Each provincial, county (city) and township level plant pest management organization has clear responsibilities and will be responsible for agricultural crops pests forecast, protection and control, pesticides management and agricultural products safety production in the same level.

According to the agricultural, environmental and food safety requirements, the Ministry of Agriculture have developed disabled or restricted list on chemical pesticides in different periods and there is a strict "three cards" system and a pesticide label management system for pesticides entering into the market. Each province, county (city) Plant Protection Station and agricultural law enforcement agencies will carry out management in accordance with relevant laws and regulations. Any one company for producing or processing of a vaccine and veterinary medicine, at first the company should register based on the "Pesticide Management Regulation" and "Vaccine and Veterinary Drugs Management Regulation" and the production should be in accordance with the safe and quality control standard and the environmental control conditions. Secondly, any vaccines and veterinary vendor to operate only after obtaining a license, but the vendors can only sell the vaccines and veterinary drugs after the registration and licensing. Any highly toxic and high toxicity veterinary drugs should not be used for food production. Finally, exceeding residual standard of agricultural products, especially for poultry, eggs, meat, milk and other products should be prohibited to sell in the market.

All grassroots pesticide and fertilizer dealers will report the annual intake of pesticide list and quantities to the county Department of Agriculture Plant Protection Station for recording and filing. The Plant Protection Station will compare it with the latest disabled list issued by the Ministry of Agriculture and province, if it is inconsistent, it should be prohibited in the area for sales. If it meets, it could be permitted for sales. While the law enforcement brigade of a County agriculture Bureau will regularly or irregularly carry out on-site inspection on all pesticide and fertilizer dealers at all grassroots to verify their inventory and pesticides are consistent with the reported sales. But the pesticide purchased by dealers from illegal sources and black mill stock, it is difficult to control and there are not any effective

monitoring means. Because the analysis on a kind of pesticide will be very complex and expensive so it will be time-consuming and costly.

In the 11 Counties of Guizhou project area, the chemical pesticides protection and control is still a major plant pest and disease control method. Meanwhile some quarantine measures, physical and mechanical methods, biological control method and the method of cultivation techniques are integrated for application. After the occurrence of plant diseases and insect pests, farmers generally through diagnosis and proposed appropriate control methods by grassroots agricultural workers, farmers will purchase chemical pesticides in the rural agricultural station, the agriculture materials sales points and the point of marketing agricultural crops hospitals, etc to carry out spraying control. When severe outbreaks or upcoming outbreak of pests and diseases on the main staple food crops or cash crops, the plant protection stations and grassroots rural county agricultural workers will be based on the pest monitoring data to organize professional teams and distribute plant protection chemicals to carry out a large area of integrated protection and control and the government will provide necessary subsidies on the control costs.

2.2 The management institutions and mechanisms on the animal disease prevention and control

Our country has established central, provincial, prefecture, county, township five epidemic prevention system, in which the Ministry of Agriculture Animal Husbandry and Food Administration is responsible for managing the national agricultural animal disease prevention and control, guidance and monitoring. Focus on central and provincial major epidemic monitoring and early warning, and control the fight with the organization and implementation of the development plan, providing high-end technical support and so on. Prefecture, county, township is mainly responsible for animal epidemic prevention within the region, and quarantine supervision and fight other tasks. The existing animal epidemic prevention system respectively formed by animal disease monitoring and early warning, prevention and control, vaccination and quarantine supervision, monitoring and quality of veterinary drugs residue monitoring, as well as technical support and material support immunization six sub-systems, the interaction of these six areas, interlocking Overall constitute animal epidemic prevention system for major animal disease prevention, control and extinguished, the quality of veterinary surveillance and monitoring of veterinary drug residues, as well as its product quality and safety of animal tracking traceability.

Government departments in charge through the implementation of the "vaccine Veterinary Regulations" will manage and limit the production, sales and use of the chemical veterinary drugs. The main measures include: (1) Any one company for producing or processing of a vaccine and veterinary medicine, at first the company will development a quality control standard then carry out a vaccine and veterinary medicine registration and obtain a production license under the conditions of pollution free on the environment and the pesticide residues could be controlled. Any highly toxic and high toxicity veterinary drugs should not be produced. (2) Any vaccines and veterinary vendor to operate only after obtaining a license, but the vendors can only sell the vaccines and veterinary drugs after the registration and licensing. (3)

Exceeding residual standard of agricultural products, especially for poultry, eggs, meat, milk and other products should be prohibited to sell in the market.

Animal diseases and parasitic diseases of the major livestock animals in Guizhou project area are mainly protected and controlled by injection of animal vaccine, injection of antibiotics and the use of chemicals. Animal immunization and disease prevention is largely dependent on county and township veterinary vaccines and veterinary stations to provide veterinary vaccines and veterinary drugs and the farming enterprises and farmers by themselves will purchase the veterinary vaccines and veterinary drugs for carrying out the vaccines injection. The government will give the necessary subsidies on the immunization program costs. However, the immunization and disease prevention has not yet fully covered all farming households. There are some remote, free-range farming farmers which are still natural restocking of livestock with a run its own course condition.

All grassroots pesticide and fertilizer dealers will report the annual intake of pesticide list and quantities to the county Department of Agriculture Plant Protection Station for recording and filing. The Plant Protection Station will compare it with the latest disabled list issued by the Ministry of Agriculture and province, if it is inconsistent, it should be prohibited in the area for sales. If it meets, it could be permitted for sales. While the law enforcement brigade of a County agriculture Bureau will regularly or irregularly carry out on-site inspection on all pesticide and fertilizer dealers at all grassroots to verify their inventory and pesticides are consistent with the reported sales.

2.3 The pest management mechanisms in Guizhou province

2.3.1 Organization and management mechanisms on pest prevention and control

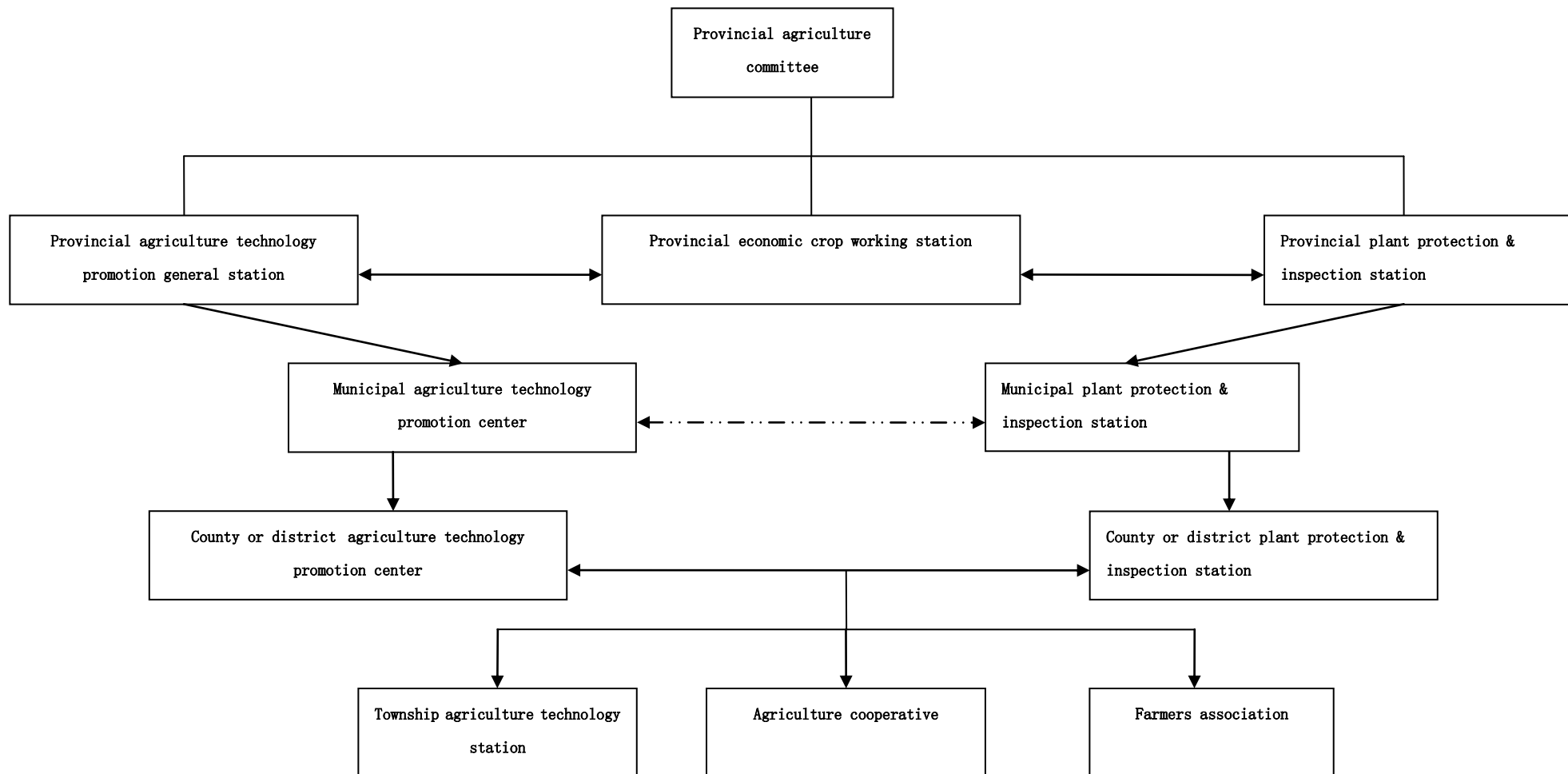


Figure 1 Schematic of the plant pest control and management agencies

Responsibilities of each agency:

Provincial agriculture committee: Head of the province's agricultural and livestock husbandry work. Responsible for the province's agricultural departments at all levels, the organization of crop pest protection and control work.

Provincial plant protection and inspection station: to carry out phytosanitary, regularly publish long-term, medium-term and short-term forecasting of the crop pests and diseases, responsible for any major pest of crops emergency prevention and lasting control, new pesticides, equipment promotion and pesticides safe use. Give publicity to farmers and training pest management techniques.

Provincial agriculture technology promotion general station: To assist the provincial agriculture committee to carry out related work and responsible for technology promotion.

Provincial economic crop working station: Responsible for planting planning, technology promotion and pest management on some economic crops, such as vegetables, fruit trees, Chinese traditional herbs and other economic crops.

City, county (district) agriculture technology promotion center: will be responsible for agriculture technology promotion in its management area, responsible for organization, planning, coordination, supervision and for decision-making and to formulate work management regulations on crop pest protection and control.

City, county (district) plant protection station: Responsible for organizing, managing, guidance and supervising within its management area. Assist and coordinate the law enforcement and technology departments to carry out publicity, training and guidance in the area on the pesticide management and integrated pest management techniques.

Township agricultural station: Responsible for monitoring and forecasting on any major pesticide in the management area and providing timely protection and control guidance.

Agricultural cooperatives and farmers' associations: organize and carry out local crop pest protection and control work.

2.3.2 Pesticide supervision and management organization

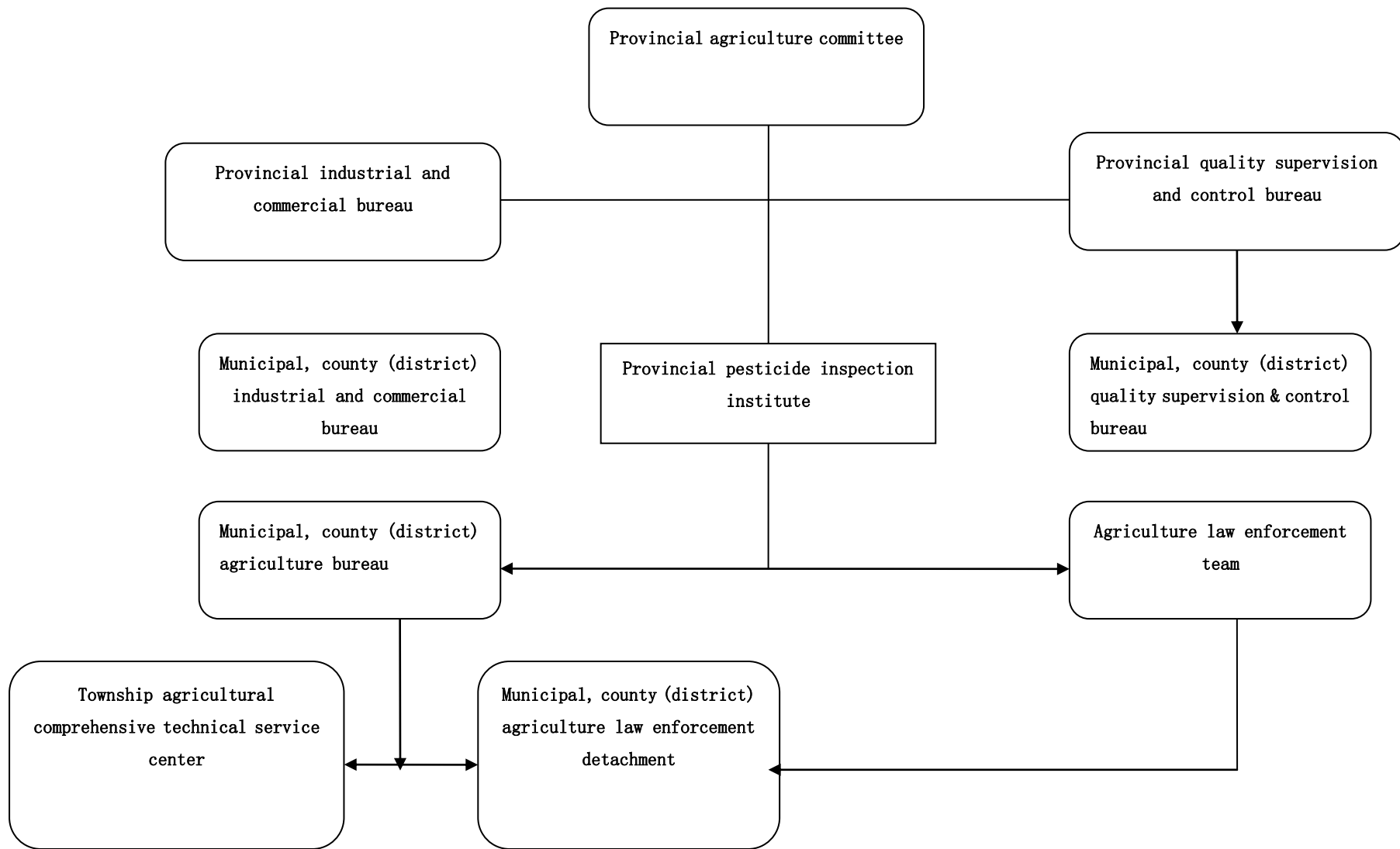


Figure 2 Schematic of pesticide regulatory institution

Responsibilities of each agency:

Provincial agriculture committee: Responsible for local agricultural development planning and management related to agricultural affairs.

Industrial and commercial bureau: Responsible for the management of pesticide market segments.

Provincial quality supervision and control bureau: Responsible for the management of pesticide production processes.

Provincial pesticide inspection institute: Responsible for pesticide application for registration, use and supervision and management, responsible for developing or participating in the development of safe use of pesticides, pesticide product quality and pesticide residues national or industry standards and other relevant agricultural affairs.

County agricultural law enforcement agencies: responsible for market supervision and quality management of agricultural chemicals.

Township Comprehensive Agricultural Technology Service Center: Responsible for assistance, coordination of law enforcement and technology departments to carry out the pesticide management and integrated pest management techniques publicity, training and guidance at the local area.

2.3.3 Pesticide residue test organization

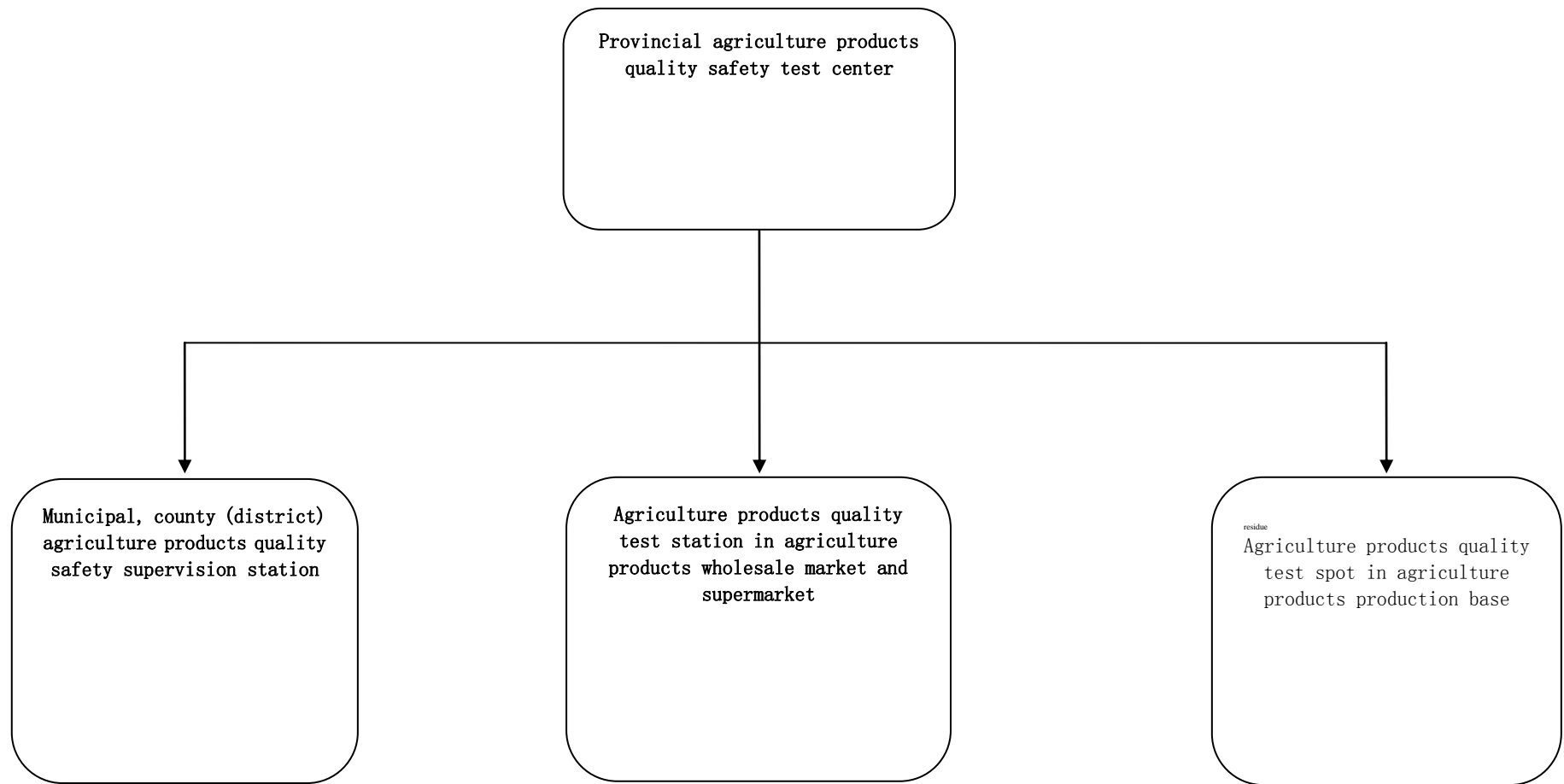


Figure 3 Schematic of pesticide residue test organization

Responsibilities of each agency:

Provincial agricultural products quality and safety test center: Responsible for the province's agricultural product quality safety supervision and management, and to guide municipalities, counties (districts) of agricultural product quality safety supervision.

Municipal, county (district) agriculture product quality supervision center (station): will be responsible for local agricultural products quality and safety supervision and management.

Agriculture products quality test station in agriculture products wholesale market and supermarket: Responsible for market (supermarket) quality inspection of agricultural products admitted.

Agriculture products quality test spot in agriculture products production base: Responsible for quality inspection of agriculture products out of the agricultural production bases.

2.3.4 Animal disease control and animal food and veterinary drugs and feed products
Quality monitoring organizations

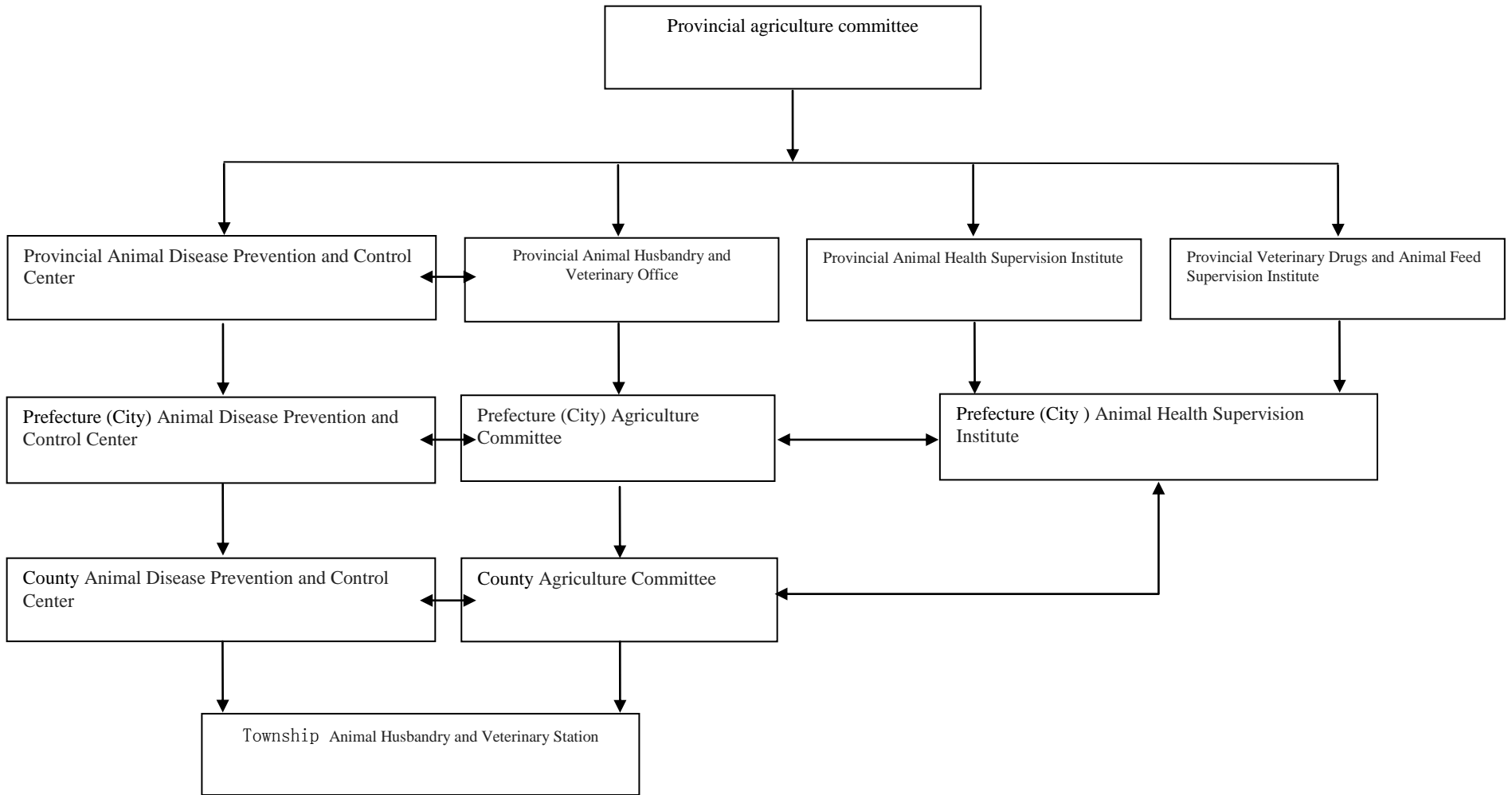


Figure 4 Schematic of animal disease control

Responsibilities of each agency:

Provincial agriculture committee: Responsible for animal disease prevention and control and responsible for preparing draft regulations on animal epidemic prevention and quarantine. Be responsible for formulating policies on animal epidemic prevention and quarantine and guidance of these policies implementation jointly with relevant department and for guidance of animal epidemic prevention and quarantine system construction. Organize and supervise the work of the provincial animal epidemic prevention and quarantine. Responsible for prevention and control of epidemic, publish epidemic situation and organize the fight against the epidemic. To organize the health care reform on veterinary and the veterinary drug administration and drug test work. Be responsible for licensed veterinarian management.

Provincial Animal Husbandry and Veterinary Bureau:

Implement the animal health and feed industry laws and regulations, guidelines and policies.

Be responsible for managing and supervising the province's animal epidemic prevention and quarantine.

Prepare any major animal disease control and extermination plans and programs and organize their implementation.

Be responsible for veterinary medical affairs, health care reform, veterinary drugs and veterinary medicine affairs, feed and veterinary administration and official veterinary and licensed veterinarian management.

Be responsible for veterinary drugs, animal feed and animal product quality and safety supervision and management and veterinary laboratory biosafety management.

Be responsible for the implementation and management of animal epidemic prevention and quarantine, veterinary medicine and feed project.

Carry out supervising and guidance on the subordinate administrative departments and animal veterinary health service system by laws.

Provincial Animal Disease Prevention and Control Center:

(1) To formulate the province's animal disease prevention and control programs.

(2) To supervising the animal disease prevention, control, diagnosis, monitoring, reporting the animal disease situation and to organize to exterminate any major animal disease in the province.

(3) To undertake the training in basic veterinary workers in the province.

(4) Responsible for the veterinary laboratory biosafety technical guidance in the territory of Guizhou province.

(5) To supervise and administer the province's animal epidemic prevention biological products.

(6) To supervise the province's animal disease prevention and control, diagnosis, surveillance and reporting the animal disease situation, etc.

(7) Responsible for completing the work of the province's compulsory immunization of animal diseases;

(8) To punish any actions violated the animal epidemic prevention laws and regulations.

Provincial Animal Health Supervision Institute: Responsible for the province's quarantine of animals and animal products. Responsible for supervising and check on the implementation of the province's animal epidemic prevention and animal health laws and regulations, correction and punish any major cases and violation actions.

Provincial Veterinary Drugs and Animal Feed Supervision Institute: Responsible for administrative law enforcement on the provincial veterinary drugs and animal feed entrusted by the administrative department. Responsible for products sampling

inspection, quality control, examination and technical arbitration on veterinary medicine, animal feed. Responsible for guidance of the operation work of the subordinate animal health supervision departments and veterinary drugs and animal feed supervision department.

Prefecture (City) Animal Husbandry and Veterinary Bureau: Responsible for construction projects and the city's animal husbandry and fishery animal epidemic prevention and quarantine, veterinary medicine, organization and implementation of projects and the management of the feed; responsible for the city's animal epidemic prevention and quarantine supervision, is responsible for monitoring and organizing the fight against the epidemic, responsible official veterinarians and veterinary practice management.

County Animal Husbandry and Veterinary Bureau:

Be responsible for preparing the development and the county animal husbandry and major animal disease prevention and control programs and plans. Supervise and manage livestock production, animal epidemic prevention and quarantine, veterinary, veterinary medicine, feed, livestock safety, grassland and aquatic work. Be responsible for the administration of veterinary medicine, veterinary medicine governance and management of animal product safety. Be responsible for animal pathogens laboratory biosafety management.

Currently in the 11 counties in Guizhou project areas there is a better organization of agricultural plant and animal pest control. The Plant Protection Station of Zunyi Municipal Agriculture Bureau, the Plant Protection Station of Tongren Municipal Agriculture Bureau, the Plant Protection Station of Bijie Municipal Agriculture Bureau, the Plant Protection Stations of the project counties are responsible for managing the project local agricultural pest control, guidance and monitoring. The Animal Husbandry and Veterinary Station of Zunyi Municipal Bureau of Animal Husbandry and Food Bureau, the Animal Husbandry and Veterinary Station of Tongren Municipal Bureau of Animal Husbandry and Veterinary Bureau, the Animal Husbandry and Veterinary Station of Bijie Municipal Bureau of Animal Husbandry and Food and the county Animal Husbandry and Veterinary Stations are responsible for local animal disease prevention and control, guidance and monitoring.

The Agriculture Bureaus, plant protection stations and the animal husbandry and food bureaus and the animal husbandry and veterinary stations of Zunyi City, Tongren City, Bijie City and the 11 counties in the project area are responsible for guiding the farmers how to prevent territorial local main crops pests, animal diseases and parasites, responsible for training farmers to use prevention of new technologies, new methods, new pesticides, by radio, by understanding papers, pamphlets, etc. for training.

The city and county agricultural comprehensive law enforcement teams of Zunyi City, Tongren City, Bijie City and the 11 counties in the project area are responsible for guiding, sales and marketing of agricultural products in a regulated market of chemical, agrochemical sales in violation of the rules and regulations of the dealer be punished. All grassroots pesticide and fertilizer dealers will report the annual intake of pesticide list and quantities to the county Department of Agriculture Plant Protection Station for recording and filing. The Plant Protection Station will compare it with the latest disabled list issued by the Ministry of Agriculture and province, if it is inconsistent, it should be prohibited in the area for sales. If it meets, it could be permitted for sales. While the law enforcement brigade of a County agriculture Bureau will regularly or irregularly carry out on-site inspection on all pesticide and fertilizer dealers at all grassroots to verify their inventory and pesticides are consistent with the reported sales.

Animal and plant pests and diseases management mechanisms currently in the project area are mainly to choose the appropriate control methods depending on the type of animal and plant pests and diseases and the occurrence of actual time. The chemical pesticides to control plant diseases and insect pests control method is still the main, as well as integrated application of quarantine method, physical and mechanical methods, biological control method and the method of cultivation techniques. After the occurrence of plant diseases and insect pests, farmers generally through diagnosis and proposed appropriate control methods by grassroots agricultural workers, farmers will purchase chemical pesticides in the rural agricultural station, the agriculture materials sales points and the point of marketing agricultural crops hospitals, etc to carry out spraying control. Generally the manufacturer will entrust a provincial level pesticides wholesaler as agent to sell pesticides. The provincial level wholesaler will distribute pesticides by wholesale to the county pesticide distributors and grassroots-level rural agricultural station, agricultural companies marketing points or hospital. Then the grassroots-level rural agricultural station, agricultural companies marketing points or hospital will resell the pesticides purchased from the licensed pesticide manufacturers, agricultural companies and agricultural higher wholesale to farmers. When severe outbreaks or upcoming outbreak of pests and diseases on the main staple food crops or cash crops, the plant protection stations and grassroots rural county agricultural workers will be based on the pest monitoring data to organize professional teams and distribute plant protection chemicals to carry out a large area of integrated protection and control and the government will provide necessary subsidies on the control cost.

Animal planned immunity mainly relies on the county and township levels veterinary station to provide vaccines and the farming enterprises and farmers themselves will purchase vaccine for vaccination and the government will give the necessary subsidies for planned immunization program costs. However, the immunization and disease prevention has not yet fully covered all farming households. There are some remote, free-range farming farmers which are still natural restocking of livestock with a run its own course condition.

3. Successful experiences and problems on the pest management in our county

3.1 Main experiences

3.1.1 Plant IPM is the priority recommended prevention and control measure adopted by agriculture department

According to the characteristics and habits of different organisms, IPM firstly considers the quarantine measure, cultivation techniques, physical and mechanical methods, biological measure for pest control. Only in the case of the above mentioned methods cannot effectively control pests the chemical method could be applied for use of efficient and low toxicity of chemical pesticides for control. In the IPM approaches, we achieved some successful experiences on use of chemical pesticides alternatives in priority, especially in the application of bio-pesticides and natural enemies. We reared *Trichogramma*, then successfully let them flying to control pest. By utilizing insect pathogens nematodes it can prevent and control a variety of fruit borer and termite dry pests in the agriculture production. Also we developed and applied a number of biological insecticides such as *Bacillus thuringiensis* Bt insecticides and bassiana formulations. Currently in the vegetables, tea and fruit production in our province, we have widely applied bio-pesticides and biological control techniques. But in the cultivation of staple food crops and cash crops, farmers also are difficult to use biological control methods to effectively control pests. When a larger plant pest breaks out in the project area, farmers still rely mainly on the use of low toxicity and

efficient chemical pesticides. In this case, the chemical method is essential. The spraying times of pesticides will be changed depending on the different types of plant pests and crop conditions. In general, pesticides are the most important means used to control the pest of the staple food crops as well as tea, orchards, vegetables, potatoes and hot peppers.

3.1.2 Animal planned immunity became the animal epidemic diseases control measures accepted by majority farmers

By giving healthy animals inoculated with some antigenic substances for stimulating the body to produce specific resistance of animals, it can form a means of making the susceptible animals becoming into not easy to be infected. Organized and planned immunization is an effective measure to prevent and control animal diseases. Especially for major animal diseases the immunity will be a key role, such as the annual preventing vaccination for foot and mouth disease, avian flu and swine fever. The animal immunity could be divided into the emergency vaccination while an epidemic disease breaking out and the usual preventive vaccination. So called usual vaccination is a kind of planned immunity vaccination in the areas where some infectious diseases happened usually or in the potential infectious diseases areas or some infectious diseases threatening areas. Often talking about the immunity vaccination, it mainly refers to the usual vaccination. In case of an epidemic disease broke out, an emergency vaccination is to quickly control and extinguish the disease. Upon carrying out an emergency vaccination, it should be in accordance with the operation specifications, strictly comply with the immunization precautions to ensure the safety and the immunization quality.

3.2 Present problems

On prevention strategy it did not focus on the prevention, while a pest or a disease breaking out, it was too late to do anything about it. The integrated prevention and the integrated treatment concept has not been paid great attention to, the measure of only one family or one household spraying drugs, it is difficult to control the pest epidemic. The reason is that the concept of integrated pest management has not gone to farmers and the pest forecasting system is lagging behind, prevention and treatment can not be fully covered. An over-relying on chemical pesticides, gradually increasing the dosage, so the chemical control area has been expanded each year resulting in deterioration of the ecological environment, significantly enhanced resistance to pests and diseases. Another reason is that chemical pesticides have quick, efficacy and stability characters and it could easily control the pest occurrence damage. The pollution-free agricultural products have no competitive prices and farmers lack the driving force for using bio-pesticides and other alternative means of chemical pesticides to control. On the prevention and control system, the prevention funding is limited and there are obviously some dead spaces in the prevention and control system. A decentralized local prevention and control is still the mainstream and the prevention and control technology is also difficult to coming into households. There is lacking of funding and technical personnel in the grassroots agricultural promotion work sector. It can only focus on the prevention and control for the significant loss of animal and plant pests and diseases each year, so the prevention and control system needs to be improved and the prevention and control technology is also to be improved. Meanwhile, the technical personnel in the agricultural sector are limited at all levels and the physical and biological control technology research and promotion is very slowly. The physical and biological control methods are simple and the control effect is not ideal. Although the project has completely eliminated the use of highly toxic pesticide residues, but there are still some problems, such as insufficient prevention

awareness, wrong technology selection, improper control methods and incorrect prevention and treatment chances resulting in the dosage of drugs used, high costs, and increased agricultural surface source pollution and waste pollution, so it is not helpful for the sustainable agricultural development.

The main problems on animal disease prevention and control are: weak animal epidemic prevention infrastructure, incomplete technical support system and the poultry immunity density is not up to the standard, the village level epidemic prevention team is instability with low level of business capacity, animal epidemic prevention and supervision is not in place, some farms (households) management staff have poor awareness of disease prevention and control.

3. 3 Main courses

Currently multiple counties and cities in Guizhou province, including the 11 counties in the project area have established major plant pest and animal disease prevention and control system for monitoring and forecasting. General plant pests and animal diseases can be controlled in time. But some of epidemic outbreak plant pests and animal disease prevention and control are still in the "stop-gap" passive stage with disadvantages of single prevention means, narrow integrated prevention and controlling coverage and instability of control effect, so the overall control capacity needs to be improved.

3.3.1 Lacking information on the occurrence and control on pests and diseases of plants and animals

The approaches for farmers to understand plant and animal pests and diseases occurrence, the use of pesticides and the veterinary drugs prevention knowledge are relatively narrow. Farmers learn agricultural knowledge often by watching TV or reading pesticide technical books and Pesticide Manual. While grassroots agricultural departments offered some training courses, county or township level technical personnel provided some consulting services, technical manuals on some crop protection and animal and plant pests and diseases and some related materials on the use of pesticides, veterinary drugs prevention methods. But the majority of farmers are also difficult to acquire the relevant information timely and accurately know well the plant and animal species and plant pests breeding, animal disease prevention and control information.

3.3.2 Lacking the concept of utilization of chemical alternatives

While selecting pest and disease control methods farmers mainly consider which method will give them maximum benefits. Farmers generally prefer selecting quick and good effects of chemical control methods. Only in the use of chemical pesticides alternatives which can also give them a better net income it is a better time to let them abandon the use of chemical control methods. Thus, the important task is to allow farmers to fully understand the advantages and disadvantages of the various methods to encourage for developing higher value of green food and organic food production, finally let farmers change the traditional concept of animal and plant protection and control.

3.3.3 Lack knowledge of the safe use of chemical pesticides

Under normal field production conditions, some farmers in pest disease prevention and control, especially spraying pesticides, while using either manual or advanced automatic spraying device, rarely wear protective clothing, rarely wearing helmets and protective masks and gloves. Because of poor personal security awareness it is likely to cause acute and chronic pesticide poisoning and pesticide residues exceeding phenomenon occurred. In Guizhou, farmers buy pesticides it is very convenient, almost all of towns have shops and agricultural crops hospital, so

farmers are generally based on the need to get ready at any time. And the rest pesticide are mostly free of storage, it could easily lead to accidental poisoning incidents.

4 Successful experiences and lessons on plant pest and animal epidemic prevention management loaned by World Bank these years

4.1 The main experiences

Guizhou Province in recent years has undertaken five poverty reduction projects loaned by World Bank. Of which the vast majority of the Bank's projects in the development of the industry focused on animal and plant integrated pest management. During the implementation and appraisal of the projects the plant and animal pest management approaches had been prepared and in a timely manner to carry out animal and plant pests and diseases forecasting, immunization and scientific control. Many local industries created green products brands promoting and forming a virtuous circle of economic development and ecological protection, the main experience includes:

--Plant pest control was not only actively to promote the use of high efficiency and low toxicity of chemical pesticides, a comprehensive application of quarantine measures, physical and mechanical methods, cultivation techniques and biological control methods began to apply in the prevent and control methods.

--Government departments in charge in the project area were mainly through the implementation of "Pesticide management regulations" to manage production and limit the sales and use of chemical pesticides.

--The planned animal immunization in the project area relied mainly on county veterinary station and township veterinary stations to provide vaccines and farming enterprises and farmers would purchase and carry out vaccination. The government will give the necessary subsidies on the immunization program costs. Major animal diseases and parasitic diseases of livestock are mainly through injection of animal vaccine, of antibiotics and the use of chemicals for prevention and treatment.

4.2 Main lessons

Guizhou province in recent years undertaken five sessions of the poverty reduction projects loaned by World Bank, there are many projects paid more attention to economic efficiency, not seriously implemented the project management approaches to the animal and plant pests and diseases and the plant and animal pest and disease control level should be improved. In the plant pest and disease control fields there was an over-reliance on chemical pesticides and there were some phenomenon neglecting agricultural prevention, biological control and physical control techniques and methods. Although the use of highly toxic pesticide residues having been completely eliminated but there are still some problems, such as insufficient prevention awareness, unsuitable technical choice, improper control methods and inaccurate prevention occasion. Many farmers still lack knowledge on integrated pest management, greatly rely on the use of chemical pesticides only seek saving time and quick efficiency, regardless on the environmental consequences and agricultural pollution. It resulted in multi times to use drug with high costs, increasing the chance of agricultural nonpoint source pollution and waste pollution; the immunization and parasite control is not yet fully covering all farming households. Some remote and free-range livestock farmers are still stocked in natural fields without animal pest control, growing and die without outside interference. Chemical control technology and promote the use of chemical inputs in a number of project areas it greatly improved the yield and efficiency, but it also intensified agriculture's dependence on chemical inputs, many local usage of fertilizers and pesticides

exceeding over the international environmental safety regulations and the unreasonable use has brought significant negative effects to the farmland environmental protection and green food production, seriously affecting the poverty effect. And it is not helpful for sustainable development of agriculture in the project area. This is a very profound lesson. Summing the main common issues and lessons learned it has great significance on the project preparation and implementation on the Integrated Pest Management program.

The main lessons in the following areas:

-- Crop cultivation costs increased. In agricultural production, farmers relied solely on chemical pesticides to control pests and diseases, arbitrarily increased the number and amount of pesticide spraying, production inputs increased and it showed an increasing trend year by year.

-- It induced pest resistant produced and pest resurgence. In the production it discovered that the diamondback moth has resistance to a variety of pesticides. Excessive use of pesticides, it not only caused pest resistant and caused pest and disease rampant again. And because of the serious destruction of natural enemies, it can also cause pest resurgence.

-- Pesticide residue hazards. Following the extensive use of chemical pesticides, pesticide pollution to water, soil and air and other ecological factors are becoming increasingly serious. Humans are at the top of the food chain, so the bioaccumulation of pesticide residues suffered the most serious damage to humans. Pesticides entered into human body will produce acute and chronic toxicity. The harmful pollution of the pesticide residues has become one of the world's major and most important food safety issues.

-- Agro-ecological environment changed. A long-term heavy use of chemical pesticides is not only a manslaughter to the natural enemies of pests, also killing the insects which are harmless to humans, thus affecting the living birds, fish, frogs and other creatures, because the insects are the food of these creatures. For example, the use of pyrethroids in orchards it will directly poison a variety of creatures, affecting freshwater aquaculture, destructing farmland ecological balance.

5. Main plants pests and animal epidemic diseases in the project area

In the main development industries in the project areas it should be based on the type of disease and pest and the infestation degree of the local animals and plants to decide how to adopt targeted prevention and control methods.

The pests and diseases occurrences situation in the main industries in the project counties, please see please see Table 1.

Sr. No.	Crops species	Pests and diseases description
1	Walnut	Fowl-brood, Nigredo, Canker, Dead-arm, Nigredo, Looper, Walnut root weevil, Longicorn, Leaf beetle, Red spider, etc.
2	Fine plums and hollow plums	Plum red spot disease, Bacterial shot-hole, bleeding disease, Longicorn beetle, Mulberry boder, Plum budworm, Aphid, Red spider, Scarab, etc.
3	Grapes	Spot anthracnose, Anthracnosis, White rot, Ash enzyme disease, Real blight, Cream enzyme disease, Powdery mildew, Spike-stalk tan disease, Tan disease, Glassy wings, Fruit piercing moth, Thrip, Green plant bug, Mite, Aphid, Mealybug, Leaf hopper, etc.
4	Common bletilla tuber	Leaf spot, Root rot, Nematodiasis, Looper, Red spider, Stinkbug, etc.
5	Figwort root	Spot blight, Southern blight, Red spider, Cutworm, Aphid, etc.
6	Codonopsis pilosula	Root rot, Rust disease, Red spider, Aphid, Cutworm, Grub, etc.
7	Salvia	Leaf spot, Root rot, Sclerotinia, Root knot nematode, Three-spotted plusia, Aphid, etc.
8	Radix pseudostellari	Virus disease, Leaf spot, Root rot, Powdery mildew, Grub, Cutworm, Mole cricket, Wire worm, etc.
9	Figwort root	Nigredo, Root knot nematode disease, Grub, Mole cricket, Wire worm, Cutworm, etc.
10	Platycodon grandiflorus	Ring spot, Spot blight, Aphid, Cutworm, etc.
11	Kudzu vine root	Leaf spot, Anthracnosis, Scarab, Cutworm, Cantharis, etc.
12	Rhizoma gastrodiae	Mycogone, Botrytis cinerea, Fusarium, Tuber rot, Scape black stem disease, Aphid, Black cutworm and Oriental tobacco budworm, etc.
13	Konjak	Konjak soft rot, Konjak southern blight, Greenish brown hawk noth, Palaeartic sweet potato, Prodenia litura, Scarab, etc.
14	White tea, Tea	Tea anthracnosis, Tea gall, Tea leaf blight, Empoasca vitis, Euproctis pseudoconsersa, Tea geometrid, Iragoides fasciata, Spiny white fly, Acaphylla theae and Tea gall mite, etc.
15	Potato	Late blight, Early blight, Bacterial wilt, Ring rot, Virus disease, Scab, Potatoes chytrid fungus, Black shank disease, Nematode, Tar spot, Spotted lady beetle, Colorado potato bug, Black cutworm, Aphid, Grub, Gryllotalpa and Tuber moth, etc.
16	Leafy vegetables	Drooping disease, Damping off, Cream enzyme disease, Blight, Ash enzyme disease, Anthracnosis, Wilt disease, Bacterial speck, Soft rot, Aphid, Black cutworm, Prodenia litura, Common cabbage worm, Diamond back moth, Oriental tobacco budworm, Asparagus caterpillar and Yellow tea mite, etc.
17	Edible Fungi	Enzyme, Mushroom flies, Mole cricket, evildoers, etc.
18	Goat	Goat pox, Foot and mouth disease, goat clostridium perfringens disease, goat infectious pleuropneumonia and other internal and external parasites.
19	Green-shell egg chicken	Highly pathogenic bird flu case, New castle disease, Marek's disease, Infectious bursal disease, Leukemia of fowls, Salmonellosis, chicken coccidiosis and other internal and external parasites.
20	Glutinous rice pig.	Foot and mouth disease, Swine fever, Highly pathogenic blue ear pig disease, Swine rabies, Swine plaque and other internal and external parasites.

Table 1 Animal and plant pests and diseases occurrence status on the major industries in the project counties

6. The major plant pest control approaches in the project area

Although the project area counties natural conditions are quite different and the crops planted are also different, but in the pest control measures and methods are about the same. If summarized it could be agricultural approaches, physical-mechanical, biological and ecological protection and control and chemical protection and control. Currently, chemical protection and control is still the main part to effectively control pests and diseases measures and it remains more than 80%, accounting for about 10% of agricultural practices, mechanical and biological control each accounted for about 5%. Implementation of this project it will vigorously promote integrated pest management (IPM) application to promote the project in the counties and it will reduce the proportion of the chemical control in control measures below than 50%.

6.1 Non- chemical prevention and control technical measures on the plant pest prevention and control in the project area

6.1.1 Plant quarantine

Plant Quarantine is a measure adopted by our country for avoiding plant and animal pests and diseases destroyed on crops and animals and the destruction or overspreading of weeds on crop production areas. Currently the potato wart disease occurred in Guizhou project area, etc. through quarantine means it can prevent any seed potato with this virus flowing into the disease-free areas in the project area. And this quarantine disease of potato production in the project area should be prevented by means of quarantine. The Plant Quarantine Stations of County Agriculture Bureaus in the project area should be responsible for plant quarantine of the plant material transport between provinces and between-counties of the province.

6.1.2 Agronomic cultivation control methods

Main measures are: ① Seed selection and application of anti-pest species, ② strengthen the management of water and fertilizer and intertillage weeding, ③ water and dry crop rotation. Studies have shown that: Seed selection and application of anti-pest plant and animal species are the most important means for pest control. Some measures, such as rational fertilization, watering, weeding tillage, crop water and dry rotation and other measures could improve plant resistance capacity against the animal and plant pests and diseases reducing the population density. Varied pest prevention and control on white tea, tea, konjak, leafy vegetables, walnuts, virus free potato, fine plums, hollow plums, grapes, edible fungus, common bletilla tuber, radix scrophulariae, codonopsis pilosula, salvia, honeysuckle, rhizoma gastrodiae, radix pseudostellariae, radix ophiopogonis, radix puerariae and platycodon gradiforum and many other diseases in the project area could be prevented and controlled by measures of seed selection, water and dry rotation and reasonable fertilizer and water management.

6.1.3 Physical and mechanical control methods

This is the common agricultural plant and animal pest control method, because: (1) Cheap - farmers do not need to buy pesticides and the Chinese labor is cheap; (2) Effective - physical and mechanical methods of prevention and treatment of some animal and plant pests and diseases is very effective; (3) Safety-pollution, environmental safety and security predators. Physical and mechanical methods can reduce the amount of pest populations and to avoid an increase in its resistance. The main limitation is that a long time, sometimes several specialized tools. This method is effective only for certain pests, only a complementary approach. The pest prevention of the longicorn, tobacco budworm, leaf beetle, tea caterpillars, beetle on the finest crops of white tea, tea, konjac, leafy vegetables, walnuts, virus free potato,

fine plums, hollow plums, grapes, edible fungus, common bletilla tuber, radix scrophulariae, codonopsis pilosula, salvia, honeysuckle, rhizoma gastrodiae, radix pseudostellariae, radix ophiopogonis, radix puerariae and platycodon gradiforum in the project area can cull through physical and manual methods to reduce damage heavy machinery mouth density, reduce pest damage.

6.1.4 Biological control methods

The biological control method is mainly to utilize the natural enemies of pests and the microbial agents to prevent and control the animal and plant pests and diseases and it could control the pest population at a lower population for many years. It is safe to humans, animals, plants and the environment. Of which microbial agents are currently used more, such as white tea, tea, konjak, leafy vegetables, walnuts, virus free potato, fine plums, hollow plums, grapes, edible fungus, common bletilla tuber, radix scrophulariae, codonopsis pilosula, salvia, honeysuckle, rhizoma gastrodiae, radix pseudostellariae, radix ophiopogonis, radix puerariae and platycodon gradiforum and many other pests and diseases, the biological pesticides and bio-antagonistic agents could be utilized. But the effect of the biological control is not so fast than the effect of the chemical pesticides and the efficacy stability is also lower than the chemical pesticides and the cost of the biological control are usually higher than the chemical pesticides cost. So many farmers mostly prefer to use chemical pesticides rather than using biological control method.

Table 2 Non-chemical pest control methods on the main crops in the project area

Name of crop	pests species	non-chemical pest control methods	Name of crop	pests species	non-chemical pest control methods
Walnut	Fowl-brood	Cut off the branches and fruit of disease	radix scrophulariae	Spot blight	Resistant varieties、Avoid seeper、Rotation
	Nigredo	Cut off the branches and fruit of disease		Root rot	Resistant varieties、Trichoderma、Rotation
	Canker	Cut off the branches of disease		Sclerotinia	Resistant varieties、Rotation
	Dead-arm	Cut off the branches of disease		Root knot nematode	Resistant varieties、Rotation
	Looper	Black light lamp, manual killing Bt		Three-spotted plusia	Bt、Insect killing lamp
	Walnut root weevil	Clean up deadwood and leavesdropped down and weeds, Bt		Aphid	Ladybug、Diaeretiella rapae mintosh、Yellow board killing
	Longicorn	Black light lamp or manual killing	Fine plums, hollow plums	Plum red spot disease	Cut off the branches of disease
	Leaf beetle	Black light lampor Manual killing		Bacterial shot-hole	Cut off the branches of disease、Agriculture chian
	Red spider	Cut off、Burn insect branches and leaves		bleeding disease	Lime-sulphur mixture
Vegetables	Drooping disease	Resistant varieties、Avoid	Potato	Longicorn beetle	Black light lampor
	Damping off	Resistant varieties、Avoid seeper		Plum budworm	Cut off insect branches
	Cream enzyme disease	Resistant varieties		Aphid	Yellow board attracting
	Blight	Resistant varieties		Red spider	Cut off、Burn insect
	Ash enzyme disease	Clean garden		Scarab	Black light lamp or manual killing
	Anthracnosis	Clean garden		Late blight	Resistant varieties, Anosis seed potato、Rotation
	Wilt disease	Trichoderma	Early blight	Resistant varieties, virus free seed potato, Rotation	

	Soft rot	Agriculture chian enzyme		Bacterial wilt	Resistant varieties、 Agriculture chian enzyme、	
	Aphid	Ladybug, Diaeretiella rapae mintosh、 Yellow board killing		Ring rot	Resistant varieties、 Anosis seed potato、 Rotation	
	Black cutworm	Insect killing lamp、 Bt、 Sex attractant		Virus disease	virus free seed potato	
	Common cabbage worm	Bt、 Sex attractant		spots	Resistant varieties、 Anosis seed potato、 Rotation	
	Diamond back moth	Bt、 Sex attractant		Black shank disease	Resistant varieties、 Rotation	
	Asparagus caterpillar	Insect killing lamp、 Bt、 Sex attractant		Nematode	Rotation	
rhizoma gastrodiae	Tuber rot	Strengthen celler management		Spotted lady beetle	Matrine、 Barbasco、 Bwauveria bassiana	
	Scape black stem disease	Strengthen celler management		Leaf beetle	Matrine、 Barbasco、 Bwauveria bassiana	
	Grubs	Insect killing lamp		Aphid	Yellow board killing	
	Mole cricket	Bait killing		Tuber moth	Plant seed potato without insect	
	Scale insect	Manual pick off		Tea	Tea anthracnosis	Cut off deadwood and
	Aphid	Yellow board attracting			Tea leaf blight	Yellow board killing
	White ant	Bait killing			Euproctis pseudoconsersa	Manual pick off egg mass、 Matrine、
Grapes	Spot anthracnose	Cut off the branches and	Tea	Tea geometrid	Matrine、 Barbasco、 Bwauveria bassiana	
	Anthracosis	Cut off the branches and fruit of disease		Iragoides fasciata	Matrine、 Barbasco、 Bwauveria bassiana	
	Ash enzyme disease	Cut off the branches and leaves of disease		Spiny white fly	Cut off deadwood	
	White rot	Cut off the branches and leaves of disease		Acaphylla theae	Predatory mite	
	Tan disease	Cut off the branches and leaves of disease		Tea gall mite	Predatory mite	
	Cream enzyme disease	Cut off the branches and leaves of disease		common bletilla tuber	Leaf spot	Cut off leaves, then centralized treatment
	Glassy wings	Cut off insect branches、 Bt			Root rot	Trichoderma
	Fruit piercing moth	Bt、 Insect killing lamp			Nematodiasis	Rotation
Edible gungus	Enzyme	Disinfection of the fungus bed		Looper	Manual killing	
	Mushroom flies	Bait killing		Red spider	Cut off、 Burn insect	
	Mole cricket	Bait killing		Stinkbug	Manual killing	
	evildoers	Bait killing		radix pseudostellariae	Virus disease	Rirus A wetable powder
Salvia	Spot blight	Select disease free soil for planting	Leaf spot		Cut off diseased leaves, then	
	Southern blight	Select disease free soil for planting	Root rot		Trichoderma	
	Red spider	Predatory mite	Powdery mildew		Cut off diseased leaves, then	
	Cutworm	Light killing	Cutworm		Light killing、 Manual killing	
	Aphid	Yellow board killing、	Grub		Light killing	
codonopsis pilosula	Root rot	Select disease free soil for planting、 Trichoderma	platycodon gradiforum	Mole cricket	Manual killing	
	Rust disease	Cut off diseased leaves, then centralized treatment		Wire worm	Manual killing	
	Red spider	Predatory mite		Ring spot	Cut off diseased leaves, then	
	Aphid	Yellow board killing、		Spot blight	Cut off diseased leaves, then	
	Cutworm	Light killing		Aphid	Yellow board attracting、	

	Grub	Light killing , Manual		Cutworm	Light killing
radix ophiopogonis	Nigredo	Cut off diseased leaves	radix puerariae	Leaf spot	Cut off diseased leaves, then
	Root knot nematode disease	Rotation		Anthracnosis,	Cut off diseased leaves, then centralized treatment
	Grub	Light killing , Manual		Anthracnosis,	Light killing, Manual killing
	Mole cricket,	Manual killing		Cantharis	Light killing
	Wire worm	Manual killing		Cantharis	Manual killing
	Cutworm	Light killing , Manual	Konjak	Konjak soft rot	Trichoderma
				Konjak southern blight	Trichoderma
				Greenish brown hawk noth	Bt, Matrine,
				Palaeartic sweet potato	Bt, Matrine,
				Prodenia litura	Bt, Matrine,
				Scarab	Light killing, Manual killing

6.2 Chemical control methods

Chemical pesticides control has its significant advantages: Firstly there is a wide range of pesticides are available up to a thousand species; Secondly, the chemical pesticides can be purchased at any time and there is not any seasonal restrictions; Thirdly, chemical pesticides control is fast and efficient and all of these are the most significant advantage. However, the extremely serious pollution by chemical pesticides caused threat to human and animal health. Many pesticides kill the natural enemies of the target pest, but also it caused many pests developed resistance to the chemical pesticides. When the number of a certain kind of pest population added too quickly causing serious harm to agriculture, the pesticides prevention is the most effective way. When using chemical methods of pest prevention and control of crops, people's concern is the types of pesticides, the use of the method, the quantity of pesticide to be used, administration time and pesticides residues period (mainly on vegetables, tea and fruit). To guide farmers medication safety and to meet the Bank's requirements for environmental management plans, according to the species in Guizhou project area, based on the above IPM methods and in accordance with the World Line pesticide Buyer's Guide (Operational Policy 4.09), after screening, lists the recommended list of pesticides (see Table 3).

Table 3 Pesticides list recommended to be applied

Crops	Pests and diseases	Species of the pesticides to be applied	Pesticide classification (WHO)
walnut	Fowl-brood Nigredo, Canker Dead-arm Looper, Walnut root weevil, Longicorn Leaf beetle Red spider	Chlorothalonil, bromothalonil, thiophonate-methyl, Chlorothalonil, Tuzet, mancozeb, Zhongshengmucin, Sulfare chain enzyme, Chlorpyrifos, cyfluthrin, cypermethrin chlorpyrifos propargite, Avermectin	III III IV III III III, IV
Fine plums, hollow plums	Plum red spot disease, bleeding disease Bacterial shot-hole Longicorn beetle, Mulberry boder Plum budworm Aphid Red spider Scarab	thiophanate methyl, mancozeb, lime-sulphur Zhongshengmucin,Sulfare chain enzyme, chlorpyrifos chlorpyrifos, cyfluthrin, deltamethrin acetaniprid, imidacloprid, Asana, pirimicarb propargite, Avermectin cyfluthrin, cypermethrin, deltamethrin	III IV III III III III, IV III
Grapes	Spot anthracnose, Anthracnosis, White rot, Ash enzyme disease Real blight Cream enzyme disease Powdery mildew Glassy wings, Fruit piercing moth Thrip, Green plant bug, Mite, Aphid, Mealybug,Leaf hopper	Spring thunder enezy, Azoxystrobin, Jिंगgangmucin enzyme,propamocarb Chlorothalonil, thiophonate-methyl Azoxystrobin, Jिंगgangmucin enzyme, propamocarb thiophonate-methyl, ketotrizole, propiconazole chlorpyrifos, cyfluthrin, cypermethrin Avermectin, deltamethrin Propargite,Avermectin Acetaniprid,imidacloprid,Asana,pirimicarb	III III III III III IV, III III, IV III
Konjak	Konjak soft rot Konjak southern blight, Greenish brown hawk noth, Palaearctic sweet potato, Prodenia litura,Scarab	Zhongshengmucin, Sulfare chain enzyme, Trichoderma,thiophonate-methyl Chlorpyrifos, deltamethrin, methomyl	IV IV, III III
White tea, tea	Tea anthracnosis. Tea gall, Tea leaf blight Empoasca vitis, Euproctis pseudoconsersa Tea geometrid, Iragoides fasciata, Spiny white fly Acaphylla theae and Tea gall mite	thiophanate methyl, Spring thunder enezy, mancozeb, acetaniprid, imidacloprid, pirimicarb Avermectin. Cyfluthrin, cypermethrin Propargite, Avermectin	III III III IV, III
Potato	Late blight, Early blight Bacterial wilt, Ring rot Virus disease Scab, Potatosets chytrid fungus Black shank disease Nematode Spotted lady beetle, Colorado patato bug Black cutworm, Grub, Gryllotalpa Tuber moth	Kocide, propamocarb, Jिंगgangmucin enzyme, Myclobutanil Zhongshengmucin, Sulfare chain enzyme, Viruside, moroxydine hydrochloride, abob ketotrizole Zhongshengmucin, Sulfare chain enzyme, phonamiphos cyfluthrin,cypermethrin chlorpyrifos,cypermethrin,deltamethrin, Angulatus Avermectin,cyfluthrin, cypermethrin	III IV III III IV III III III III III

According to oral and percutaneous rats fed on a mouse LD50 (mg / kg body weight), the World Health Organization (WHO) and China separately formulated pesticide acute toxicity grading standards, the World Health Organization (WHO) agriculture pesticide toxic grading: IA : extremely hazardous, IB: high hazard, II: moderately hazardous, III: mild hazards and IV: no harm, corresponding Chinese pesticide acute toxicity grading standards, there are five classes, they are extreme toxic, highly toxic, moderately toxic, low toxicity and non-toxic.

The current list of recommended pesticides listed in Table 3 in the World Health Organization (WHO) list of toxic pesticide classification is entirely consistent with the Chinese standard list of pesticide acute toxicity classification. Table 3 lists the pesticide pesticides used for recommendation which belong two classes of III: lower level of toxic and IV: non-toxic, which with an asterisk "※" will be bio-pesticides, belonging to the category of non-toxic. The above recommended pesticides completely: to meet the requirements of the World Bank and national policies in the related documents. Any pesticides included in the World Health Organization (WHO) IA, IB levels and pesticide included in China's latest disabled list that should not be purchased and used in the project.

During project implementation PMO of the project area counties will guide farmers in procurement and use on the related pesticides recommended in accordance with the list in Table 3. During project implementation as a new species of pest occurring outside of the Table 1, while elected the species of the pesticide within the scope of the list listed in Table 2 and Table 3, it can not effectively control the pest, you can also increase the types of pesticide to use outside the scope of the list in Table 3. But you should base on the World Health Organization (IA, IB) Prohibited List and China's latest disabled list to carry out screen selection and report to the World Bank project authorities.

7. The major animal epidemic diseases control and prevention approaches in the project area

7.1 Scientific management

It should fully strengthen raising management and take comprehensive measures to effectively reduce the occurrence of animal diseases. It mainly include: ① Site selection should be conducive to disease isolation and the functional zoning should be scientific and reasonable. ② To control flow of goods and people. It mainly includes fauna control, environmental hygiene control and pathogen control. ③ To establish and improve disease prevention system. It mainly includes sanitation and disinfection system, immune system, medication system, dead livestock and pollutants harmless disposal, pesticides and rodent control system and the epidemic reporting system.

It should promote intensified and standardized animal breeding in scale. It should fully take account of the scale of farming and environmental carrying capacity and the risk of disease for promoting healthy farming methods. To keep the pens clean, airy and warm. It should take care of feed deployment to prevent the use of moldy feed, to ensure clean drinking water of animals and do not polyculture other animals in the same farm. It should establish strict biosecurity management system for improving the biosafety level.

7.2 Immunize anthelmintic

It should take necessary immunization program against foot and mouth disease and other diseases. It should do immunization program record well and regularly monitor the immune effect. If it was not up to the standard on the immunization antibody levels, a supplement immunization program should be timely added up. In

the parasitic diseases prevalent region, it is necessary to take drug deworming measures in timely.

7.3 Symptomatic treatment

If the animals infected disease of bird flu or foot and mouth disease, they should be killed and be not necessary to be treated. Some parasitic diseases and acute infectious diseases could be treated by bacterial antibiotics or chemotherapy. It should strengthen farms drug safety regulation, establish and improve medication records system, strictly implement the drug withdrawal period and prescription drug system and the drug use should be under the guidance of licensed veterinary.

7.4 Disinfection and sterilization of source

To establish a regular disinfection system and select the appropriate broad-spectrum, high efficiency, low toxicity disinfectant for disinfection. UV can be taken out for coming in and going out personnel, by spraying disinfectant, stepping on disinfectant foot pad or pool disinfection and hand washing disinfection basin, etc. Any vehicle entering in should be thoroughly disinfected before entering by rinsing. Equipment tools could be sprayed with disinfectant, or by autoclaving, fumigation and other methods. Cleaning and disinfecting pens must be firstly carried out for removing dirt and it should frequently replace the disinfectants varieties and it shall be used interchangeably. Good personnel protection should be carried out during sterilization for reducing irritation to staff.

7.5 Purify disease

It should be strictly accordance with relevant national technical regulations and handling procedures and some specific disease-positive animals should be eliminated, killed and a harm free treatment should be carried out. It should encourage some qualified animal farm to take quarantine, disinfection, culling or eliminating approaches and other technical measures to carry out disease decontamination work.

7.6 Harmless treatment

The affected animals carrying large amounts of pathogens and they are the source of infection diseases. Farms and households shall actively cooperate with animal husbandry and veterinary competent departments at all levels to cull livestock and poultry suffering brucellosis, goat pox, foot and mouth disease, avian flu and other diseases according to regulations. Under the supervision of local animal health supervision institution, the carcasses of the infected animals and the dead animals, the streaming animals, the stillbirth (germ) and the contaminated forage should be harmlessly treated.

7.7 The control and prevention approaches on major animal epidemic diseases

According to the actual situation in the project area, it should overall arrange the sustainable development relationship among the animal disease prevention and control, public health and environmental health and the livestock breeding industry and actively explore the animal disease prevention and control mode in line with the project area.

(1) Implementation of distinguishing disease category, distinguishing region and phased prevention and control program. There are plans to control and purify the key diseases which will cause a large animal and public health and safety hazard and it should periodically assess the health and the prevention and control of animal populations effects, implement the major animal diseases and zoonoses control programs, focus on efforts to achieve a stability control from active disease control and ultimately eliminate and purification.

(2) To implement breeding livestock health promotion strategies. Establishment of healthy breeding philosophy, strengthening disease source control and actively

implement the self reproduction and self-sterile and closed breeding patterns for improve self-sufficiency and animal health level. Complete breeding animal health standards, the implementation of farm livestock and poultry diseases purification program. Implement the regular animal health testing.

(3) Implementation of standardized scale farming promotion strategies. Vigorously support large-scale, standardized, intensive farming. Gradually reduce the proportion of free-range farming. Orderly reduce the cross circulation. Improve livestock farming methods to purify the culture environment. Perfect supervision system on the animal epidemic prevention checkup in the breeding places and improve bio-safety level and providing the pre-conditions for animal epidemic prevention. Guide farmers unified prevention, regular monitoring and strict disinfection for reducing the risk of animal disease. The main animal diseases and management plans are shown in Table 4.

Table 4 Major animal diseases and Management Plan

Animal	Epidemic and diseases	Management plan	
		Prevention	Control and treatment
Chicken	Highly pathogenic bird flu	Vaccinating Highly pathogenic bird flu	Mandatory culling, innocent treatment and terminal disinfection
	New castle disease	Vaccinating New castle disease	
	Marek's disease	Vaccinating Marek's disease	
	Gumboro disease	Vaccinating Gumboro disease	
	Avian leukosis	Quarantine, eliminating and purification	Quarantine, eliminating and innocent treatment
	Salmonellosis	Quarantine, eliminating and purification	Quarantine, eliminating and innocent treatment
	Chicken coccidiosis	Vaccinating chicken coccidiosis vaccine	Injecting or throw in aktisol-weiss or other anti- coccidiosis vaccine drug.
	Other internal and external parasitic diseases	Throw in Ibiza vaccine + albendazole or ALB	Throw in Ibiza vaccine + albendazole or ALB
Pig	Foot and mouth disease	Vaccinating Aptha	Mandatory culling, innocent treatment and terminal disinfection
	Swine fever	Vaccinating Swine fever	
	Highly pathogenic blue ear pig disease	Vaccinating Highly pathogenic blue ear pig disease	
	Swine rabies	Vaccinating Swine rabies	
	Swine plaque	Vaccinating Swine plaque	Injection or hurl sensitive antibiotics
	Internal and external parasitic diseases	Throw in ivermectin vaccine	Injection of ivermectin vaccine
Goat	Goat pox	Vaccinating Goat pox	Compulsion of killing, innocent treatment and terminal disinfection
	Aptha	Vaccinating Aptha	
	Goat Clostridium perfringens disease	Vaccinating triple or four anti-vaccine	Injection or hurl sensitive antibiotics
	Infectious pleuropneumonia of goat and goat	Vaccinating infectious pleura pneumonic vaccine	Injection or hurl sensitive antibiotics
	Ectoparasitic diseases	Hypodermic Ivermectin	Hypodermic Ivermectin
	Worm		
		Fluke disease	Hurl albendazole or albendazole bolus
Cestodiasis			

Table 5 Common used vaccines species

Animal	Diseases	Commonly used vaccines	Remarks
Chicken	Marek's disease	Turkey herpesvirus live vaccine HVT (FC-126 strain)	
	Bird flu	Recombinant avian bird flu live vaccine (H5N1-re-6 strain)	
		Bird fluH5+H9 bivalents live vaccine (H5N1-re-6+H9N2-re-2)	
	New castle disease	ChickenNew castle diseaselive vaccine (Clone30strain)	1. new -. Branched bivalent live vaccine (HB1+H120) 2. New -. Branch –
		ChickenNew castle diseaselive vaccine (HB1strain)	
		ChickenNew castle diseaselive vaccine (LaSotastrain)	
		New castle diseaselive vaccine (v4strain/HB92 clone strain)	
		ChickenNew castle diseaselive vaccine (VG/GAstrain)	
	Infectious bronchitis	Infectious bronchitislive vaccine (H52strain)	Less triple live vaccine (LaSota+M41+HSH23)
		Infectious bronchitislive vaccine (H120strain)	
Infectious bronchitislive vaccine (M41strain)			
Gumboro disease	ChickenGumboro disease heat resistance agents live vaccine (B87strain)		
	ChickenGumboro disease live vaccine (Xstrain)		
Coccidiosis	Chicken clone Eimeria coccidiosis live vaccine (Coccivac-Bstrain)		
Pig	Foot and mouth disease	Pig O type- Foot and mouth disease inactivated vaccine (O/Mya98/XJ/2010 strain+O/GX/09-7strain)	
		Pig O type- Foot and mouth disease synthetic pepetide vaccine (polypeptide2570+7309)	
	Swine fever	Swine fever cell vaccine (cell vaccine Shimen C strain)	
		Swine fever rabbit tissue cell vaccine (tissue vaccine Shimen C strain)	
		Swine fever splenic lymph vaccine vaccine (tissue vaccine Shimen C strain)	
	Highly pathogenic blue ear pig disease	Highly pathogenic blue ear pig disease inactivated vaccine (JXAI strain)	
		Highly pathogenic blue ear pig disease live vaccine (TJM-F92 strain)	
		Highly pathogenic blue ear pig disease live vaccine (JXAI-R strain)	
		Highly pathogenic blue ear pig disease live vaccine (HuN4-F112 strain)	
	Swine rabies	Swine rabies live vaccine (Bartha-K61 strain)	
Swine fever,swine red fever	Swine fever,swine red fever, pasteurilla multocida triplex viable bacteria		
Necrotic enteritis	Paratyphus live vaccine for piglets		
Goat	Aptha	O type-Asian I Aptha FMD live vaccine (OSstrain+JSLstrain)	
	Goat pox	Goat poxattenuated vaccine	
	Goat Clostridium perfringens disease	Clostridium perfringens goat disease perfringens four anti triple vaccine (Clostridium perfringens type B C58-2, D-type C60-2, corruption Clostridium C55-1)	Anti-Goat fast epidemic, Lamb diarrhea, sudden spy, intestinal toxemia
	Infectious pleuropneumonia of goat and goat	Infectious pleuropneumonia of goat and goat Mycoplasma inactivated vaccine (C87-1strain+Y-98strain)	

The animal epidemic diseases control should mainly focus on the prevention, on the part of the bacterial disease, mycoplasma disease and parasitic diseases some sensitive drugs could be applied for treatment. The commonly used veterinary drugs reference should be included in the raw materials and pharmaceutical preparations of the national pharmacopoeia, Veterinary Pharmacopoeia or national legal pharmacy drugs standards. Drugs and medication applied should be carried out under the guidance of a licensed practicing veterinarian. The Recommended Drug List is as follows:

Table 6 Common used vaccine categories

(1) Tilmicosin premixes	(2) lincomycin hydrochloride soluble powder
(3) Amoxicillin soluble powder	(4) Colistin sulphate premix
(5) Florfenicol powder	(6) Doxycycline hydrochloride soluble powder
(7) Tartrate Taiwan streptozotocin premixes	(8) Ampicillin soluble powder
(9) Sodium sulfa Chloropyrazine Soluble Powder	(10) Lonicera and Forsythia powder
(11) Bupleurum injection	(12) Radix Injection
(13) Andrographis injection	(14) Shuanghuanglian oral
(15) Houttuynia injection	(16) Injection of potassium penicillin
(17) compound aminopyrine injection	(18) ceftiofur sodium for injection

8. Implementation arrangements on pest management plan

8.1 Institutional arrangements and responsibilities

In order to ensure the smooth implementation of the pest management plan PMO will prepare a strict management system, will carry out strict management and assessment on staff participated in the pest management program, project funds, activities and achieved results. Based on the pest management plan formulated, it should set up a leading group, a Technical Advisory Group and the implementation team for the Pest Management Plan. Of which the project leadership group will be led by the PMO of World Bank, the responsible persons of the PMO in each project prefecture and county and persons in charge in the township should be participated in and will be responsible for supervising, coordinating the pest management planners, such as the use of funds and the implementation of the inspection and evaluation. The Technical Advisory Group will be led by the Provincial Agricultural Science Institute, the plant protection and animal epidemic prevention workers in each project county will be participated in and they will be responsible for preparing the implementation program on the pest management plan, for formulating the technical information, technical training and technical guidance on the pest management plan and the effectiveness and the assessment pest on the pest management plan implementation. The implementation team will be led by the provincial plant protection station and the provincial veterinary station, city and county animal husbandry and veterinary department, related, Agricultural Technology Promotion Center, Plant Protection Stations, agricultural associations, cooperatives and planting farmers with a great scale of planting will be participated in and they will be responsible for the practice implementing on the pest management plan.

The project will rely on the existing plant protection stations and animal husbandry and veterinary stations of Guizhou province, Zunyi City, Tongren City, Bijie City and the 11 project counties and the PMO of Guizhou Province, Zunyi City, Tongren City, Bijie City and the project county PMO will be as the organizations of the pest management plan and be responsible for implementing animal and plant pest management program. Their responsibilities include guiding the implementation of each project unit to carry out the integrated plant and animal pest management programs, training staff at all levels of agricultural technology technicians and farmers, training and monitoring of the integrated pest management methods. The Plant Protection Stations and the Animal Husbandry and Veterinary Stations in the 11 project counties will participate in the implementation and training of animals and plants Integrated Pest Management in the county.

Provincial PMO is responsible for preparing the pest management plan of the project and for carrying out guidance and supervision on the pest prevention and control of the leading industries in each project area. The City Project Management Office will refine the Pest Management Plan in order to ensure the implementation of these plans more in line with the conditions and suitable for low-level technicians and farmers' training. The funds of the project can only buy pesticides in the list. Each PMO at all levels and it will keep the records in detail in order to monitor the procurement. The list will run as a project basis for training courses at all levels of county, township and technical staff and farmers. The Provincial PMO and the municipal PMO will monitor the training, as well as the integrated applications of the animal and plant pest management methods.

County PMO should appoint technical staff to escort the pesticides, vaccines and veterinary drugs to ensure them timely and safely delivered to the destination. Once the containers which installed the pesticides, vaccines and veterinary drugs broken or destroyed, it is necessary to take quick lime for treatment to prevent the environmental pollution. County PMO will keep the original records of the transport and delivery. Under the support and participation of the county local Plant Protection Station and Animal Husbandry and Veterinary Station, county PMO will be responsible for training to the agricultural workers (county and township) and farmers training. City PMO will ensure consultation with relevant experts to form the specific recommendations tailored to the local conditions. Experts will include the persons concerned from Provincial Plant Protection Station and the Provincial Animal Husbandry and Veterinary Station, or Guizhou University and the Provincial Academy of Agricultural Sciences.

8.2 Pest management mechanisms and processes

The procurement, storage and use on the pesticides, vaccines and veterinary drugs in the project will strictly abide the relevant state laws and regulations and the Project Management Office will control this in accordance with the following process:

8.2.1 Planners Management of the Pest Management Plan

It is necessary optimize the combination on the existing scientific and technical personnel in the implementation region of each project area for consisting of a highly qualified technical team on the pest management plan to develop participated personal responsibility, clearly the annual work time, their tasks and the forecasted targets to be completed, etc. to each member. Based on the task completion result it will carry out individual punishment or award and there will be a performance appraisal system to the members which participated in the implementation of the project to ensure fully mobilization of the enthusiasm of the individual work.

8.2.2 Fund Management

The use of the planned funds of the Pest Management Plan should strictly be in accordance the relevant stipulations on the financial aspects of the World Bank loan project funding management practices and Chinese government regulations in the World Bank loan projects and it should follow the principle of "earmarking a fund for its specified purpose only" and regular auditing principles to establish a special account funds for the pest management plan for preventing the occurrence of misappropriation and the phenomenon of crowding out funding. The materials procurement should be scientifically studied and it should be public tender for supplies. Any subsidies paid to farmers and materials distributed to farmers should be required to register and it will have a return visit to farmers.

8.2.3 The implementation and management of the Pest Management Plan

Each project area will develop the region's the annual implementation plan on the pest management plan, regularly convene work joint meetings participated by farmers, associations (cooperatives) persons in charge, local government representatives, technology management department heads on the Pest Management Plan to summarize and notify the execution status on the Pest Management Plan in a timely manner to resolve the issues arose and carry out suitable adjustments.

Each PMO will submit an interim summary report of the project and project acceptance report at mid-term and end of the project implementation. Meanwhile, PMO in the project area will regularly write the Pest Management Plan Implementation briefing submitted to the Provincial Office of the World Bank loan project to report on the implementation of pest management programs, achievements and problems. It is necessary to use different forms to actively promote the

implementation achievements of the pest management program and to accelerate the demonstration outcomes in each project area.

8.2.4 Procurement, supply and utilization management on the pesticides, vaccines and veterinary drugs

(1) Based on the animal epidemic disease and plant pests situation which actually occurred and may happen in the industrial development process in the project area the management plan prepared a recommended procurement list related to the pesticides, vaccines and veterinary drugs (see Table 3 and Table 5). The pesticides, vaccines and veterinary drugs on the procurement list should have product registration certificate and production licenses approved by the state. Any pesticides, vaccines and veterinary drugs which does not recommend in the purchase list shall not be purchased, used and reimbursed. Under the equal conditions the biological agent and lower toxin products shall be purchased in priority. If it is necessary to buy any product which is not in the list, it should promptly organize some experts for argument and it should be approved by the PMO above city.

(2) According to actual plant pest situation occurred in the crop fields for cultivation of white tea, tea, konjak, leafy vegetables, walnuts, virus free potato, fine plums, hollow plums, grapes, edible fungus, common bletilla tuber, radix scrophulariae, codonopsis pilosula, salvia, honeysuckle, rhizoma gastrodiae, radix pseudostellariae, radix ophiopogonis, radix puerariae and platycodon gradiforum (see Annex 1) it should report a predicting on the plant pests and the needed pesticides names, dosage, etc. to the county PMO, County Agriculture Bureau and the county plant protection station. Based on the actual occurrence situation of the animal epidemic diseases and parasitosis on chickens and goats (see Annex 2), farmers shall report a predicting on the animal epidemic diseases and parasitosis and the needed pesticides names, dosage, etc. to the county PMO, County Animal Husbandry and Food Bureau and the county Animal Husbandry and Veterinary Station. County PMO will prepare a procurement plan according to the pesticides, vaccines and veterinary drug recommended procurement list reporting to superiors projects PMO. Upon approved the procurement could be started.

(3) The pesticide, vaccines and veterinary drugs in the related list must be purchased to whose manufacturers which obtained marketing license. Any county bulk purchases on the pesticides, vaccines and veterinary drugs it must undergo by public bidding or three parties or more price comparison.

(4) If you need larger amounts of pesticides, vaccines and veterinary drugs, it can be directly obtained from the county PMO. If you only need small amounts of pesticides, vaccines and veterinary drugs, it can be purchased directly from the township agricultural store and the pesticides, vaccines and veterinary drugs supplied by the store should be the pesticides, vaccines and veterinary drugs approved by the County PMO.

9. Pest Management Training and Technical Services

During the project implementation, each municipality should develop program and budget for overall training and technical services including: the annual number of training courses and technical details of the service, the number of participants, training and service locations, training programs and training materials. The prior approval of the provincial PMO should be detailed for annual training and technical service programs. The budget should describe unit cost (per person per day) of the training and services and the training and technical consultation materials. The payment basis on training and technical service activities are: (1) prepared training and technical consulting materials; (2) evidence of the training courses which could

be monitored (person number participated, teachers and duration records); (3) evidence of the technical services which could be monitored (service times, person number participated in the services and times, service hours records).

Provincial PMO will pay the related expenses according to the detailed annual training plan and fund budget submitted. Table 7 is the training expenses budget table.

Table 7 Training and technical services expenses budget

Training content	Object trained	Training courses (course number)	Persons participated in training (person/times)	Expenses Budge (RMB 10,000 yuan)
Total		539	88100	75.8
1. Provincial class		1	30	5.4
(1) Laws and regulations	Environmental protection personnel of PMO in the city level agriculture bureaus	1	30	5.4
(2) Safety use and management on the pesticides, vaccines and veterinary drugs				
(3) Agriculture technologies and animal disease and plant pest control				
2. Municipality class		18	120	12.8
(1) Prevention and control technologies and pesticides safety use	Environmental protection personnel of PMO in the county level agriculture bureaus	9	60	6.4
(2) Basic knowledge on animal disease and plant pest, the animal disease and plant pest verification, their living history, and their biological characters.	Environmental protection personnel of PMO in the county level agriculture bureaus	9	60	6.4
3. County class		120	2950	23.6
One training-course and 2-3 times of technical consultation services (practical demonstration operation on animal disease and plant pest control and pesticides, vaccines and veterinary drugs safety use) per year in each project area.	Township and forest agriculture technicians	120	2950	23.6
4. Township class		400	85000	34.0
One training-course and 2-3 times of technical consultation services (practical demonstration operation on animal disease and plant pest control and pesticides, vaccines and veterinary drugs safety use) per year in each project area	Farmers or households	400	85000	34.0

10. Monitoring on the pest management

10.1 Monitoring purpose and key points

Monitoring is the most effective measure actively to prevent the animal diseases and plant pest spreading hazards for nipping a thing in the bud. By scientifically setting up monitoring sites and establishing a rigorous pest monitoring network, we can early identify the pathogen distribution trends of animal and plant diseases, scientifically assess the immune effects. So it can effectively prevent any exotic disease and the new disease in priority, regularly analyze and assess the animal and plant epidemic situation and scientifically judge the prevention and control situation to provide scientific basis for prevention and control decisions.

Plant pest monitoring will focus on: the plant pest and disease which had occurred and caused a major impact or any risk of diseases and pest which have not introduced yet on white tea, tea, konjak, leafy vegetables, walnuts, virus free potato, fine plums, hollow plums, grapes, edible fungus, common bletilla tuber, radix scrophulariae, codonopsis pilosula, salvia, honeysuckle, rhizoma gastrodiae, radix pseudostellariae, radix ophiopogonis, radix puerariae and platycodon gradiforum.

The focus on animal disease surveillance will be: foot and mouth disease, highly pathogenic bird flu, brucellosis, swine fever, Newcastle disease, highly pathogenic blue ear pig disease.

10.2 Monitoring point arrangement

According to the project layout it should establish city and county two levels of monitoring points. Each county will arrange less than 4 monitoring points of the municipal level monitoring samples and there will be at least three monitoring points of county level samples located in the major towns. Of which the municipal monitoring points will mainly use the existing monitoring points in Zunyi City, Tongren City and Bijie City, it is not necessary to duplication arrangement. The county monitoring samples can be built with a new distribution in the major towns of the project implement area. By laying the three level monitoring samples, it can ensure a pre-accessing to the occurrence data of the plant and animal pests and diseases at any time, while tracking of pesticides, vaccines and veterinary drugs procurement, distribution and the safe use information. The monitoring task on the monitoring points on the animal and plant pests should be included in the daily work of the plant protection station and the veterinary station at same level.

10.3 Monitoring program

The plant pest occurrence situation in the plant pest monitoring points of the provincial level, municipal level, County level and township-level will be unified by the County Agriculture Bureau PMO and the plant protection stations for observation or investigation. And the County Agriculture Bureau PMO will sum these data to report to the Municipal Agricultural Bureau PMO and the provincial PMO. Based on the information, the PMO of the province will disseminate the occurrence and the development of the plant and animal pests and diseases and forecast the trend.

Animal and Plant Pest Management monitoring budget should indicate the detection capacity building and monitoring unit cost (per person per day). The expenses payment basis for the Plant pest management monitoring are: (1) The plant pest management monitoring plan prepared and the monitoring records; (2) The actual released surveillance data on the animal diseases and plant pest occurrence and the pesticides and veterinary drugs procurement, pesticides, vaccines and veterinary safety use and other aspects of monitoring information (released times, monitoring and recording information, etc.). The provincial PMO should prove the detailed

annual monitoring budget plan on pest management in advance. The detailed monitoring program, see Table 8.

Table 8 Monitoring on animal disease and plant pest management

Monitoring object	Pests and diseases	Monitoring place	Monitoring frequency	Estimated cost (RMB 10,000 yuan)
1. The incidence of plant pests				
walnut	Fowl-brood, Nigredo, Canker, Dead-arm. Looper, Walnut root weevil, Longicorn, Leaf beetle Red spider	Zhengan County, Dejiang County, Yanhe County, Yinjiang County and Hezhang County	4 times/growing	
Fine plums, hollow plums	Plum red spot disease, bleeding disease, Bacterial shot-hole, Longicorn beetle, Mulberry boder, Plum budworm, Aphid, Red spider, Scarab	Sinan County and Yanhe County	4 times/growing	
Grapse	Spot anthracnose, Anthracnosis, White rot, Ash enzyme disease, Real blight, Cream enzyme disease, Powdery mildew, Glassy wings, Fruit piercing moth, Thrip, Green plant bug, Mite, Aphid, Mealybug, Leaf hopper	Sinan County	4 times/growing	
Common bletilla tuber	Leaf spot, Root rot, Nematodiasis, Looper, Red spider, Stinkbug, etc.	Zhengan County	4 times/growing	
Figwort root	Spot blight, Southern blight, Red spider, Cutworm, Aphid, etc.	Daozhen County	4 times/growing	
Codonopsis pilosula	Root rot, Rust disease, Red spider, Aphid, Cutworm, Grub, etc.	Daozhen County and Sinan County	4 times/growing	
Salvia	Leaf spot, Root rot, Sclerotinia, Root knot nematode, Three-spotted plusia, Aphid, etc.	Shiqian County	4 times/growing	
Radix pseudostellari	Virus disease, Leaf spot, Root rot, Powdery mildew, Grub, Cutworm, Mole cricket, Wire worm, etc.	Sinan County	4 times/growing	
Radix ophiopogonis		Shiqian County	4 times/growing	
Platycodon grandiflorus	Ring spot, Spot blight, Aphid, Cutworm, etc.		4 times/growing	
Honeysuckle	Leaf spot, powdery mildew, bituminous disease, gray leaf spot, brown beetles, spider mites, aphids, etc.	Daozhen County and Sinan County	4 times/growing	
Rhizoma gastrodiae	Mycogone, Botrytis cinerea, Fusarium, Tuber rot, Scape black stem disease, Aphid, Black cutworm and Oriental tobacco budworm, etc.	Dejiang County	4 times/growing	
Radix pseudostellari	Virus disease, Leaf spot, Root rot, Powdery mildew, Grub, Cutworm, Mole cricket, Wire worm, etc.	Nayong County	4 times/growing	

Platycodon grandiflorus	Ring spot, Spot blight, Aphid, Cutworm, etc.	Nayong County	4 times/growing	
Konjak	Konjak soft rot, Konjak southern blight, Greenish brown hawk moth, Palearctic sweet potato, Prodenia litura, Scarab, etc.	Weining County and Hezhang County	4 times/growing	
White tea, Tea	Tea anthracnosis, Tea gall, Tea leaf blight, Empoasca vitis, Euproctis pseudoconspersa, Tea geometrid, Iragoides fasciata, Spiny white fly, Acaphylla theae and Tea gall mite, etc.	Zhengan County	4 times/growing	
Potato	Late blight, Early blight, Bacterial wilt, Ring rot, Virus disease, Scab, Potato sets chytrid fungus, Black shank disease, Nematode, Tar spot, Spotted lady beetle, Colorado potato bug, Black cutworm, Aphid, Grub, Gryllotalpa and Tuber moth, etc.	Dejiang County, Shiqian County, Weining County and Hezhang County	4 times/growing	
Leafy vegetables	Drooping disease, Damping off, Cream enzyme disease, Blight, Ash enzyme disease, Anthracnosis, Wilt disease, Bacterial speck, Soft rot, Aphid, Black cutworm, Prodenia litura, Common cabbage worm, Diamond back moth, Oriental tobacco budworm, Asparagus caterpillar and Yellow tea mite, etc.	Daozhen County	4 times/growing	
Edible Fungi	Enzyme, Mushroom flies, Mole cricket, evildoers, etc.	Yinjiang County	4 times/growing	
2. Animal diseases (pass percentage of immunity antibody and positive rate)				
Chicken	Highly pathogenic bird flu and New castle disease	Weining County, Yinjiang County and Shiqian County	1 time/6 months ×5 years	18
Goat	O type Apatha, Asian type Apatha, Goat pox, Brucellic disease, Infectious pleuropneumonia of goat and goat (C87-1 strain+Y-98 strain)	Wuchuan County and Yanhe County	1 time/6 months ×5 years	36
Pig	O type Foot and mouth disease, Swine fever, Highly pathogenic blue ear pig disease	Nayong County		

11. Information disclosure and public consultation

In order to effectively implement the "Pest Management Plan" developed in this project in the 11 project counties (cities) and play the best results, the "Pest Management Plan" prepared for this project should be publicity on the newspapers and on websites and media of the provincial poverty alleviation office and each municipality and county. Beginning from 2014, each county PMO will convene alone or combine with the project EIA to convene public consultation meetings in the project area. The consultation participant parties will be the county PMO, agriculture and animal husbandry administrative departments, county-level technology promotion agencies, county animal husbandry and veterinary agencies, some farmer cooperative organizations and some technology demonstration households. Views and opinions raised by parties involved are summarized in the following table.

Table 9 Public consultation feedback form

Time	Participants	Questions feedback	How to respond
2014.	World Bank Office in the project county (city)	If the pest control program can be executed in schedule? If the priority financial support can be provided on the pest control management plan research and promotion? The policy implementation awareness can be improved in the implementation duration?	Can provide and satisfy
	Agricultur administrative department in the project county (city)	Strengthen the capacity building of the basic animal and plant protection (the necessary funds and materials, Upgrade the integrated management capabilities on the animal disease and plant pest.	Can provide and satisfy
	Agriculture technology promotion department in the project county (city)	Carry out professional and technical training to grassroots agricultural technology workers, Make them familiar with IPM methods, enhancing technological innovation and strengthen the demonstration and promotion efforts.	Can provide and satisfy
	Agriculture cooperatives organization in the project county (city)	Increase the support efforts to the professional cooperative organizations, to strengthen technical personnel training of the agricultural cooperation organizations. Carry out the technical training and the product testing for the production of pollution-free (green, organic) agricultural products.	Can provide and satisfy
	Scientifi and technological demonstration h ouseholds in the project county (city)	Predominant crop pest identification, formulate reasonable prevention and treatment strategies, safe use of pesticides, training and demonstration of new technologies.	Can provide and satisfy

Annex:

Annex 1 Main pest types and protection and control approaches on white tea, tea, konjak, leafy vegetables, walnuts, virus free potato, fine plums, hollow plums, grapes, edible fungus, common bletilla tuber, radix scrophulariae, codonopsis pilosula, salvia, honeysuckle, rhizoma gastrodiae, radix pseudostellariae, radix ophiopogonis, radix puerariae and platycodon gradiforum in Guizhou

I Main plant diseases and insect pest prevention and control technology for tea

1. Insect pest

Empoasca vitis: adults and nymphs suck tea plant juice, and affect the normal transport of nutrients in tea plant. When a tea plant is suffered, the production of summer and autumn tea will be reduced more than 10%, sometimes the great loss could be 30%-50%, or no tea leaves income. In addition, buds and leaves suffered by *empoasca vitis* will be broken with increasing crushed tea in course of working and they are easy to be broken and smashed, easy to generate some scorched flavor, so it could have serious influence to quality of tea.

(1) Protection of natural enemy: It should try to decrease the times of applying pesticide in tea garden and reduce dosage of pesticide for, avoid applying of more lethality pesticide for natural enemy of *Empoasca vitis*

(2) Strengthen the tea garden management, timely removal of weeds: clear weeds and reduce insect population overwintering or in the same year.

(3) Picking of insect and pest control: picking tea-leaves batch by batch, so that a lot of worm eggs will be taken away with buds and leaves, and the spawning grounds and nutrition environment will be deteriorated.

(4) Chemical control: spraying control with 20% acetamiprid EC, 10% imidacloprid WP, 5% pirimicarb WP.

1.2 *Euproctis pseudoconspersa*: larvae will eat old leaves and some tender leaves of tea plant. With strong gregariousness, approximately hundreds of 1 and 2-instar larvae often cluster in the back of a blade at the middle and lower part of a tea plant. They will eat the hypodermis and mesophyll. Insect infestation leaves appear transparent retinal spot. 3-instar larvae often begin eating from the leaf margin, causing incision. 4-instar larvae only remain chief vein and petiole after eating. Beginning from the fourth instar, it will encroach on the whole leaf. In 4-instar it comes into gluttony period and it can eat all the tea bushes and leaves to make a serious impact on the yield and quality of tea. In addition, if human skin touched the poisonous hairs and exuvium of larva polypide, it will cause skin redness, swelling and itching, the normal picking tea-leaves and field management will be affected.

(1) Removal of egg masses: removal of overwintering egg masses from November to March of the following year.

(2) Light trapping: trapping and killing adult with frequency vibration insecticidal lamps and it can reduce the field damage.

(3) Biological control: manually release trichogramma or telenomus spp in egg stage.

(4) Pesticides control: optimum control period is larval phase before 3-instar. Spraying 1.8% Avermectin EC, 2.5% beta-cyfluthrin EC, 10% cypermethrin.

1.3 Tea geometrid: larvae will eat leaves. When serious, larvae will eat all the old leaves and immature stems, causing tea bushes to be polished as rods, not only the serious influence in tea production and it will cause recession in the tree vigour. It is difficult to restore within 2-3 years so it is a big menace for tea production.

(1) Clearing the tea garden to destroy pupa: in wintering period of tea geometrid, combining with the management in the fall and winter of tea garden, or remove the fallen leaves under the tree crown and pupa in surface soil.

(2) Light trapping: trapping and killing adult with frequency vibration insecticidal lamp in moth emergence period in order to reduce the egg laying amount.

(3) Manually catch and kill: frightened larvae will spin and droop down to strike them and kill in the evening or morning. Also we can catch and kill at statvolt place of adult in the early morning.

(4) Chickens disinsection: chickens eat pupas and larva.

(5) Chemical prevention and biological control is same as that of euproctis pseudoconspersa.

1.4. Aleurocanthus spiniferus: larva will pierce and sucks leaves and old leaves juice of tea plant. Its excreta will lead to sooty mould. When serious the buds will stop germinating, tree vigour will be recession, a large number of leaves will fall and the crown will appear black.

(1) Agricultural control: in accordance with tea garden management to clip and intertillage weeding to make tea garden ventilate and pervious to light and it could reduce the occurrence quantity.

(2) Biological control: aleurocanthus spiniferus has a variety of natural enemies, including parasitic wasp, predatory ladybug and parasitic fungi. They should be protected and utilized.

(3) Chemical prevention: spraying 20% acetamiprid EC, 10% imidacloprid WP and 5% pirimor WP.

2. Diseases

2.1 Gloeosporium theae-sinensis Miyake: it will start with dark green waterlogging shape scab in leaf margin and leaf apex, then expanding into irregular shape bronzing scab along leaf vein, becoming hoary in the later period. Boundary is obvious. There are many little black bump dots densely in the obverse side of scab and without annulations in scab. In serious disease tea garden, it will cause a lot of fallen leaves. This disease can live through the winter in sick leaves tissue in the form of mycelium. In May and June of the next year it forms conidium in rainy day, and spread with the rainwater, invade leaf blade from fuzz on the reverse side of tender leaf, forming scab after 8-14 days.

(1) Strengthen tea garden management: ditching and draining away water for tea garden, and removal of the fallen leaves in autumn and winter.

(2) Select and use resistant varieties: appropriately use phosphate and potash fertilizer in order to enhance resistance capacity.

(3) Chemical control: spray with 70% thiophanate-methyl WP, 2% kasugamycin water aqua and 80% mancozeb WP, etc.

2.2 Tea sooty mould: mainly do harm to leaf blade, primary black suborbicular to irregular small spot on surface of branches and leaves, then expanding to the whole leaf, the leaf area will be covered with a layer of black mould like soot. Growth of bud and leaf will be restricted, photosynthesis will be hindered and the yield and quality of tea will be affected, particularly acute in tea garden with extensive management.

(1) Start with strengthening tea garden management, timely and proper clip to create a good ventilation and pervious to light conditions; timely draining away water after raining, protecting moisture retention, enhancing tree vigour by all manner of means to prevent disease.

(2) Timely prevention and control of tea garden injurious insect, pay attention to the control of aleyrodid, scale insect, aphid and other insect pests and it is one of effective actions for prevention and treatment.

2.3 Leaf blight: mainly do harm to leaf, old leaf, new shoot, branch and fruit. leaf blade which caught an illness it will mainly produce roundness to irregular scab like

water lagging shape in the leaf apex or other part of leaf, old leaf or tender leaf, with brown and gray interphase undulating clouding and it has flat circular black small grain of point, and is arranged into a round to oval along annulations.

(1) Choosing suitable terrain, topography and soil when building tea garden; selecting and using resistant varieties according to circumstances. Clear away fallen leaves after picking off the autumn tea and carrying out the intertilling of the ground, burying the sick leaf into the soil in order to reduce bacteria source of the next year.

(3) Using organic fertilizer or special fertilizer for tea plant to improve premonition of tea plant.

(4) Strengthening tea garden management, completing antifreezing, drought resisting and pest control work, timely removal of weeds in tea garden; applying phosphate-potassium fertilizer to promote the growth of tea plant it can reduce the possibility of disease occurring.

(5) Spray control with 70% thiophanate-methyl WP, 2% kasugamycin water aqua and 80% mancozeb WP, etc.

II. Main plant diseases and insect pest prevention and control technology for konjak

Insect pest

1.1 *Clanis bilineata tsingtauca* and *herse convolvuli*

(1) Trapping and killing adult with frequency vibration insecticidal lamp;

(2) Spray control with Bt insecticide, 40% chlorpyrifos EC, 2.5% deltamethrin EC, 24% methomyl water soluble agent in the emergence period of larvae.

1.2 *Prodenia litura*

(1) Trapping and killing adult with frequency vibration insecticidal lamp;

(2) Trapping and killing adult with *prodenia litura* sex pheromone;

(3) Spray control with Bt insecticide, 40% chlorpyrifos EC, 2.5% deltamethrin EC, 24% methomyl water soluble agent in the emergence period of larvae.

1.3 Scarab:

Grub, its larvae will gnaw konjak tuber and spread disease along with transferring on feeding plant.

(1) When planting to kill larvae with 3% phoxim CR 3 kg per 667 m² land;

(2) Trapping and killing adult with frequency vibration insecticidal lamp;

. Disease

2.1 Soft rot of konjak

(1) Full deep ploughing and turn up the soil about 30 cm before planting and disinfect the soil. The method is: to irrigate the soil with 500~1000 times liquid of shell 750kg + plant ash 750kg + sulfur 15kg or fenaminosulf raw powder per hectare, or sprinkle shell 750kg + copper sulfate 15kg evenly in soil and plough under to great depth, dry the soil for 2d after soil preparation and it can be planted.

(2) Disinfection treatment of konjak seed tuber: soaking seed for 30 min with 500 times liquid of chlorothalonil + 5 million units of agricultural streptomycin for 10kg of water, or 1000 times liquid of kocide + 5 million units of agricultural streptomycin for 10kg of water, or 600 times liquid of nitro fulvic acid salt + 800 times liquid of 40% DuPont Fuxing, then wrapping clothes with plant ash / lime / sulfur powder according to the proportion of 50:50:2.

2.2 Southern blight of konjak

(1) Full deep ploughing and turn up the soil about 30 cm before planting and disinfect the soil. The method is: to irrigate the soil with 500~1000 times liquid of shell 750kg + plant ash 750kg + sulfur 15kg or fenaminosulf raw powder per hectare, or sprinkle shell 750kg + copper sulfate 15kg evenly in soil and plough under to great depth, dry the soil for 2d after soil preparation and it can be planted.

(2) Disinfection treatment of konjac seed tuber: soaking seed for 30 min with 500 times liquid of chlorothalonil + 5 million units of agricultural streptomycin for 10kg of water, or 1000 times liquid of kocide + 5 million units of agricultural streptomycin for 10kg of water, or 600 times liquid of nitro fulvic acid salt + 800 times liquid of 40% DuPont Fuxing, then wrapping clothes with plant ash / lime / sulfur powder according to the proportion of 50:50:2.

(3) When found any infected plant, mixing with trichoderma and fine soil and scatter them on the root of infected, and then cover with the soil.

III Main plant diseases and insect pest prevention and control technology for leaf vegetable

1. Disease

1.1 Viral disease: common symptoms feature is smaller leaves, shrunken, malformed, mottled floral leaf, dwarf plants and withered. It mainly infects through aphid, also it can be transmitted through contact and friction. Tea garden with extensive cultivation management, lacking of rain, more number of aphids will cause more serious disease.

(1) Agricultural control: apply enough organic fertilizer, pay attention to applying phosphate-potassium fertilizer. Clear away the weeds and timely remove the infected plant;

(2) Physical control: timely removal of center infected plant, capping with sunshade net; using yellow board to trap and kill aphid also it can reduce the incidence of viral disease.

(3) Chemical prevention: soaking seed for 3-4 hours with clear water, then soaking seed for 40-50 minutes with 10% trisodium phosphate solution, accelerating germination and seeding after draining and washing down with clear water, or soaking 30 minutes with 0.1% potassium permanganate. Spraying 15% virus Bike WP, 20% moroxydine · copper acetate WP, 20% moroxydine hydrochloride suspending agent at the early onset of the virus.

1.2 Wilt, root rot, bacterial wilt: they are the common diseases in vegetable field, it will have a great influence on vegetable yield, and it will be more serious diseases in continuous cropping field.

(1) Agricultural control: adopt 3-4 years of rice field-upland field rotation system.

(2) Chemical control: in the early stages, adopt root-irrigation control with 72% agricultural streptomycin sulphate SP, 3% Zhongsheng mycin WP and trichoderma viride.

1.3 Damping-off, blight: damping-off commonly is known as sprout tumble and mildew root. Blight is also called as dead plant. Damping-off easily occurs under the condition of low temperature (10-16°C), high humidity, weak light and high density planting; blight easily occurs under the condition of high temperature (20-24°C), more soil moisture, application of undecomposed fertilizer and high density planting. Damping-off generally occurs in earlier stage, late blight occurs.

(1) Agricultural control: choose the high terrain, ventilation, sunny and well-drained place for early spring grow seeding. Strengthen the cultivation and management, proper ventilation, watering;

(2) Chemical control: adopt root-irrigation control with 50% Tuzet WP, 50% carbendazim WP, 25% bromothalonil EC and azoxystrobin suspending agent, use interchangeably.

1.4 Gray mold: the disease occurs seriously mainly in protected area, it is a major disease for early spring protected area cultivation.

(1) Agricultural control: first, let in fresh air and removal of moisture reasonably. In January and February, ventilate 1-2 hours at noon in rainy days, and let in fresh air

and removal of moisture about 5 hours at 10:00 in sunny day; second, cover greenhouse tightly in high temperature. Close the greenhouse door in sunny day, the temperature rise to 33 °C and then let in the fresh air (best to keep at 33 °C for 2 hours); third, need for timely clearing plant debris to reduce pathogen infection;

(2) Chemical control: spray control with 50% Tuzet WP, 50% carbendazim WP, 25% bromothalonil EC, and 25% azoxystrobin suspending agent.

1.5 Epidemic disease: early blight generally presents to eggplant, tomato and chili, and late blight presents to tomato. Early blight generally has concentric round lines. Late blight of tomato usually starts from leaf apex and leaf margin, infected section has white mildew when wet; phytophthora blight of chili shows crotch susceptible to disease in adult plant, the contact infection is serious, and the infected fruit is soft and rot.

(1) Agricultural control: selection of resistant varieties, rational close planting, strengthening field management, rational crop rotation, timely pruning and removal of infected leaves and old leaves;

(2) Chemical control: 72.2% propamocarb water aqua, 72% cymoxanil · mancozeb WP, 58% metalaxyl WP, 5% validamycin SP, 12.5% myclobutanil WP, etc.

1.6. Anthracnose: the disease mainly harms melon, chili and Chinese cabbage. When infected, primarily yellowish white round spots presents on leaf, stem and fruit, then changes to brown, with concentric round lines, easy to break when dried-up; sunken scab on fruit, chapped centre, scab on stem and leaf stalk of Chinese cabbage is prismatic and sunken.

(1) Agricultural control: adopt rice field-upland field rotation above 3 years; soaking seed for 20 minutes in warm water with 50-55°C;

(2) Chemical control: spray control with 50% Tuzet WP, 50% carbendazim WP, 25% bromothalonil EC, and 25% azoxystrobin suspending agent at the beginning of the disease.

1.7 Downy mildew: cucumber downy mildew is a major disease worldwide, it occurs all in the area of cucumber cultivating in our country. Especially in protected cultivation, in the event of this disease, it will be serious losses. When the humidity is high, within 3 days the incidence can lead a greenhouse to have no harvests.

(1) Agricultural control: strengthen ventilation and moisture removal to reduce moisture condensation time in protected cultivation, apply phosphorus, potassium fertilizer, enhance premonition of plant.

(2) Chemical control: spray control with 25% azoxystrobin suspending agent, 5% validamycin soluble powder, 72.2% propamocarb water aqua.

Pests

2.1 Bemisia tabaci: It will mainly do harm to tomato, cucumber, eggplant and other solanaceous vegetables. The adults and larvae absorb vegetable plants juice; infected vegetable leaves are loss of green, and turn to yellow and wilting, then lose plant. In addition, adults and larvae also secrete large amounts of honeydew to contaminate leaves and fruits of the vegetable, cause to the sooty mould.

2.2 Aphids: aphids will harm the greenhouse vegetable mainly include Aphis gossypii Glover, Aphis craccivora Koch and green peach aphid. Aphids cluster on the vacuum side of blade and on the tender stems suck plant juice with piercing-sucking mouthparts, so that leaves turn yellow, curl, shrinkage and deformity, even dead. In addition, aphids also spread the morbus virosis, have great perniciousness.

2.3 Thrips: mainly do harm to melon crop, eggplant, leguminosae and other vegetables. The larvae are yellow and adults are brown. Thrips absorb juice of tender leaves, shoots, flowers and young melon. Infected blade is hoary, gradually turns

yellow and white, dry, infected shoots and flowers are blacken and colour fading, harden and shrink, the growth is seriously affected.

2.4 Red spider: red spider occurs on greenhouse vegetable in winter is mainly *tetranychus cinabarinus* boisdu and two-spotted spider mite, is serious under the condition of high temperature and drying; it is not conducive to happen when the temperature exceeds 30°C and humidity greater than 70%; old blade is more serious when applying more nitrogenous fertilizer. Red spider sucks juice with piercing-sucking mouthparts on the reverse side of leaves, and form silk screen. Infected leaf blade is loss of green, appears white point, and then dried up.

(1) Agricultural control: timely clear away residual branch and leaves in the field after harvesting vegetables, and concentratedly destroy, reduce population base of insects. Secondly, in the period of circulating from March to November, set 30 mesh of fly net at ventilation opening in greenhouse to prevent pests entering the greenhouse.

(2) Physical control: utilizing phototaxis of pests, hang palette in greenhouse to trap and kill *bemisia tabaci*, aphid, thrips and other injurious insects.

(3) Chemical control: using 1.8% abamectin EC, 20% acetamiprid EC, 10% imidacloprid WP to control *bemisia tabaci*, aphid, thrips and other injurious insects; using 73% propargite EC, 1.8% abamectin EC to control red spider.

2.5 Diamondback moth: is a worldwide important pest of cruciferous vegetables. It mainly does harm to cabbage, cauliflower, Chinese cabbage, radish, rape and leaf mustard, if lack of prevention and cure in can cause devastating disasters.

(1) Agricultural control: reasonable layout, avoid cruciferous vegetables anniversary continuous cropping. After harvesting, timely clear away residual branch and leaves and immediately plow, so that can eliminate a large number of insect source.

(2) Physical control: trap and kill with frequency-vibrancy pest-killing lamp to reduce insect source.

(3) Trap and kill adults with sex attractant: trap and kill adults with diamondback moth sex attractant in emergence period of adults.

(4) Biological control: using Bt, 4% rotenone powder WP and other mist spray before 2-instar of larva.

(5) Chemical control: spray control with 40% chlorpyrifos EC, 10% alpha-cypermethrin EC, 20% diflubenzuron suspending agent. For the prevention and cure of diamondback moth, should pay special attention to promote biological control, reduce dependence on chemical pesticides; when chemical pesticides must be used, be sure to be alternative use or mixed use, avoid long-term single use of a single type of chemical pesticides, so that avoid or delay the generation of drug resistance.

2.6 *Phyllotreta striolata* fabricius: it does harm to leaf vegetables. *Phyllotreta striolata* fabricius has two peak season of damage (summer and winter) annually, often due to winter vegetables are more, abundant foodstuffs, temperature and humidity is very suitable, so it runs wild: adults gnaw leaf blade, causing leaf holes and reducing photosynthesis, finally remain leaf vein, even death; larvae bite to eat velamen in the soil, so that root system absorbs water, soil fertility decline. Thus it results in a large number of spraying pesticides causing very serious pesticide residue, and often receive less than perfect pest control effect.

(1) Agricultural control: appropriate rice field-upland field rotation to reduce population base of insects. No partial applying nitrogenous fertilizer, but more applying high quality decomposed organic fertilizer. Reduce the food source and destroy habitat. For the vegetable field ready to cultivate, ted two weeks ahead of time, clear away weeds, residual leaves and other foodstuffs for injurious insect. Turn over

the soil again 5 days before planting, and sprinkle the right amount of lime, plant ash according to the demand aftercrop to kill part of pupa and larva.

(2) Chemical control: 40% chlorpyrifos EC, 10% alpha-cypermethrin EC, 20% diflubenzuron suspending agent, etc.

2.7 *Liriomyza*: It will harm the beans, celery, melons, tomato, chili and eggplant, etc. Adults lay their eggs in leaves with ovipositor, hatched larvae eat mesophyll between the upper and lower epidermis, keel and leaf vein are favoured. Leaves being bitten appear lucency plaque, causing seeding wither, with great destructive effect. Larvae formed the mine along leaf vein, also eat spongy parenchyma in the lower of leaf blade. Adults cause injury spot when laying eggs and eating, destroy leaf chlorophyll cells and leaf tissue of plant. When in serious situation, leaf blade is loss of green, and turn into white.

(1) Agricultural control: selection of resistant varieties, timely clear away dry branches and fallen leaves in the field to reduce the number of overwintering pests;

(2) Physical control: trap and kill adults with yellow board.

(3) Chemical control: 1.8% abamectin CE, 1% methylamine abamectin EC, 20% diflubenzuron suspending agent, 48% chlorpyrifos EC and so on.

2.8. *Prodenia litura*: It will on the reverse side of leaf, massive texture, most is in the middle part of plant. Early hatching larvae clustered near the egg mass to eat mesophyll, leaving the veins and upper epidermis, when slightly shock, crawling in all directions or spinning and drifting away; older larvae often encroach on and do harm to leaf blade, flower and flower bud when they enter into the gluttony period.

(1) Physical control: can be manually killing egg masses and early hatching larvae not diffused. Trapping and killing the adults with black light lamp, sweet and sour liquid (sugar: vinegar: water = 3:1:6) adding a little of trichlorfon stomach poison.

(2) Trap and kill adults with sex attractant: trap and kill adults with *prodenialitura* sex attractant in emergence period of adults.

(3) Chemical control: 1.8% abamectin CE, 1% methylamine abamectin EC, 20% diflubenzuron suspending agent, 48% chlorpyrifos EC and so on.

2.9 Imported cabbageworm: larvae are known as the cabbage caterpillar. Hosts are oilseed rape, cabbage, broccoli, Chinese cabbage, radish and other cruciferous vegetables. Especially prefers cabbage and broccoli containing mustard oil glycosides with smooth and glabrous leaf surface.

(1) Agricultural control: reasonable layout, try to avoid cruciferous vegetables anniversary continuous cropping in a small area, in order to avoid insect source go round and round. Strengthen seeding field management and timely prevention and control to avoid bringing insect source to the field. After harvesting, timely clear away residual branch and leaves and immediately plow, so that can eliminate a large number of insect source.

(2) Biological control: promote the use of fly net, protection and utilization of *Pteromalus puparum*, *trichogramma* and other natural enemy insects, effectively control the number of cabbage caterpillar.

(3) Chemical control: 1.8% abamectin CE, 1% methylamine abamectin EC, 20% diflubenzuron suspending agent, 48% chlorpyrifos EC and so on.

IV. Main plant diseases and insect pest prevention and control technology for walnut

1. Pest

1.1 *Apocheima cinerarius* Ershoff:

Larvae will eat walnut leaf. When outbreak, walnut leaves are ate up, have a strong impact on trees growth and yield.

(1) Trap and kill or manually catch adults with black light lamp in adult stage;

- (2) Organize the masses digging pupae in great amount of pupae area in early spring;
- (3) Spray control with 40% chlorpyrifos EC, 2.5% beta-cyfluthrin EC, 10% cypermethrin EC before 4-instar larvae.

1.2 Walnut root snout beetle: also known as transverse furrow snout beetle, and has occurred at walnut region in Guizhou. It inflicts heavy damage to walnut tree grow in the fertile soil or eugenic walnut tree. Due to the pests eating in cortex of walnut root and neck, destroy transfusion tissue of the tree, hinder the normal transport of water and nutrients, and result in weak grower. When pests are not important, the output will be reduced; when serious, will cause tree plant death.

(1) From April to June, digging up the soil around the root, cutting with an ax to break the cortex about 10 cm intervals, brushing infected part with walnut Baoguoling I, then backfilling the soil, larva in the root will be killed;

(2) Prior to the beginning of winter, completely remove dry branches and fallen leaves under the crown, scraped off the old skin of tree stem base, centralized burning. Tilling soil under the tree, most of the overwintering larvae can be eliminated.

(3) In spring, before falling of infected fruitlet, timely cut, pick and deeply buried to reduce the population density of the following year.

1.3 Walnut long-horned beetle

It is distributed at walnut production areas in Guizhou. It mainly does harm to the limb, in serious area the infected plant rate reaches 95%. Infected tree is death due to the infected trunk.

(1) Before the winter or spawning period, brushing trunk with walnut Baoguoling I; where there is worm channel, clear away bits of wood in it with iron wire, inject active compound of walnut Baoguoling I into wormhole with injection syringe, and then sealed the wormhole with soil.

(2) Using phototaxis and playing dead habit of adult, trap and kill under the tree with lamplight in the evening. Frequently observed leaves and twigs daytime, when founding small twigs have bitten and showed fresh-like, adults will be captured nearby. Regular inspection after oviposition, when founding spawning crevasse and cutting, tapping with a hammer can destroy eggs and newly hatched larvae. When larvae eat into trunk, marked by frass, using hooklet made of fine iron wire insert from wormhole to hook and kill larvae.

1.4 Walnut leaf beetle:

It mainly does harm to walnut branches and leaves, is one of the major pests of walnut leaf. Adults and larvae eat mesophyll, appear mesh or incision, and sometimes eat up the whole leaf leaving only the veins. When serious, leaf blades of the whole tree are ate up, seem to be burnt. If suffered injury for 2-3 years continuously, it will cause the whole plant die.

(1) In late April and early May, combination of prevention and treatment of Walnut root snout beetle, spray control with walnut Baoguoling;

(2) In emergence period of adults, trap and kill with a heap of fire or black light lamp. Using its habit of playing dead to shake off and kill manually.

1.5 Red spider:

It does harm to leaves, absorbs nutrients of the tree body. It's serious in mid-August to late September, can lead to dry the leaves, leaf surface is shed, vacant shell and flat shell increase. Influence to the yield can reach more than 50%, so it is necessary to pay attention.

The best period of prevention and treatment is mid-to-end of June, in order to reduce the population density of insects and control the furious period in August and September, control with 73% propargite EC, and 1.8% abamectin EC mist spray.

2. Disease

2.1 Walnut rot

The disease is a fungal disease, mainly against branches and tree trunks. Infected branch, one is loss of green, dry branches with black point (pycnidium); another is obvious scab spreaded down from saw bite, a circle around branches then forms dieback.

(1) Strengthen walnut garden management, apply organic fertilizer, reasonable pruning, enhance tree vigour, paint the tree trunk white;

(2) In the beginning of summer and the growing season timely scraping scab, then coated with 20-30 times liquid of 40% crystal lime sulfur, 5-10 baume degree lime sulfur or 1000 times liquid of 50% carbendazim WP to prevent.

2.2 Walnut black spot

The disease is a bacterial disease. It mainly does harm to fruits, leaf blades and branches. Infected fruits appear small and slight ridgy black brown punctation, then enlarge into round or irregularly shaped black spot and sag, no obvious edge, surrounded by water stain, rotten fruit from outside to inside. Infected leaf blades appear small black spots along the veins, then enlarge and show round or polygon black spots. When serious, contiguous scabs result in perforations, leaves fall ahead of time. Fruits change to black and fall ahead of time, yield rate of peach kernel and oil content are all lower.

(1) Strengthen cultivation and management, apply organic fertilizer, reasonable pruning;

(2) Spray 1 : 0.5 : 200 bordeaux mixture or 50% thiophanate methyl WP, 50% Tuzet WP for 1-3 times in growing period.

2.3 Walnut canker:

(1) Clear away infected branches and fallen leaves, strike off tertia of tree stem base, coated with 5 Baume degrees – 10 Baume degrees lime sulfur or 50% thiophanate methyl WP and so on;

(2) Spray 50% Tuzet WP for 2 times in July – August, can reduce disease incidence below to 1%.

2.4 Walnut stem canker:

It mainly does harm to branches, especially branches 1-2 years old. The bacterium is weak-sense parasitic fungi, weak trees or branches are easy to be infected. It is serious in spring drought or freeze injury year.

(1) Strength walnut garden management, timely prunes infected branches, deeply buried or burnt to reduce the bacteria source. Apply organic fertilizer, enhance tree vigour, improve premonition.

(2) Pay attention to cold-proof, and prevent tree body to endure the cold. Timely prevention of walnut tree pests, avoid hurt by insect or other mechanical injury.

(3) For the infected main tree trunk, it should scrape the infected part, disinfect with 1% copper sulfate or 50% Tuzet WP, and coated with coal tar.

2.5 Walnut black spot

Also known as black rot, widely distributed in walnut production areas, generally infected plant rate of 60%~100%, infected fruit rate of 30%~70%, when serious above 90%, nucleolus output reduce to 40%~50%. If infected, fruitlet nucleus rot and drop ahead of time, indeciduous infected fruits are lower oil extraction rate, there is a significant impact on yield.

(1) Removal of infected leaves and fruits, pay attention to the health of forest land; after harvesting, pericarp being peeled off should be disposed; wipe out infected

branches and fruits combined with pruning, clear away fruit drop, centralized burning, to reduce source of bacteria.

(2) Strengthen management, enhance tree vigour to improve disease resistance; avoid knocking with sticks when harvesting, and reduce the tree body wound. In serious area, especially in area that *Atrijuglans heterochei* insect pests occurred, it should timely control injurious insect, thus reduce the wound and mediator carrying germs, and achieve disease prevention purposes.

(3) Spray 1 : 0.5 ~ 1 : 200 Bordeaux mixture each time before the female flowers appear, after blossom drop and early stage of fruitlet. In addition, also can spray 72% agricultural streptomycin WP, 80% mancozeb WP and so on, thus it will achieve better control effect.

V. Main plant diseases and insect pest prevention and control technology for potato

1. Pests

1.1 Potato tuber moth: larvae sneak into the leaf mesophyll to eat along the veins, upper and lower epidermis remaining, and translucent state. When serious, immature stems and leaf buds wither, the whole plant seeding may die. In farming area or storage period, it can eat into potato tuber, honeycomb or even all being worm-eaten hollow with shrinking surface and cause decay.

(1) Pharmaceutical treatment potato seed. For the wormy potato seed, spray 1000 times liquid of 90% crystal dipterex, dry before storage.

(2) Timely hilling. In farming area, do not let the tubers exposed to the surface soil for avoid eggs produced by adult.

1.2 Potato *henosepilachna vigintioctopunctata* Fabricius: adults and nymph eat leaf blades, tubers and immature stems, leaving only the veins and upper epidermis on the infected blade, forming a number of irregular transparent dimpled grain, later becoming brown scar, causing leaves to wither; infected tubers are gnawed into a lot of dimpled grain, gradually harden, with a bitter taste, loss of commercial value.

(1) Manually catch adults, using the habit of playing dead, play thin film under plants and beat the plants to let adults drop, collect and kill them.

(2) Manually removal of egg masses, it lays eggs in groups with bright color, easy to find and remove.

(3) Chemical control, seizing the opportunity before dispersing of larvae, control with 2.5% beta-cyfluthrin EC, 10% cypermethrin EC and other mist spray.

1.3 *Acyrtosiphon solani*: adults and nymphs absorb vegetable juice and spread the morbus virus.

Control with 20% acetamiprid EC, 10% imidacloprid WP, 5% pirimicarb WP, 10% alpha-cypermethrin EC and other mist sprays.

2. Disease

2.1 Potato late blight: mainly do harm to leaves, stems and tubers. Serious infected leaf blades wilt down and curling, cause the whole plant black and rot, whole field withered, and throw off the smell of corruption. Infected tubers appear primary brown or puce scabs, slightly sunken, subcutaneous potato meat of infected part also appear brown, and slowly expand to all around or rot away.

(1) Selection of resistant varieties. Currently promoting resistant varieties are: Kangqing 9-1, cooperation 88 and so on. These varieties are affected lighter in late blight popular year, can be selected according to local conditions;

(2) Selection of disease-free seed potatoes, reduce primary infection source. In the process of cellar for storing in autumn harvest, examine cellar in winter, out of the cellar, cutting and vernalization, strictly eliminate infected potato every time, in

conditional case to build a disease-free seed field for disease-free reserving seed for planting.

(3) Strengthening the cultivation management, early sowing in optimum period, choosing loose soil and well-drained field to plant, promoting healthy plant growth, enhancing resistance to disease;

(4) When infected or appeared centre infected plant, control with 77% Kocide WP, 72.2% propamocarb water aqua trichoderma WP, 5% validamycin SP, 12.5% myclobutanil WP and other mist sprays.

2.2 Potato early blight: mainly occurs in leaf blades, also can infect tubers. Serious infected leaves dry off, and the field is withered and yellow. Infected tubers appear crineous slightly sunken round or nearly round scab, with clear edges, sandy beige spongy dry rot under skin.

(1) Selection of early-maturing resistant varieties, proper harvest ahead of time.

(2) Selection of high and dry field with fertile soil to plant, apply organic fertilizer, implementation of formula fertilization, enhance disease resistance of host;

(3) In early stages, control with 77% Kocide WP, 72.2% propamocarb water aqua trichoderma WP, 5% validamycin SP, 12.5% myclobutanil WP and other mist sprays.

2.3 Potato chytridiomycosis: mainly do harm to underground tubers. Since bacteria stimulate host cells split continuously, infected tubers or stolon appear different sizes of tumour like cauliflower, skin often cracks, easy to be rot and stink. In cellaring period infected potato could continue to expand, even cause rotten cellar. Flowers, stems and leaves of plant in serious infected field all can be infected and produce cancer lesions.

(1) Strictly quarantine, delimit the epidemic area and protection area, strictly prohibit potato seed in epidemic area allocate and transport outward, soil of infected field and plant growing in it are also prohibited to move outside.

(2) Serious infected field should not be planted potato, generally infected field should also replant non-solanaceous crop according to the actual conditions.

(3) Strengthen the cultivation management, intertill frequently, apply net manure, increase phosphorus-potassium fertilizer, timely excavate infected plant and centralized burning.

(4) Disinfect the soil with 25% triazolone EC.

2.4 Potato bacterial wilt: is a bacterial disease, with infected plant slightly dwarf, light green or verdant leaf blade, whole plant wilting after drooping lower leaves firstly, begin to restore in morning and evening, sustained 4-5 days, stem leaves of the whole plant are wilting and death, but remain turquoise, leaves do not wither and fall.

(1) Above 4 years crop rotation with cruciferae or graminaceous crop, rice field-upland field rotation with the grass family is the best.

(2) Selection of resistance to bacterial wilt varieties;

(3) Selection of growing seedling in disease-free field, adopt high bedding cultivation, avoid flood irrigation;

(4) Clear away the infected plant and sprinkle shell to disinfect;

(5) Spraying 7500 times liquid of Zhi-Bao-Su or 6000 times liquid of atonik, applying fully rotten organic fertilizer or plant ash can change microflora. Applying lime 100-150kg per 667m² can adjust soil pH value;

(6) Chemical control, root-irrigation control with 72% agricultural streptomycin sulfate SP, 3% Zhongsheng rhzomorph WP in initial stage.

2.5 Potato ring rot: It is bacterial vascular bundle disease. Infected overground part can be divided into necrosis and wilting. Necrosis type most infect overhead of compound leaf at plant stem base, leaf apex, leaf margin and vein appear green,

mesophyll is yellow green or celadon with obvious motley, leaf apex is dried-up or vertical roll inward, state of illness scale up and cause the whole plant to wither; wilting type is wilting from compound leaves at top in initial stage, leaf margin slightly involutes, like water shortage, state of illness extend downward and cause leaves of the whole plant loss of green, roll inward, finally cause the plant lodging and withering.

(1) Establishment of disease-free reserve seed field, as far as possible adopts the whole potato planting. Combining with seed selection of new product is the best, the use of cross-fertilizing seedling, breeding disease-free potato seed;

(2) Planting resistant varieties;

(3) Eliminating infected potato before sowing. Firstly, stack potato seed for 5-6 days indoor, air the seed, constantly removing rotten potato, and greatly reduce ring rot in farming area;

(4) Combine with intertillage and hilling, timely removal of infected plants, carrying and centralized processing outside the field. Root-irrigation control with 72% agricultural streptomycin sulfate SP, 3% Zhongsheng rhzomorph WP in initial stage.

2.6 Potato virus disease: common potato virus disease has potato virus X, potato virus S, potato virus A, potato virus Y and potato leaf roll virus.

(1) The use of disease-free potato seed, establishment of disease-free potato seed breeding base, foundation nursery should be located at high latitudes or high altitudes area, eliminating infected potato through a variety of detection methods and expanding stem tip tissue detoxification;

(2) Cultivate or utilize resistant varieties;

(3) Timely control aphid before and after the emergence;

(4) Improve cultivation measure. Including reserve seed field away from solanaceae vegetable field; early removal of infected plant; implementation of intensive cultivation, high ridge cultivation, timely earth up; avoid applying excessive nitrogenous fertilizer, increasing phosphorus-potassium fertilizer; pay attention to intertillage and weeding; control autumn water prevent flood irrigation;

(5) Spray with 15% virus Bike WP, 20% moroxydine · copper acetate WP, 20% moroxydine hydrochloride suspending agent in initial stage.

VI. Main plant diseases and insect pest prevention and control technology for quality plum and hollow plum

1. Disease

The diseases are: plum red spot disease, bacterial shothole disease and bleeding disease.

(1) Agricultural control: selection of resistant varieties, clean the garden, cut out the infected branches combined with pruning, scientific nutrient and water management. Loose the soil and improvement of soil fertility and dig through the drainage ditch to prevent soil ponding; increase manure or bran fertilizer and phosphorus-potassium fertilizer rich in organic matter; keep the soil loose for the growth of root, enhance tree vigour, reduce the incidence.

(2) Chemical control: prevention of plum red spot disease and bleeding disease can use 70% thiophanate-methyl WP, 80% mancozeb WP, 5 baume degree – 10 baume degree lime sulphur, prevention of bacterial shothole disease can use 72% streptomycin sulphate water soluble powder, 3% Zhongsheng rhzomorph WP.

2. Pests:

Pests are: citrus long-horned beetle, apriona germari Hope, grapholitha funebrana treitscheke, aphid, red spider, scarab and so on.

(1) Physical control: trap and kill adults of Lepidoptera pests with frequency-vibrancy pest-killing lamp, reduce the amount of eggs; use an iron wire hook to hook and kill longicorn larvae; trap and kill scarab using fruit vinegar liquid; trap and kill aphid with yellow board and so on.

(2) Chemical control: to prevent and treat longicorn, firstly fish out bits of wood and fecula in channel, dip in 40% Dursban EC stoste with cotton wool and slip it into channel, immediately seal the hole with yellow sticky mud to kill adults and larvae; for grapholitha funebrana treitscheke, control with 40% Dursban EC, 2.5% beta-cyfluthrin EC, 2.5% deltamethrin EC mist spray; for aphid, control with 20% acetamiprid EC, 10% imidacloprid WP, 10% alphamethrin EC and other mist sprays; for red spider, control with 2.5% beta-cyfluthrin EC, 2.5% deltamethrin EC, 10% cypermethrin EC mist spray.

VII. Main plant diseases and insect pest prevention and control technology for grape

1. Disease

Main plant diseases and insect pests are anthrachose of grape, anthracnose, white rot, botrytis, downy mildew, powdery mildew, brown blotch and so on.

(1) Agricultural control: selection of resistant varieties, elevated cultivation, clean the garden, timely and moderately cutting branches, pinching to control the growth, scientific nutrient and water management and cluster bagging can reduce the occurrence of disease;

(2) Chemical control: from period of dormancy to stages in germination, give priority to prevention and treatment of overwintering germs and eggs, after pruning in winter, spray 1:1:200 lime sulphur to the tree at a time; when grape buds sprout, make a good use of crevasse medicine, spray 5:200 lime sulphur at a time, reduce the bacteria source of white rot, anthrachose of grape, anthracnose and other multiple diseases. to prevent and treat anthrachose of grape, anthracnose, white rot and gray mold, control with 2% kasugamycin water aqua, 25% Azoxystrobin suspending agent, 5% validamycin soluble powder mist spray; for downy mildew, control with 25% Azoxystrobin suspending agent, 5% validamycin soluble powder, and 72.2% Propamocarb water aqua mist spray; for powdery mildew, control with 50% thiophanate-methyl WP, 25% triadimefon WP, 25% propiconazole EC mist spray; for brown blotch, control with 40% chlorothalonil SC, 50% thiophanate-methyl WP mist spray.

2. Pests

Pests are clearwing moth, noctuid, thrips, green plant bug, mite, aphid, mealybug, leafhopper and so on.

(1) Physical control: trap and kill noctuid with sugar and vinegar liquid, trap and kill aphid, thrips, leafhopper and other pests with yellow board. In emergence period of adults, trap and kill clearwing moth, noctuid and other pests with frequency-vibrancy pest-killing lamp, reduce eggs in garden, so that destroy pests and reduce pollution on grapes using chemical pesticides.

(2) Chemical control: in period of adults spawning and newly hatching larvae doing harm to tender tip, sieze the opportunity, spray medicine 1 time every 7-10 days, the effect is good when spraying continuously 3 times. To prevent and treat clearwing moth and noctuid, use 40% Dursban EC, 2.5% beta-cyfluthrin EC, 10% cypermethrin and so on; for thrips and green plant bug, select and use 1.8% abamectin EC, 2.5% deltamethrin and so on; for mites, select and use 1.8% abamectin EC, 73% propargite EC and so on; for aphid, mealybug and leafhopper, select and use 20% acetamiprid EC, 10% imidacloprid WP, 5% esfenvalerate EC, 5% pirimor WP and so on.

VIII. Main plant diseases and insect pest prevention and control technology for edible mushrooms

1. Strict aseptic technique procedures: in the period of production of edible mushrooms culture and cultivation bag making, from medium sterilization to inoculation and hypha cultivation, must strictly enforce aseptic technique instruction. Cultivating highly purified edible mushrooms culture and clinker cultivated hypha is the key technology to acquire successful edible fungi cultivation and reduce medicine.

2. Effectively strengthen agricultural control: Firstly it will select resistant varieties. Select and use fast growth, strong vitality, strong miscellaneous force resistance, especially anti-*Trichoderma viride* edible mushrooms variety. Secondly, it should adopt the high quality culture. Select and use characters of strain pure, strong vitality, without viruses, infectious microbe, mites and nonaging, nonsingular culture of the right age. Doing a good job in environmental health, vaccination room, culture room and mushroom house should be away from chicken farm, animal house and feed storage. Thirdly, it should do a good job of daily sanitation. After each wave of mushroom harvesting, should timely clear away mushroom roots, dead mushrooms and rotten mushrooms in growing bed. These cultivation rubbish and pollutional fungus bag should be concentrated composting fermentation keeping away from production environment. After a cultivation period, mushrooms shed should be thoroughly clean, ventilate and lower the humidity, reduce infectious microbe cardinal number. Fourthly, crop rotation or empty crop, implementation of edible mushrooms and rice or vegetable crop rotation, can reduce the occurrence of pests and diseases, and good ecological environment of rice field is in favour of edible mushrooms growing. In conditional place, it can replace edible fungi cultivation site yearly. Place where cannot carry out crop rotation and replace field, in every season after the edible fungus cultivation, it should empty crop above 2 months, cannot continuous cropping, or else the plant diseases and pests easily outbreaking. Fifthly, it should be rational distribution. For cultivation mushroom shed occurred serious diseases and pests, it should empty crop above 6 months, using high temperature disinfection in summer. For mushroom occurred serious diseases and pests should stop production more than 1 year, thorough disinfection treatment, and change to plant other mushroom seeds.

① Production of hybrid seeds and cultivation of wood-destroying fungus and straw rotting fungus should be in parvial field. Compost for cultured mushroom and straw mushroom composting outdoor during the period of fermentation, mass propagation of germs, mosquitoes and flies around material pile, easily contaminate culture and clinker fungus bag of oyster mushroom, *lentinus edodes*, *flammulina velutipes* and other wood-destroying fungi, so it should proceed in parvial field.

② In conditional place it should carry out two-period form cultivation, namely hypha culture room and sporocarp fruiting mushroom house do not put in the same site, best to have a certain isolation space, avoid hypha culture room is infected by pests and infectious microbe of mushroom house, increase the rate of contamination during the growing period of hypha. Place without these conditions should send fungus bag and fruiting cultivation in different shed, can not be placed in the same shed.

③ Area of cultivated shed should not be small, the same mushrooms should be planted in the same shed, sowing in the corresponding period and fruiting harvesting in the corresponding period, in order to facilitate the management, reduce pest damage and pesticide pollution. Sixthly, it should optimize the cultivation environment. Adopting thermophilic sowing and appropriately increase seeding rate, adjusting appropriate water content and power of hydrogen for compost, adjusting temperature, humidity and ventilation of hypha culture room and fruiting house with

modern facilities and new type of cover material, create a suitable ecological environment of growing development for edible mushrooms, no or little use of pesticides.

3. Rapid development of physical and biological control: using protection facilities, moist-heat sterilization, fermentation sterilization, uperization, ozone, ultraviolet lamp sterilization, black light lamp and fluorescent lamp can prevent insect disease, without polluting the environment and infecting man and beast, and do not become resistant to pests medicine.

4. Emphasizing suit the remedy to the case: select and use 60% thiabendazole WP for prevention and treatment of mould, 1.8% abamectin EC, 2.5% deltamethrin EC for prevention and treatment of sciarid, phorid flies, mole cricket, moth and so on.

IX. Main plant diseases and insect pests prevention and control technology for *Bletilla*

1. Disease

The diseases are: leaf spot disease, root rot and nematodosis.

(1) Agricultural control: timely unchoke irrigation canals and ditches, lower field humidity, clear away field weeds to reduce the occurrence of leaf spot disease and root rot; quantity;

(2) Physical control: trap and kill ted spider with yellow board, and kill inchworm with frequency-vibrancy pest-killing lamp;

(3) Chemical control: use 2.5% beta-cyfluthrin EC, 4% derris powder WP, 20% diflubenzuron suspending agent, 1.8% abamectin EC for prevention and treatment of inchworm and stinkbug; 1.8% abamectin EC, 73% propargite EC for prevention and treatment of red spider.

X. Main plant diseases and insect pest prevention and control technology for *radix scrophulariae*

1. Disease

1.1 leaf blight: scab appears polygon, round or irregularity, the diameter of 1-2 mm. scab is sometimes divided into a mesh by the veins, with puce edge. Many tiny black spots scattered on scab, namely pathogenic bacteria pycnidium. When serious, scabs merge each other into irregularity big spot, finally, whole leaf is dead.

1.2 Southern blight: pathogenic site is at rootstock of plant, common in adult-plant stage. When the plant is infected, leaf blades are yellowing and wilting, the tips are withered, dropped and dead.

(1) Agricultural control: clean the garden after harvesting, wipe out invalidism plant, pay attention to drainage and good ventilating, thus can effectively control leaf blight. Crop rotation with graminaceous crop, avoid continuous cropping, pay attention to drainage and good ventilating, should adopt high ridge cultivation to prevent southern blight.

(2) Chemical control: use 50% Tuzet, 50% carbendazim WP, 25% bromothalonil EC, 25% Azoxystrobin suspending agent for prevention and treatment of leaf blight and trichoderma prior to the attack; 70% thiophanate methyl WP, 50% carbendazim WP for prevention and treatment of southern blight.

2. Pests

The main pests are: red spider, cutworm, aphid and so on.

(1) Physical control: trap and kill red spiders and aphids with yellow board, trap and kill adults of cutworm with frequency-vibrancy pest-killing lamp, and manually kill the larvae.

(2) Chemical control: use 1.8% abamectin EC, 73% propargite EC for prevention and treatment of red spider; root-irrigation with 50% phoxim EC for prevention and

treatment of cut worm; 20% acetamiprid EC, 10% imidacloprid WP, 5% esfenvalerate EC, 5% pirimor WP for prevention and treatment of aphid.

XI. Main plant diseases and insect pest prevention and control technology for codonopsis pilosula

1. Disease

1.1 Root rot: in initial stage, bottom fibril lateral root appear crineous scabs, then blacken and rotten, when expands to the main root, gradually appears waterlogging rot from bottom to top. When most of root rots, the whole plant is dead.

1.2 Rust disease: the infected leaves appear pale yellow to yellowish-brown spot, with yellowish white aureola around spots. Blister spots are often inserted on two sides of vein, gather to form a pile, skin burst in later period and spill out a large number of orange-yellow uredospore. When serious the leaves rapidly withered, yield of root will be affected. Uredinium on receptacle and stem is bigger.

(1) Agricultural control: timely intertilling, seeding and topdressing. When codonopsis pilosula seeding grows to 30 cm, build a holder to let vine growing along the frame, is conducive to air and light, enhance photosynthesis, and can prevent disease arising from the field temperature and humidity is oversize. In hot season, according to the growing of codonopsis pilosula planted in land with a sunny exposure, cutting the tendril reasonably, eliminating apical dominance to reduce rising, promoting nutrient accumulation and improving premonition of codonopsis pilosula.

(2) Chemical control: use trichoderma, 70% thiophanate methyl WP, 50% carbendazim WP for prevention and treatment of root rot; 25% triazolone EC, 80% mancozeb WP, 12.5% myclobutanil WP for prevention and treatment of rust disease.

2. Pests

Pests are: red spider, aphid, cutworm, grub and so on. Control methods are as follows:

(1) Physical control: trap and kill red spider and aphid with yellow board, and trap and kill adults of cutworm with frequency-vibrancy pest-killing lamp;

(2) Chemical control: use 1.8% abamectin EC, 73% propargite EC for prevention and treatment of red spider; 20% acetamiprid EC, 10% imidacloprid WP, 5% esfenvalerate EC, 5% pirimor WP for prevention and treatment of aphid; root-irrigation with 50% phoxim EC for prevention and treatment of cut worm and grub.

XII. Main plant diseases and insect pest prevention and control technology for salvia

1. Leaf spot disease

1.1 Symptoms: mainly do harm to leaves. When serious scabs densely covered and mix together, leaf blades are black, dried-up and fallen off, serious diseased plant wither.

1.2 Control measures

(1) Agricultural control: clean the field, timely removal of infected leaves and weeds, burned or buried away from the field.

(2) Chemical control: Before seeding, to carry out disinfection treatment of seeds with 70% thiophanate methyl before sowing, can choose the general broad spectrum bactericide for prevention and treatment, such as controlling with 20% chlorothalonil WP, 50% carbendazim WP, 25% bromothalonil EC, 25% Azoxystrobin suspending agent and other mist sprays.

2. Root rot

2.1 Symptoms: root soil-borne disease caused by fusarium equiseti. Radicula of infected plant primarily appear brown dry rot, gradually spread to large root, crosscutting vascular bundle fracture surface of root has obvious brown lesions. Roots

decompose in later period; overground part is wilting and withered. It occurred in producing area of salvia inordinately, causing some damage.

2.2 Control measures

(1) Agricultural control: rational application of fertilizer, applying organic fertilizer, increasing phosphatic fertilizer and potash fertilizer; timely removing stagnant water in rainy season, paying attention to loosen the soil and improving disease resistance of plant. Proper using rotation of crops, crop rotates 3-5 year with different genus of plant. Cultivate with the improved varieties.

(2) Chemical control: root-irrigation with trichoderma, stir and mix 50% carbendazim WP, 70% thiophanate methyl WP with fine earth and scatter into the hole or spray rootstock.

3. Sclerotinia

3.1 Symptoms: bacteria firstly encroach on basal part of stem, bud and rootstock, so that these part gradually decay, turn brown, often in the surface of infected part, the soil surface nearby and inside of stalk basilar, generate cinereous mouse droppings shaped sclerotium and white mycelium. Meanwhile, the upper leaves of infected plant gradually yellowing, and finally plant die.

3.2 Control measures

(1) Agricultural control: Proper using rotation of crops, crop rotates 3-5 year with different genus of plant. Not suitable for gathering seeds and seedlings in field sclerotinose occurred. Pay attention to protection against drought, draining flooded fields and keeping steady soil moisture content. Strengthen field management, timely ripping, weeding and reducing soil hardening, in order to be helpful for lowering humidity and raising ground temperature. Cultivate with the improved varieties. Strengthen quarantine; don't introduce a fine variety in disease areas.

(2) Chemical control: use 40% dimethachlon WP, 25% iprodione suspending agent, 25% Azoxystrobin suspending agent, 2% kasugamycin water aqua mist spray.

4. Root-knot nematode

4.1 Symptoms: etiology is meloidogyne incognita, sexual dimorphism. Lateral root and fibre of infected plant root appear unequal-sized warty root and knot. Serious infected plant is maldevelopment, short and small, yellowing and wilting. When serious the whole plant die.

4.2 Control measures

(1) Agricultural control: Establish disease-free seedling base for cultivating disease-free seedling. Select the field which did not plant salvia above 3 years as salvia seedling base for cultivating disease-free seedling. Breed disease-free seeds. Breed disease-free seed in a disease-free field. Applying disease-free fertilizer and irrigating with disease-free water to ensure no nematodosis at its source. Implementation of 3-5 year crop rotation with graminaceous crop (corn, wheat, etc.) and timely removal of plant debris, including diseased seedling, diseased root, weed and so on, centralized burnt, and farm tools should be cleaned and disinfected. Deeply ploughing the soil and reducing source of the disease.

(2) Physical control: use high temperature of the soil to kill nematode in the field, namely ploughing under to great depth in summer, covering mulching film to seal after irrigation water, and sun shining about 20 days, using high temperature (50°C) and high humidity (soil moisture content: 90%-100%), control efficiency can reach above 90%.

(3) Chemical control: broadcasting 20% ethoprophos granula.

5. Plusia agnata Staudinger

5.1 Symptoms: larvae do harm to leaves, causing notches and holes. Adults hide by day and come out by night, strong phototaxis, and weak chemotaxis. It likes to spawn in dense growing bean field; eggs are always dispersed on the back of upper leaves. Early instar larvae hidden in blade back to eat mesophyll, larvae above 3-instar eat upper tender leaves into holes, often do harm in the night. Last instar larvae knot white thin cocoon and pupate on the back of leaves.

5.2 Control measures

(1) Agriculture control: this pest also does harm to vegetable, soybean and other crops, thus avoid vegetables mixed planting with soybean.

(2) Physical control: trap and kill adults of *Plusia agnata* Staudinger with black light lamp, sex attractant.

(3) Chemical control: control with nuclear polyhedrosis virus biocontrol agent, 1.8% abamectin EC, 2.5% beta-cyfluthrin EC, 20% diflubenzuron suspending agent and other mist sprays.

6. Aphid

6.1 Symptoms: aphids are the main virus transmission medium, smaller body, no or winged. Mainly do harm to leaves, flowers, fruits and other tender parts; gathering and absorbing juice in dry environment, let buds be out of shape until withering.

6.2 Control measures

(1) Physical control: trap and kill with yellow sticky trap.

(2) Agricultural control: clear away weeds in the field and reduce the suitable habitat and host of aphids, and protection of natural enemy, such as *Coccinella septempunctata*, *Diaeretiella rapae* Mintosh, *Chrysopa perla* and so on.

(3) Chemical control: control with 20% acetamiprid EC, 10% imidacloprid WP, 5% esfenvalerate EC, 5% pirimor WP and other mist spray.

XIII. Main plant diseases and insect pest prevention and control technology for honeysuckle

1. Disease

1.1 Grey speck disease: the disease is caused by fungi imperfecti fungus *Cercospora*, it mainly does harm to leaves. *Helvolutia chlorosis* small spot appears on leaves preliminary stage, enlarge into a nearly circular, because limited by vein it appear polygon, yellowish-brown, without margin, gray mildew layer on the spot.

(1) Agricultural control: once found infected leaves immediately removed.

(2) Chemical control: control with 50% Tuzet WP, 50% carbendazim WP, 25% bromothalonil EC, 25% Azoxystrobin suspending agent mist spray in preliminary stage.

1.2 Bitumite disease: mainly does harm to leaves. A layer of thin brown small spots were formed on blade surface at the beginning of the disease, and then enlarge into a fluffy black, dark brown or slightly gray mildew layer.

(1) Agricultural control: clean the field, destroy habitat of some insect result in disease. Once found infected leaves immediately removed.

(2) Physical control: arrange sticky trap in different color in the field to catch and kill aphid, aleyrodid and other insect vector.

(3) Chemical control: control with 50% carbendazim WP, 25% bromothalonil EC, and 25% Azoxystrobin suspending agent mist spray in preliminary stage.

1.3 brown blotch: mainly do harm to leaves. Little red spots appear on leaves in preliminary stage, and then enlarge into round, the diameter of 2-4 mm, hazel, with obvious brown edge scab, and small black dot on it.

(1) Agricultural control: clean the field, destroy habitat of some insect result in disease. Once found infected leaves immediately removed.

(2) Chemical control: control with 50% Tuzet WP, 50% carbendazim WP, 25% bromothalonil EC, and 25% Azoxystrobin suspending agent mist spray in preliminary stage.

1.4 Powdery mildew: pathogenic sites are leaves, flowers and tender tips. In preliminary stage white powdery dot appear on the leaf, and then enlarge into white powdery spot, finally bestrew the whole leaf, have a strong impact on photosynthesis, let the leaves yellow, wrinkled deformation, and finally leaves and flowers fall, branches are dried-up.

Chemical control: control with 50% thiophanate-methyl WP, 25% triazolone EC, and 25% propiconazole EC mist spray in preliminary stage.

1.5 Leaf spot disease: mainly do harm to leaves. Scabs are often in the blade edge and leaf apex, yellowish spot firstly, enlarge into nearly circle, brown, with slightly ridgy puce edge, and then form round spot with a diameter of 10-20 mm.

(1) Agricultural control: clear away dry branches and fallen leaves before overwintering, bring them out of the field and burnt.

(2) Chemical control: control with 50% Tuzet WP, 50% carbendazim WP, 25% bromothalonil EC, and 25% Azoxystrobin suspending agent mist spray in preliminary stage.

2. Pests

2.1 Aphid: the adults and nymph pierce and suck juice of stems, leaves and flowers, make the leaves crimping and shrinking, causing undergrowth, when serious the leaves die.

(1) Physical control: arrange yellow sticky trap in the field to catch and kill.

(2) Agricultural control: manually remove insects on branches and centralized processing. Put in natural enemy, such as coccinella septempunctata and so on.

(3) Chemical control: control with 20% acetamiprid EC, 10% imidacloprid WP, 5% esfenvalerate EC, 5% pirimor WP and other mist sprays.

2.2 Red spider: adults, nymph and mites absorb juice on the back of blade, relevant leaf surface appear yellow and white foxiness, when serious, blade fall off.

Control measures: control with 1.8% abamectin EC, 73% propargite EC mist spray.

2.3 Nadezhdiella cantori: adults do harm to the tree rind, larvae eat in tree trunk, saliva colloid secreta and fecula or bits of wood in channel, infected plant grow weak.

(1) Agricultural control: manually remove branches with opening or hole, and centralized burnt; or stab the pests to death with iron wire; manually catch and kill adults.

(2) Chemical control: dip in 40% Dursban EC stoste with cotton wool and slip it into channel, seal the hole with sticky mud.

XIV. Main plant diseases and insect pest prevention and control technology for rhizome gastrodiae elata

1. Disease

1.1 Tuber rot

Gastrodia tuber rot, also known as ROT and rotten cellar, is the most important disease in producing area of gastrodia. Once the disease occurs, will be crop failure in less serious case, falling off in quality, and total crop failure in serious case. Even if there is harvest, generally can't reproduce again as gastrodia seed. Infected gastrodia tuber mainly appears rotten part or all of gastrodia tuber. Control methods are as follows:

(1) Weed out gastrodia seed continuous application for many years and asexual reproduction for several times, choose sexual propagation white gastrodia as production seed, improve disease resistance and antianaphylaxis of gastrodia seed.

(2) Choose appropriate site, the best choice for planting is the area which once wild gastrodia elata growing. Low-lying or heavy clay soil and poor permeability field easy to occur this disease, should pay attention to avoiding.

(3) Strengthen cellar field management, complete protection against drought and prevention of waterlogging, keep stable cellar humidity, providing optimal conditions for the growth of halimasch and gastrodia and to inhibit the growth of infectious microbe in soil.

(4) Choose full, no injury, brightly-colored white gastrodia as seed, not bruised and exposed to the sun when excavation and transportation, the amount of culture should be sufficient. Culture contaminated with infectious microbe can't be use.

(5) Growth of gastrodia elata is supplied nutrients by halimasch, selection of halimasch is particularly important. The best selection of local halimasch species, or foreign halimasch culture confirmed by the test that both in a good affinity and it can build well symbiotic relationship.

(6) Compost should be stacked, disinfected and aired. Selection of clean, no bacterial humus soil, leaves, sawdust and other loosen filler, and fill the lacuna, not compacted or missed, surface coating filler thickness should be about 15cm, not too shallow or too thick so in favor of water, gas management after sowing, so that gastrodia elata grow well with sufficient nutrition.

(7) During the whole growth period from sowing to harvesting, if the tuber rot is found, should timely early harvest and process into commodity, thereby reducing losses.

1.2 Mould (infectious microbe) infection

If infected by mould (infectious microbe) in the period of cultivating, often cause 'rotten cellar', resulting in the failure of gastrodia elata cultivating. Categories of mould (infectious microbe) are more, such as trichoderma, rhizopus, blue mould, yellow mould, green mould, hair mould, aspergillus, walnut meat-like bacteria and so on, all can damage halimasch fungus material and gastrodia tuber. Prevention methods are as follows:

(1) When cultivate the bacteria material, carefully examine bacteria branch and bacteria stick. Infectious microbe likes saprogenesis, should select un-decayed and no mould fresh wood to cultivate bacteria stick, and as far as possible shorten the incubation time. If found infectious microbe on bacteria stick, scrape it in less serious case, sun 1-2 days, and discard in serious case.

(2) Examine gastrodia seed, and bruised, rotten seed should be discarded.

(3) Examine halimasch to be used for production, seed contaminated by mould (infectious microbe) should be discarded.

(4) Filler should be tamped, must not leave gaps. Strengthen the temperature, humidity and air management. Humidity control in cave can reduce the occurrence of mould.

(5) Gastrodia cave should not be too big and too deep, the number of bacteria material per hole is generally controlled at about 150. Using fewer number of bacteria stick for seed cultivating is one of the best methods of prevent bacteria infection.

(6) Increase the dosage of halimasch. Put more bacteria branches and bacteria, it grows faster, can inhibit the growth of other infectious microbe.

(7) Promote sexual propagation technique of gastrodia elata, improve stress resistance of it.

1.3 Halimasch pathological infection and harms

Epidermal layer of infected gastrodia elata fester, blacken, similar to symptom of black rot. Point of distinction is: gastrodia tuber rotting body caused by halimasch

pathological infection full of ring shoestring; black rot caused by fusarium infection has no shoestring. When Halimasch pathological infection is in serious case, can cause 'rotten cellar', happen 'defusing and disappear' phenomenon, the people often said that the gastrodia elata was gone. Prevention methods are as follows:

(1) Select a good aeration and drainage humus soil and sandy loam; choose sexual propagation white gastrodia elata as seed, enhance growth vigour of gastrodia elata, improve stress resistance.

(2) In the process of planting, pay attention to set up drainage ditch, especially after continual rainstorm, when water accumulated in cultivation cave, timely remove. When autumn changes into winter, in addition to doing exclude water accumulation, but also often doing spot check, if found serious halimasch pathological infection, gastrodia elata should be harvested early.

1.4 Scape black stem

Scape black stem occurs mainly in sexual propagation tuber and scape of gastrodia elata, is an important disease of sexual propagation scape of gastrodia elata. Prevention methods are as follows:

(1) Select venues around occur less disease as cultivated field for gastrodia sexual propagation; site should be disinfected prior to use.

(2) Selection of healthy disease-free gastrodia tuber for sexual propagation, black rot tuber should not be used for sexual propagation.

(3) In period of disease, spraying or coating stems with 50% carbendazim WP, mancozeb dry suspending powder, 75% chlorothalonil WP and so on.

1.5 Sunscald

Gastrodia elata sunscald is a kind of physiological disease. When gastrodia elata put forth and bloom, because no sunshelter, the sunny side of the stem exposed to strong light and blacken, in rainy day, easy to be infected by mould and die. Control methods: setting up the sunshelter before gastrodia elata put forth.

2. Pests

2.1 Grub

Grub is the general terms of coleopteran *mimela lucidula* hope superfamily larvae, namely white grub. Larvae dwell in soil all its life, be fond of eating seed, root, earthnut, tuber and seedling and so on newly sowed, resulting in lack of seedling; adults are fond of eating leaves and flower of fruiter and woods. Prevention methods are as follows:

(1) Process of growth from sowing to harvesting is completed in cellar, once occurs grub infestation is difficult to pesticide control. Prevention for grubs must adopt the principle of early prevention and treatment.

(2) Before sowing, survey insect quantity of grub in Gastrodia elata area, if more insect quantity, should trap and kill adults with black light lamp, and using omnivorous characteristic to set trapping area, 50% phoxim EC 200-250g, adding water 100 times, spraying at 25-30kg fine soil, mix, made of toxic soil to kill; or concentrated kill with 800 times liquid of 90% dipterex crystal and so on.

(3) Before sowing, spray concave surface with 30 times of liquid of 50070 zinc sulfide EC, turn over the soil, and then sow.

(4) In growing period, irrigate gastrodia elata cellar with 800 times of liquid of 90% dipterex.

(5) In harvest time, if found grubs, can manually catch and kill; or appropriate for early harvest time, processed into commodities, in order to reduce losses.

2.2 Mole cricket

It is a kind of mole cricket orthoptera insect and its adults have phototaxis, omnivorous, like sweet food. Nymphs and adults dig tunnel under surface soil layer of gastrodia elata cave, eating gastrodia tubers into holes or notch, so damage nutrient supply relationship between gastrodia elata and halimasch, often by this induced tuber rot. Prevention methods are as follows:

(1) Prevention and control of poison bait: 5kg blighted grain boiled half-cooked, or 5kg wheat bran fried, mixed (90% dipterex 0.15kg adding water to be 30 times liquid) to be baits, in hot windless evening, spread baits in the tunnel of mole cricket.

(2) Light trap: use the strong phototaxis of mole cricket, setting a black light lamp to trap and kill adults.

2.3 Scale insect

It is mainly the mealybug, and homoptera insect, in winter nymphs and adults cluster on gastrodia elata tuber or bacterium for overwintering, female adults most concentrate a place, secrete villiform egg capsule, secrete wax filament while laying eggs, do harm to gastrodia elata in a group, so gastrodia tuber color deepened, and affect tuber growth, so that tubers are thin and weak. Control methods: it's more difficult to prevent, mainly to take the isolation and elimination measures. Because of mealybugs clustered in the soil, it is difficult to use chemical control, but it generally points to the unit damage, limited spread. When harvesting, if found mealybug on tuber or bacterium, the cave should be harvested separately, and the white gastrodia elata should not be used as seed. When it is in serious case, bacterial sticks can be placed in the original cave to be burnt in the fuel, to prevent the spread.

2.4 Aphids

There are many species, homoptera insect, with strong fertility, from May to June adults and nymphs clustered on the stems and spica, piercing and sucking organization juice. When the plants were infected, stop growing, short and small, deformity, spica curved, affect flowering and fruiting, leading to thin the fruit. Control methods: when aphid outbreaks, control with 1500-2000 times liquid of 40% dimethoate EC, 2000-4000 times liquid of 5% Sumi-alpha EC and other mist spray.

2.5 Termite

It mainly includes odontotermes formosanus, coarse jaw soil termites, macrotermes barneyi light, reticulitermes flaviceps and coptotermes, of which the most vicious is odontotermes formosanus, it damaged with fast speed, deeply and wide range. Control methods:

(1) Digging and site-clearing: before planting, place a central site for the center termite infestation maximum distance radius to find and dig all the termites;

(2) Poison soil isolation method: along gastrodia planting area edge, digging deep 100cm, width 30cm deep groove, the chlorine preparations (or coal tar) with preservative oil formulated into a ratio of 1:1 mixture, pouring soil mix fill in, in order to achieve the purpose to prevent termite attack.

(3) Buried and trapping method: excavating pit where there is termite activity, filling wrapped poison bait (with mirex 500g, adding corn flour and pine sawdust 500g each, mixing to the poison bait) to trap and kill termite; or mix alum with food (food for termites induced force must be higher than the culture medium induced mycelium of termites force), and then placed in termite frequented place, after the termites eat the food, and the leftovers will be moved into the cave, and the rest of termites eat would have died of poisoning in succession; or waiting for termites being induced, concentrated kill them in the area with destroy termites powder, king of termite elimination, termite paste and so on.

(4) Light trapping method: in April – July, using phototaxis of termite, set light trap in the termite place early and late every day, trapping and killing swarming winged adults of termite.

2.6 ants

Control methods: using drugs to kill ants; buried pork skin, meat, chicken and fish bones nearby infected *gastrodia elata*, stir and watch after two days, when ants gather, kill them with hot water.

XV. Main plant diseases and insect pest prevention and control technology for *radix pseudostellariae*

1. Disease

Pests and diseases are: morbus virosus, leaf spot, root rot and powdery mildew.

1.1 Morbus virosus: infected leaves usually present floral leaf, mottled floral leaf, shrinking, twist distortion and crimp up trend, short and small infected plant, small earthnut, roots obviously reduced, when it's in the serious case, the whole plant die.

1.2 Leaf spot: infected leaves first appear hoary round small necrosis, surrounded by yellow halo, scab enlarge and leaves grow black dot, arranged like annulations, in later period several scab join into irregularity spot, old scabs bore a hole in center, the whole leaf withered.

1.3 Root rot: the plant is infected, blacken, rotten, and expanding to main root. Infected main root early appear irregularity black spot, expanding constantly, causing most of root blacken, expanding to xylem, causing the entire root rot, infected plants grow weak, leaves are small and yellowing, plant wither until dead.

1.4 Powdery mildew: occurs in leaves, stems, anthocaulus, flower bud, petal and other parts, first appears yellow green irregular small spot, edge is not obvious. Later on scab continuously extend, put forth chalk mark on surface, in the end appear number of black spots. Infected part grizzled, covered the surface, the edge is not obvious, appears dirty white or light hoary. When it is in serious case, leaves shrinking and diminished, tender tip twist distortion, flower buds don't open.

(1) Agricultural control technologies: clear away infected plant, reduces overwintering bacteria sources; selection of resistant varieties, establishment of virus-free; implementation of crop rotation, and not be continuous cropping reduces the occurrence of disease to some extent.

(2) Chemical control: At the initial stage of the disease for the prevention and treatment of morbus virosus, use 15% virus Bike WP, 20% moroxydine-copper acetate WP, and 20% moroxydine hydrochloride mist spray in preliminary stage; 50% Tuzet WP, 50% carbendazim WP, 25% bromothalonil, 25% Azoxystrobin suspending agent mist spray for leaf spot disease; trichoderma root-irrigation, stir 50% carbendazim WP, 70% thiophanate methyl WP with fine earth, scatter into the cave or spray rhizome for prevention and treatment of root rot; 50% thiophanate-methyl WP, 25% triazolone EC, 25% propiconazole EC mist spray for prevention and treatment of powdery mildew.

2. Pests

Pests are mole cricket and wireworm.

(1) Physical control: manually catch and kill mole cricket.

(2) Chemical control: root-irrigation, select and use 40% phoxim EC, 4% rotenone powder WP, 20% diflubenzuron suspending agent.

XVI. Main plant diseases and insect pest prevention and control technology for *Radix Ophiopogonis*

1. Disease

The diseases are black spot and root knot nematode disease.

Radix Ophiopogonis black spot: in preliminary stage, leaf apex yellowing and down spread, appears blue, white different colors of water-soaked scab.

Later all leaves will be yellowing and dead.

Knot nematode disease: swelling root is malformation like chicken feet, blacken and rotten root organization, with some blobular root and knot. After a parasitic nematode root function is damaged, the plants shoot grow weak, yellowing, affecting the output.

(1) Agricultural control: crop rotation, where conditions permitted it may adopt rice field-upland field rotation for avoiding flue-cured tobacco, milk vetch, green bean, taro, sweet potato, melons, mangosteen, atracylodes, salvia and other crops. The graminaceous crop is the best choice. Selection of disease-free seed and seedling, cutting the old root; selection of resistant varieties can prevent the occurrence of disease.

(2) Chemical control: the prevention and treatment of black spot, use 50% Tuzet WP, 50% carbendazim WP, 25% bromothalonil, 25% Azoxystrobin suspending agent mist spray in preliminary stage; 20% ethoprophos granula for prevention and treatment of root knot nematode disease.

2. Pests

The pests are grub, mole cricket, wireworm, cutworm and so on.

(1) Agricultural control: timely clear away weeds in the field and broken branches can reduce the occurrence of pests.

(2) Physical control: trap and kill cutworm, grub, mole cricket and other adults of pests with insecticidal lamp.

(3) Chemical control: root-irrigation, select and use 40% phoxim EC, 4% rotenone powder WP, 20% diflubenzuron suspending agent.

XVII. Main plant diseases and insect pest prevention and control technology for pueraria lobata

The main plant diseases and insect pests are leaf spot disease, anthracnose, scarab, cutworm, cantharis and so on. Prevention methods are as follow:

Agricultural control: timely clean the garden, destroy overwintering bacteria could have been effective in reducing the incidence;

Physical control: trap and kill adults of cutworm with frequency-vibrancy pest-killing lamp; trap and kill adults of cutworm with sugar and vinegar liquid (brown sugar 6 parts: wine 1 part: vinegar 4 parts: water 2 parts, adding a little of dipterex). Manually catch and kill cantharis.

Chemical control: the prevention and treatment of leaf spot disease, use 50% Tuzet WP, 50% carbendazim WP, 25% bromothalonil, 25% Azoxystrobin suspending agent mist spray; 2% kasugamycin water aqua, 25% Azoxystrobin suspending agent, 5% validamycin SP for anthracnose; 40% phoxim EC, 4% rotenone powder WP, 20% diflubenzuron suspending agent for scarab and cutworm; 2.5% beta-cyfluthrin EC, 1.8% abamectin for cantharis.

XVIII. Main plant diseases and insect pest prevention and control technology for platycodon grandiflorum

1. Disease

The diseases are: ring spot and spot blight.

1.1 Ring spot: sandy beige scabs on leaf blades, different shape and size, from round to irregularity shape, with 2-3 circles of annulations, densely grow small black dot, namely pseudothecium of pathogenic bacteria. In the form of hypha or pseudothecium in scabs of infected leaves, germs live through the winter, become primary source of infection the next year, in growing period spore-bearing spread by wind and rain to do secondary infection.

(1) Agricultural control: timely clean the garden, destroy overwintering bacteria could have been effective in reducing the incidence;

(2) Chemical control: control with 25% triazolone EC, 80% mancozeb WP, and 25% bromothalonil EC in preliminary stage.

1.2. Spot blight: scab is round or nearly round, 2-5 mm in diameter, hoary, or restricted by the veins into irregular shape, in later period scabs appear taupe and densely grow small black dot, when it is in serious case, scabs expanding to be continuous, causing the leaves withered.

(1) Agricultural control: timely clean the garden, destroy overwintering bacteria could have been effective in reducing the incidence;

(2) Chemical control: control with 50% Tuzet WP, 50% carbendazim WP, 25% bromothalonil EC, 25% Azoxystrobin suspending agent mist spray in preliminary stage;

2. Pests

The main pests are: inchworm, red spider, stinkbug and so on.

(1) Agricultural control: timely clear away field weeds and dry branches and fallen leaves, thus can deteriorate the hibernacles of pests, reduce occurrence

(2) Physical control: trap and kill aphids with yellow board and cutworm with frequency-vibrancy pest-killing lamp

(3) Chemical control: select and use 20% acetamiprid EC, imidacloprid WP, 5% esfenvalerate EC, 5% pirimor WP mist spray for prevention and treatment of aphids; root-irrigation select and use 40% phoxim EC, 4% rotenone powder WP, 20% diflubenzuron suspending agent for prevention and treatment of cutworm.

Annex 2 Main epidemic diseases categories and green protection and control approaches on goat, green shell egg chicken and glutinous rice pig in Guizhou

2.1 Immune procedure for chicken

2.1.1 Immunization program for egg chicken flock or breeder flock

Vaccination age in days	Vaccine	Vaccination approaches	Remarks
1-day-old	Marek's disease live vaccine	Subcutaneous vaccination	Cell combining vaccine preserved in liquid nitrogen
7-day-old	ND-IB combined live vaccine	Eyes drop, nasal drip	Lasota+H120
14-day-old	Bursal disease live vaccine	Eyes drop, nasal drip	Moderate virulence, not drinking water
16 to 20-day-old	AI inactivated vaccine	Intramuscular injection	Half or full dose inoculation
21 to 24-day-old	Bursal disease live vaccine	Eyes drop, nasal drip	Moderate virulence, not drinking water
28-day-old	ND-IB combined live vaccine	Eyes drop, nasal drip	Lasota+H120
50 to 55-day-old	AI inactivated vaccine	Intramuscular injection	Full dose inoculation
60-day-old	Newcastle disease live vaccine I or ND-IB combined live vaccine	Intramuscular injection	Lasota+H52 or nephropathy type infectious bronchitis strain

100 to 120-day-old	AI inactivated vaccine	Intramuscular injection	Full dose inoculation
120 to 130-day-old	ND-IB-EDS combined inactivated vaccine	Intramuscular injection	Full dose inoculation
Getting an AI inactivated vaccine every six months hereafter ; based on monitoring results to determine whether Newcastle disease enhanced immune			

2.1.2 Immunization program for broiler chicken flock

Vaccination age in days	Vaccine	Vaccination approaches	Remarks
1-day-old	Marek's disease live vaccine	Subcutaneous vaccination	60-day-old broiler chicken don't vaccinate 60 to 110-day-old broiler chicken must be vaccinated
6 to 7-day-old	ND-IB combined live vaccine	Eyes drop, nasal drip	Lasota+H120
12 to 14-day-old	Bursal disease live vaccine	Eyes drop, nasal drip	Moderate virulence, not drinking water
16 to 18-day-old	AI inactivated vaccine	Intramuscular injection	Half or full dose inoculation
19 to 21-day-old	Bursal disease live vaccine	Eyes drop, nasal drip	Moderate virulence, drinking water is incertitude
25 to 30-day-old	Newcastle disease C30 live vaccine or ND-IB combined inactivated vaccine	Eyes drop, nasal drip or Intramuscular injection	Lasota+H120 or Nephropathy type infectious bronchitis strain
45 to 50-day-old	AI inactivated vaccine	Intramuscular injection	Full dose inoculation
Suggested to get a Newcastle disease vaccine to enhance immune about 60 day-old in broiler chicken farm which has the Newcastle disease history.			

2.2 Immune procedure for glutinous rice pig

Growth stage	Immune time	Type of vaccine	Immunizing dosage	Method of application
Multiparous sows	40 days prior to hybridization	Swine fever live vaccine	For 4 pigs	Retroauricular intramuscular injection
	30 days prior to hybridization	Porcine pseudorabies attenuated vaccine	2mL	Retroauricular intramuscular injection
	20 days prior to hybridization	Porcine reproductive and respiratory syndrome vaccine	4mL	Retroauricular intramuscular injection
	Twice a year	Porcine type O foot-and-mouth vaccine	3mL	Retroauricular intramuscular injection
Replacement gilts	40 days prior to hybridization	Swine fever live vaccine	For 4 pigs	Retroauricular intramuscular injection

	30 days prior to hybridization	Porcine pseudorabies attenuated vaccine	2mL	Retroauricular intramuscular injection
	20 days prior to hybridization	Porcine reproductive and respiratory syndrome vaccine	4mL	Retroauricular intramuscular injection
	10 days prior to hybridization	Porcine parvovirus vaccine	For 2 pigs	Retroauricular intramuscular injection
Growing piglets	14-day-old	Piglet edema disease vaccine	For 1 pig	Retroauricular intramuscular injection
	21-day-old	Swine fever live vaccine	For 2 pigs	Retroauricular intramuscular injection
	28-day-old	Porcine reproductive and respiratory syndrome vaccine	2mL	Retroauricular intramuscular injection
	35-day-old	Porcine type O foot-and-mouth vaccine	2mL	Retroauricular intramuscular injection
	42-day-old	Porcine pseudorabies attenuated vaccine	2mL	Retroauricular intramuscular injection
	50-day-old	Swine fever and Porcine reproductive and respiratory syndrome vaccine	Each for 2 pigs	Retroauricular intramuscular injection
	110-day-old	Porcine type O foot-and-mouth vaccine	2mL	Retroauricular intramuscular injection

2.3 Immune procedure for goat

2.3.1 Immune procedure for lamb

Inoculation time	Type of vaccine	Vaccination approaches	Inoculation dosage	Immunity period
6-8 weeks prior to lambing (unimmunized ewes)	Ovine braxy, lamb dysentery and enterotoxaemia inactivated vaccine	Intramuscular injection	5.0mL	180 days
2-4 weeks prior to lambing (ewes)	Ovine braxy, lamb dysentery and enterotoxaemia inactivated vaccine	Subcutaneous injection	5.0mL	180 days
7-day-old	Ovine contagious pustular dermatitis inactivated vaccine	Oral lips submucous injection	0.2mL	360 days
15-day-old	Caprine infectious pleuropneumonia inactivated vaccine	Subcutaneous injection	3.0mL	360 days
1 month of age	Goat pox inactivated vaccine	Tail head intradermal injection	0.5mL	360 days
2 months of age	Asia type I-O bivalent foot-and-mouth disease inactivated vaccine	Intramuscular injection	1.0mL	180 days
3 months of	Ovine braxy, lamb dysentery and	Intramuscular	5.0mL	180 days

age	enterotoxaemia inactivated vaccine	injection		
4 months of age	Ovine braxy, lamb dysentery and enterotoxaemia inactivated vaccine	Intramuscular injection	5.0mL	180 days
	Anthrax spore vaccine II*	Subcutaneous injection	0.2mL	210 days
	Ovis streptococcus inactivated vaccine*	Subcutaneous injection	0.5mL	180 days
7 months of age	Asia type I-O bivalent foot-and-mouth disease inactivated vaccine	Intramuscular injection	1.0mL	180 days

Note : *Vaccinate due to disease.

2.3.2 Immune procedure for adult ewe

Inoculation time	Type of vaccine	Vaccination approaches	Inoculation dosage	Immunity period
2 weeks prior to hybridization	Asia type I-O bivalent foot-and-mouth disease inactivated vaccine	Intramuscular injection	2.0mL	180 days
	Ovine braxy, lamb dysentery and enterotoxaemia inactivated vaccine	Intramuscular injection	5.0mL	180 days
1 week prior to hybridization	Anthrax spore vaccine II*	Subcutaneous injection	0.2mL	180 days
	Ovis streptococcus inactivated vaccine*	Subcutaneous injection	1.0mL	180 days
1 month postpartum	Asia type I-O bivalent foot-and-mouth disease inactivated vaccine	Intramuscular injection	2.0mL	180 days
	Ovine braxy, lamb dysentery and enterotoxaemia inactivated vaccine	Intramuscular injection	5.0mL	180 days
	Anthrax spore vaccine II*	Subcutaneous injection	0.2mL	180 days
one and half months postpartum	Caprine infectious pleuropneumonia inactivated vaccine	Subcutaneous injection	5.0mL	360 days
	Goat pox inactivated vaccine	Tail head intradermal injection	0.5mL	360 days
	Ovis streptococcus inactivated vaccine*	Subcutaneous injection	1.0mL	180 days

Note : *Vaccinate due to disease.

2.3.3 Immune procedure for adult rams

Inoculation time	Type of vaccine	Vaccination approaches	Inoculation dosage	Immunity period
Vaccination once every 6 months	Asia type I-O bivalent foot-and-mouth disease inactivated vaccine	Intramuscular injection	2.0mL	180 days
	Ovine braxy, lamb dysentery and enterotoxaemia inactivated vaccine	Intramuscular injection	5.0mL	180 days
	Anthrax spore vaccine II*	Subcutaneous injection	0.2mL	180 days
	Ovis streptococcus inactivated vaccine*	Subcutaneous injection	1.0mL	180 days
Vaccination once every 12 months	Caprine infectious pleuropneumonia inactivated vaccine	Subcutaneous injection	5.0mL	360 days
	Goat pox inactivated vaccine	Tail head	0.5mL	360 days

		intra dermal injection		
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Note : *Vaccinate due to disease.