

The Project of China
Integrated Economic Development of Small Towns

Pest Management Plan

Entrusted by: The Loan Project Office of the World Bank of Gansu

Provincial Development and Reform Commission

Formulated by: The Plant Protection Research Institute of Gansu

Provincial Academy of Agricultural Science

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Appendix 1: List of recommended non-pollution pesticides

Appendix 2: Questionnaire on the pesticide use status

Abbreviations, acronyms and units

ATESC: Agro-Tech Extension & Service Center

FAO: Food and Agriculture Organization

GB: Chinese standard

IPM: Integrated Pest Management

PMO: Project Management Office

PMP: Pest Management Plan

PPMO: Provincial Project Management Office

CPMO: City/County Project Management Office

Cm: County level project managements

Ct: County level technicians

Tt: Town level technicians

Fm: Project peasant household union or backbone peasant household

representatives

1. Introduction

1.1 Project overview

Gansu is a less-developed agricultural province in Western China. In order to raise the developmental level of the small towns of Gansu province, cultivate its rural leading industry, boost its comprehensive development rural economy, the Ministry of Finance of China incorporated into the 2009-2011 candidate project planning the *Project of Constructing the Integrated Development Demonstration Town of Rural Economy in Gansu Province with loans provided by the World Bank*. This Project covers an area of 7264km² in 12 townships (Dongwan Township of Jingyuan County, Hongshui Township of Jingtai County, Ganquan Township of Maiji District, Zaojiao Township of Qinzhou District, Meichuan Township of Minxian County, Wenfeng Township of Longxi County, Shizi Township of Lingtai County, Dongzhi Township of Xifeng District, Dangzhai Township of Ganzhou District, Hongwansi Township of Sunan County, Huahai Township of Yumen City, Qili Township of Dunhuang City) under 7 prefecture-level cities, i.e. Baiyin, Tianshui, Dingxi, Pingliang, Qingyang, Zhangye and Jiuquan. as well as 12 townships (Project activities focus on the development and boost of local pillar industry or extended pillar industry, mainly including road construction, water conservancy works, trading market of various agricultural products, production bases of forage, apple, walnut and Chinese medicinal plants and nursery stocks and seedling propagation.

The implementation of this project is designated to develop and boost the township leading industries and the pillar industries, promote the construction of the related facilities in the demonstration industry park area, raise the capability of translocation of rural surplus labor, create the employment opportunities for local peasants and expand the channels to increase their incomes, thus effectively accelerating the progress of city and countryside integration, enhancing urbanization, pushing forward the economic and environmental sustainable development in all the demonstration towns and their surrounding areas.

Although the project activities at all demonstration towns in this project all focus on the construction and improvement of basic conditions, e.g. some infrastructures, conditional facilities and farmland consolidation undertaken in the economic development of all regions, they are closely correlated with the agricultural leading industries and characteristic agricultural products in all villages and towns. In order to ensure the successful implementation of the project, we sent separate teams to all regions to conduct investigations and interviews, and after the collection of large amount of data and information, we formulated the “Plan on the Pest Prevention and Management” of the project in accordance with the *Environmental evaluation on the Pest Management* of the World Bank.

With the plant protection guidelines of “Prevention first, practicing integrated prevention and treatment” as basis, this project is designated to implement and practice the concept of “Communal plant protection” and “Green plant protection”, summarize and put forward the prevention and treatment methods of commonly emerging pests and diseases of the staple

crops, fruit trees and Chinese medicinal plants, etc. This prevention and treatment plan under the premise of protecting ecological environment, emphasizes the effect of natural control, popularizes the agricultural, physical and biological prevention methods, so as to control pests and diseases, coordinate and use appropriate chemical prevention measures, reduce the dependence on agricultural pesticides, keep the pests and weeds under economically allowable level and attain optimum economic, social and ecological benefits.

1.2 Overview of natural conditions in the project regions

1.2.1 Geographic location of the project regions in Gansu Province

Gansu Province neighbors the Loess Plateau, the Inner Mongolia Plateau and the Tibet Plateau in China, long and narrow from the west to the east and narrow from the north to the south. It has complex topography and greatly varied sea level elevation including high mountains, basins, rivers, upland plains, deserts and gobi. The province has complicate climate, dry and rainless, and it has great temperature difference. The province has the annual average temperature of 4.8°C and annual average precipitation of 300 mm with uneven space-time distribution and mainly concentrated in three months, i.e. July, August and September. There are many meteorological disasters, e.g. droughts, gales, sand storms, rainstorms, hailstones, frosts and dry hot winds. The harsh and changeable natural conditions and relatively backward production basis bring about not only many restrictions to the agricultural development of Gansu Province, but also many problems in the prevention of various pests and diseases.

Table 1-2-1 Distribution of the project regions in Gansu Province

No.	City	Township, County (District)	No	City	Township, County (District),
1	Baiyin City	Dongwan, Jingyuan	7	Pingliang City	Shizi, Lingtai
2		Hongshui, Jingtai	8	Qingyan City	Dongahi, Xifeng
3	Tianshui City	Ganquan, Maiji	9	Zhangye City	Dangzhai, Gangzhou
4		Zaojian, Taizhou	10		Hongwansi, Sunan
5	Dingxi City	Meichuan, Minxian	11	Jiuquan City	Huahai, Yumen
6		Wenfeng, Longxi	12		Qili, Dunhuang



Fig. 1-1 Geographic location of the project regions in Gansu province

1.2.2 Overview of the hydro meteorology in the project regions

Table 1-2-2 Hydro meteorology overview of project regions

Name of project region	Altitude (m)	Average temperature (°C)	Average precipitation (mm)	Effective accumulated temperature (≥10°C)	Frost-free period (d)	Average evaporation (mm)
Dongwan Township	1360	8.8	244	2700	168	1563
Hongshui Township	1682	8.9	180	2700	150	2361
Ganquan Township	1300	9.5	600	3800	179	1600
Zaojian Township	1600-2059	9	639	2063	168	1600
Meichuan Township	2040	6.7	571.2	1500-2100	115	1061.5
Wenfeng Township	1721	7.7	445.8	1700-2400	155	1440

Shizi Township	1102	8.4	661.2	2539-3336	150	1384
Dongzi Township	1410	10	500	3000	170	541.1
Dangzhai Township	1518.6	7	137.2	1611-3078	147	2047
Hongwansi Township	2311.8	4.8	267.1	2201.8	123	1770.2
Huahai Township	1160-1400	8	79	3417.6	150	2918.3
Qili Township	1148	9.5	39.9	3709.1	158	2480

1.3 Social and economic overview in the project regions

The project regions cover an area of 7264 km² in 12 townships under 7 prefecture-level cities, distributed from the west to the east of Gansu Province. The total population is 500,300 (including 376,700 agricultural population, accounting for 75.3% of the total population in the project regions). The farmland accounts for 968,200 mu with total grain output being 172,300 tons in 2010. The GDP in 2010 was 5,283,000,000 yuan (including 1.882 billion yuan, 2.265 billion yuan and 1.527 billion yuan for the primary, secondary and tertiary industries respectively). The peasants' annual per-capita income is 4576 yuan (Refer to Table 1-3-1).

According to Table 1-3-1, there exists distinctive gap in the agricultural and social development status between the rural areas of Gansu Province and the Central and Eastern China. Of the 12 project regions, the 4 townships, i.e. Dangzhai, Hongwansi, Huahai and Qili, situated at the oasis irrigation area of Hexi corridor in Gansu Province have relatively fast social and economic development, and their secondary and tertiary industries account for a large portion in the GDP. The peasants' per-capita annual income above has represented the highest level of Gansu Province. The 2 townships, i.e. Dongwan and Hongshui, along the Yellow River irrigation area come next, while Meichuan Township situated at the high-cold and damp regions of Taomin has the peasant annual per capita income of only 2258 yuan due to its harsh natural conditions, backward production and sluggish social and economic development. The implementation of the project is of great importance to the social and economic development of Gansu rural areas.

Table 1-3-1 Social and economic overview of project regions (2010)

Name of project area (town)	Total area (km ²)	Agricultural area (10,000 mu)	Total population (10,000 persons)	Agricultural population (10,000 persons)	Per capita arable land (mu)	Total grain output (10,000 tons)	Total output value (100 million yuan)			Annual per capita income (yuan)
							The primary industry	The secondary industry	The tertiary industry	
Dongwan town	229	4.46	4.5	4.2	1.02	0.14	3.5	3.5	0.5	4400
Hongshui town	320	7.94	2.51	1.89	3	2.57	0.93	0.54	0.20	3865
Ganquan town	240	8.7	4.29	2.98	3.2	1.48	0.98	0.04	0.06	2469
Zaojian town	260	10.24	3.78	3.75	2.67	2.2	1.44	0.51	0.54	2810
Meichuan town	184	5.55	4.35	4.37	1.25	0.0059	0.014	0.006	0.0001	2258
Wenfeng town	257	10.8	8.01	5.69	1.4	0.1673	1.39	3.696	4.994	3800
Shizi town	176	10.9	4.1	2.92	3.1	2.7478	2.1	1.65	0.965	3454
Dongzi town	222	14.1	6.3	5.8	2.63	3.7	1.7	3.56	0.89	3980
Dangzhai town	76	8.5	3.1	3.07	2.7	3.85	2.4508	3.0337	3.5811	5771
Hongwansi town	1233	1.4	1.46	0.49	0.96	0.034	0.75	1.2	0.61	5607
Huahai town	4011	11.43	1.33	1.21	9.2	0.5282	1.968	3.05	1.46	7959
Qili town	56	2.8	6.3	1.3	1.8	0.0037	1.5964	1.87	1.47	8539
Total	7264	96.82	50.03	37.67	2.75	17.2269	18.8192	22.6557	15.2702	4576

1.4 Planting patterns of main crops involved in the project regions

1.4.1 Pattern of the staple crops planted in the project regions

The crops planted in the project regions fall into two categories, the first being grain crops, e.g. wheat, corn and potato, to meet the basic needs of people's life and to feed livestock or poultry; the second being fruit trees and various economic crops of local advantage and characteristics (Table 1-4-1), i.e. related industry developed and boosted in this project. According to Table 1-4-1, the social and economic development of all project regions are closely correlated to the peasant's income and the management level of crop and plant cultivation. The regions in the project have different industries due to their different natural conditions and ecological environment. For example, the vegetables are mainly planted in Dongwan town and Dangzhai town, apple in Ganquan town, Zaojiao town and Shizi town, Chinese medicinal plants in Meichuan town. According to the situations in Huahai town and Qili town, their characteristic and advantageous crops are varied, including not only grape, vegetables and cotton, but also Chinese medicinal plants (medlar and liquorice) and pasture grass, which are well operated and managed, so their rural social and economic development and construction are rapid and the peasant's income level sees drastic increase.

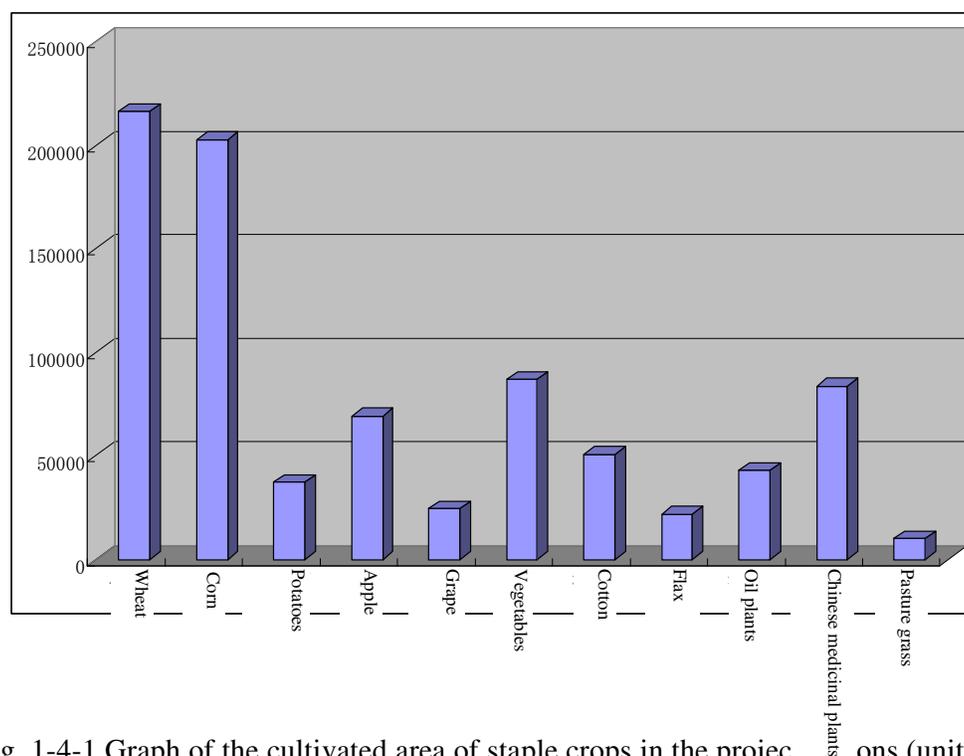


Fig. 1-4-1 Graph of the cultivated area of staple crops in the project regions (unit: mu)

Table 1-4-1 Staple crops and their distribution in project regions (2010; land area in mu)

Project region (town) Name	Grain crops			Fruit trees		Economic crops					Feed
	Wheat	Corn	Potato	Apple	Grape	Vegetables	Cotton	Flax	Rape	Chinese medicinal plants	Pasture grass
Dongwan town	2000	5000	1500	200	/	19500	/	1000	1000	/	/
Hongshui town	8600	43200	9700	/	/	2580	/	480	/	10930	2000
Ganquan town	41266	27895	2650	19565	/	3492	/	1022	5600	/	/
Zaojian town	38500	24500	8400	9650	/	1680		3000	6600	/	/
Meichuan town	240	/	1300	/	/	/	/	/	/	41650	/
Weifeng town	43210	49350	13200	30	/	6200	/	2600	7800	1820	/
Shizi town	38600	28030	6150	12000	/	5800		16000	920		
Dongzi town	68000	25350	800	26396	/	10800			28000		5000
Dangzhai town	11695	46769	6002	1231	234	15209		180	320		900
Hongwansi town	1656	/	648	/	/	43		102	468		409
Huahai town	5678	1516	/	/	4610	23554	40518	/	/	31266	1632
Qili town	107	499	/	39	19485	4151	10136	/	/	/	/
Total	259552	252109	50350	69111	24329	93009	50654	24384	50708	85666	9941

1.4.2 Cultivation measures of staple crops cultivated in the project regions

For the agricultural cultivation measures, it can be said that each project region represents the advanced level in their local regions. In Gansu Province 70% of the agricultural land uses dry farming, and except for the Hexi corridor and the irrigation area along Yellow River in Baiyin, all other areas are rain irrigated, so the agricultural cultivation technical measures used in all regions are the agricultural cultivation technique of dry farming with the core of drought resisting, seedling protecting, increasing usage ratio of natural precipitation. Local farmers mainly use the measures of mechanical sowing and sowing in line for the wheat, the technique of ditch sowing corn in double ridges mulched with plastic film for corn, the film-covering and ridge-forming method for the cultivation of potato, the mechanical sowing and film-covering methods for cotton. For the vegetable planting, the seedling transplant and open cultivation are used in summer and autumn, and the cultivation with facilities, e.g. solar heat greenhouse and plastic shed, is applied in winter and spring.

At present except for vegetables and cottons, there lack irrigation conditions for other field crops, and because the production mode is based on peasant household, and there lacks agricultural lands and there is prominent phenomenon of continuous cropping and succession cropping and film covering, the occurrence of soil-borne diseases and subterranean pests became increasingly severe. In addition, the lack of farmyard manure, the prominent use of chemical fertilizers lead to the soil hardening and the decrease of organic matter content and land fertility year by year.

In pest management, as most adult peasants leave their hometown to seek job elsewhere, the labor is inadequate, resulting in inadequacy of field management, careless disposal of various crop straws and diseased plants. Meanwhile lacking of IPM related knowledge and totally relying on chemical pesticides in prevention and treatment of pests and diseases and frequently occurred improper mixing of agricultural chemicals at random will not only reduce the prevention effect but also easily lead to the drug resistance of the pests and diseases. In addition, there is frequent occurrence of phytotoxicity caused by the use of chemicals not complying with prescriptions and willful increase of the dosage.

1.5 Concept of Integrated Pest Management

The Integrated Pest Management (IPM) is the strategy for integrated pest management, that is, from the comprehensive perspective of agriculture ecological system, based on the interrelations between the pests and environment, coordinately applying various prevention measures of agricultural, physical and chemical nature, bringing into full play the effect of natural control factors in agriculture ecological system, and keep the agricultural pests under the economically allowable level. The prevention is only taken when the pest harm may lead to economic loss, that is, a certain number of bacteria and pests are permitted as long as their population has not been big enough to cause economic loss. In IPM, extraordinary attention is paid to the application of integrated prevention techniques, such as resistant cultivars, cultivation measures, natural enemy organisms, chemical agents, especially the use of natural enemy factors in the control of pests and diseases, and the adoption of caution attitude in use of agricultural chemicals.

IPM is also a systematic management method, valuing the participation of the croppers, the quality and decision-making ability of the croppers as well as the support of related policies. In practice, it advocates the healthy cultivation and natural enemy protection, adheres to regular field ecological investigation and analysis and observes the crop growing status as well as its pests and diseases, natural enemies, population dynamics of other insects. It replaces the traditional experience threshold with the field ecological analytic results to finally make its own decision. Its guiding ideology has been transformed from simple pursuit of high production to the target of developing sustainable agriculture, with the core of income increase, rational use of limited resources, and improvement of the producer's comprehensive quality. The implementing steps of this strategy are divided into three closely connected stages: prevention, supervision and intervention. The prevention is put at the first place by reducing as far as possible the use of or not using agricultural chemicals at all, with the purpose of reducing the pollution to the natural ecological environment, creating an environment to the disadvantage of the occurrence of pests and beneficial to the growth and propagation of useful insects.

This project is in favor of the Integrated Pest Management (IPM). It covers the following aspects:

(1) Treating the pests and diseases and keeping them under the economically allowable level, not trying to root out the pests and diseases;

(2) Bringing into full play the effect of natural control factors, using as far as possible non-chemical measures to keep the total amount of pests and disease at a low level;

(3) When an agricultural chemical must be used, selecting a kind and the use method that reduce its adverse impact on beneficial organisms, human and ecological environment to the least.

1.6 Objective of implementing pest management in the project regions

The implementation of the project may change the input amount and application method of agricultural chemicals (fertilizers and pesticides) used at present. This project will pay attention to the potential adverse effects incurred by the changes of the dosage and application method of agricultural chemicals, and alleviate these effects by introducing to the peasants more effective agricultural chemicals and application techniques. Meanwhile, by introducing, demonstrating and popularizing more environment-friendly integrated prevention and treatment techniques of pests and diseases, the planting area of green agricultural products and pollution-free agricultural products are expanded in the project regions so as to increase the output and quality of agricultural products and increase the peasants' income.

The Pest Management Plan for the project of constructing integrated development and demonstration town of rural economy in Gansu province will be firstly implemented in 12 demonstration towns in the project regions, which will radiate to their surrounding areas on the basis of continuous perfection and acquirement of experiences, so as to vigorously push forward the pest control by agricultural, physical and biological measures, reduce the dependence of agricultural production on agricultural chemicals and realize the sustainable development of

agriculture in a step-by-step manner. Therefore the formulation of Pest Management Plan in this project is very necessary.

2. Current status of the pest management in the project regions

2.1 Current status of the occurrence of main pests and disease in the project regions

2.1.1 Main categories of pests and diseases

Gansu Province boasts a vast territory as well as complex and varied terrains and landforms, extending over 1500 km from the west to east. Its varied ecological types and unique climate conditions generate all kinds of pest species, so it is one of the provinces with prominent pest occurrence, characterized by increased types of recurrent pests and diseases and increased biological risks of invasive species, especially with the vigorous development of plateau summer vegetables, characteristic advantageous industries, such as potatoes, apples and genuine Chinese medicinal plants. The existing pest prevention and control techniques obviously lag behind, causing increasingly severe harm incurred by pests and diseases. By the investigation and survey on the project regions, presently the varieties of diseases and pests of staple crops are as follows.

2-1-1 Common pest varieties and conventional prevention pesticides in project regions

Crops	Common pests	Common pest diseases	Commonly used prevention pesticides
Wheat	Subterranean pests, aphid (<i>Aphididae</i> spp.), Mythimna separate, red spider (<i>Tetranychus</i>), midge	stripe rust disease, powdery mildew, full rot disease, viral diseases	Phoxim, chlorpyrifos, acetamiprid; triadimefon, tebuconazole, propiconazole, etc
Corn	Subterranean pests, European corn borer (<i>Ostrinia furnacalis</i>), cotton bollworm (<i>Heliothis armigera</i>), aphid (<i>Aphididae</i> spp.), red spider (<i>Tetranychus</i>)	Maize head smut, gall smut, ear rot disease, stalk rot disease, bacterial wilt	Phoxim, chlorpyrifos, acetamiprid, cyhalothrin, thiacloprid; propiconazole, tebuconazole seed coating, carbofuran- diniconazole seed coating agent
Cotton	Cotton aphid (<i>Tetranychus cinnabarinus</i>)	Cotton verticillium wilt, fusarium	Phoxim, profenofos, avermectins, pyridaben, chlorpyrifos, cypermethrin,

		(<i>Aphididae</i> spp.), cotton red spider (<i>Tetranychusurticae</i> spp.), cotton bollworm (<i>Heliothis armigera</i>), cutworm (<i>Agrotis</i> <i>segetum</i>)	wilt	etc
Potato		Subterranean pests, aphid (<i>Aphididae</i> spp.), leaf beetle (<i>Chrysomelidae</i> spp.)	Late blight, early blight, ring rot disease, black shank disease, scab disease, stem base rot diseases (tarspot, damping off), viral disease	Phoxim, chlorpyrifos, acetamiprid, imidacloprid ; copper hydroxide, cymoxanil mancozeb, hymexazol mancozeb, mancozeb, triflumizole propamocarb, metalaxyl mancozeb, tebuconazole
Vegetables		Subterranean pests, diamond back moth (<i>Plutella xylostella</i>), Cabbage worm (<i>Pieris</i> <i>rapae</i>), aphid (<i>Aphididae</i> spp.), leafminer (<i>Liriomyza</i> <i>sativae</i>), greenhouse whitefly (<i>Trialeurodes</i> <i>vaporariorum</i>)	Downy mildew, grey mold disease, anthracnose, blight, powdery mildew, viral diseaseS, greensickness, wilt disease, root knot nematode	Phoxim, chlorpyrifos, avermectins, spinosad, decamethrin, thiophanate methyl, carbendazim, chlorothalonil, mancozeb, cymoxanil mancozeb, propamocarb, dimethomorph, fosetyl-Al, polysulfide suspending agent, alkene moroxydine, streptomycin, copper hydroxide, pyrimethanil, iprodione, etc
Chinese medicine	Lycium barbarum	Aphid (<i>Aphididae</i> spp.) and phylloxera	Anthracnose, black fruit disease and root rot disease	Imidacloprid, kushenin, fenvalerate , mancozeb , chlorothalonil and carbendazim

The Project of China Integrated Economic Development of Small Towns in Gansu Province with Loans Provided by the World Bank - Pest Management Plan

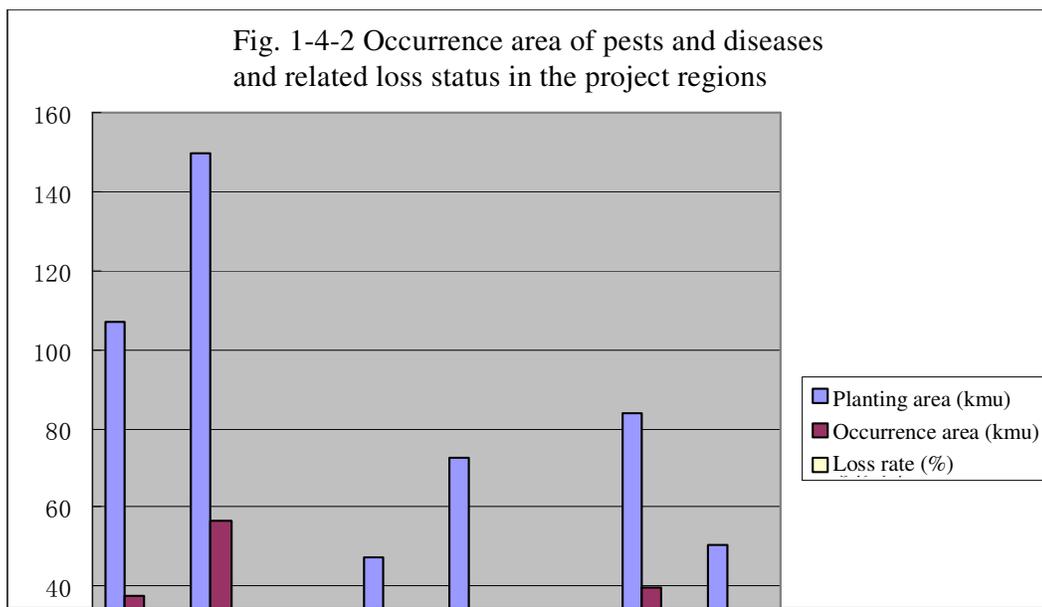
cinal plant s	Glycyrr hiza	Aphid (<i>Aphididae</i> spp.), leaf beetle (<i>Chrysomelidae</i> spp.) and leaf hopper	Rust disease, powdery mildew and brown spot disease	Pirimicarb, imidacloprid, deca-methrin, fenvalerate, difenoconazole , carboxin, triadimefon, chlorothalonil and carbendazim
	Angelic a sinensis	Aphid (<i>Aphididae</i> spp.), agrotis ypsilon , wireworm (<i>Elateridae</i> spp.) and grup	Ma-mouth disease, brown spot disease and root rot disease	Pirimicarb, imidacloprid, phoxim, beauveria bassiana, carbendazim, thiophanate methyl and fenaminosulf
	<i>Odonop sis pilosula</i>	Aphid (<i>Aphididae</i> spp.), red spider (<i>Tetranychus</i>), cutworm (<i>Agrotis segetum</i>), wireworm (<i>Elateridae</i> spp.) and grup	powdery mildew and root rot disease	Pirimicarb, imidacloprid, avermectin , phoxim, agricultural antibiotic 120 , mancozeb , carbendazim and fenaminosulf
Apple	Apple fruit borer, red spider (<i>Tetranychus</i>), Aphid (<i>Aphididae</i> spp.), psylla chinensis, scale insect (<i>Coccoidea</i> spp.), leaf roller (<i>Tortricidae</i> spp.) and Carpocapsa pomonella	Rot disease, powdery mildew, rust disease and <i>Alternaria mali</i> Roberts	Chlorpyrifos, acetamiprid , avermectin , fenvalerate , propargite, thiophanate methyl , lime sulfur mixture , carbendazim, mancozeb , pine taroil, tebuconazole and propiconazole, etc	
Pear	Aphid (<i>Aphididae</i> spp.), psylla chinensis, scale insect (<i>Coccoidea</i> spp.) and leaf roller (<i>Tortricidae</i> spp.)	Powdery mildew, rust disease, pear scab, pear stem spot disease and dry rot disease	Chlorpyrifos, acetamiprid , avermectin , fenvalerate , thiophanate methyl , lime sulfur mixture , carbendazim, mancozeb , tebuconazole , propiconazole and asomate, etc	
Grape	Colomerus vitis and grape leaf beetle	Powdery mildew, gray mold, downy mildew	Chlorpyrifos, phoxim, avermectin , fenvalerate , thiophanate methyl , mancozeb , triadimefon and propiconazole, etc	
Oil plants	Striped flea beetle (<i>Phyllotretacruciferae</i>	Sclerotinia rot of colza,	Imidacloprid, thiacloprid, acetamiprid, chlorpyrifos,	

	spp.), <i>Entomoscelis suturalis</i> weise, <i>Ceuthorrhynchus asper</i> , aphid (<i>Aphididae</i> spp.), leafminer (<i>Liriomyza sativae</i>)	powdery mildew, flax wilt disease, flax blight disease, flax anthracnose, sunflower downy mildew, etc	triadimefon, polysulfide suspending agent, tolclofos-methyl, carbendazim, etc
Pasture grass (alfalfa)	Aphid (<i>Aphididae</i> spp.), <i>Thripidae</i> spp., and <i>Miridae</i> spp., etc	Alfalfa rust disease, downy mildew, powdery mildew, brown spot disease	Imidacloprid, avermectin, chlorpyrifos, mancozeb, triadimefon, thiram, thiophanate methyl, chlorothalonil and procymidone

2.1.2 Endangering area by main pests and diseases and the loss incurred

As shown in Table 2-1-2 and Fig. 2-1-2, despite of the great efforts invested in the prevention and treatment of pests and diseases in the project regions year by year, there are still large yield loss for all kinds of crops. The yield loss for various crops is sequenced from high to low as follows: cotton > oil plants > potato > wheat > vegetables > Chinese medicinal plants > fruit trees > corn.

Meanwhile as shown in the table, due to different natural conditions and ecological environment in all project regions, the extent of harm incurred by pests and diseases for various crops also varies, so even for the same variety of crop, the loss varies largely from one project region to another. For example, the loss of wheat, corn, potato and fruit trees (Grape) in Huahai town is less than that in other project regions, while the loss of cotton in Huahai town is more severe than that of other crops, as does Qili town.



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Table 2-1-2 Occurrence area of pests and diseases and related loss status in the project regions (mu. %)

Town	Wheat		Corn		Potato		Fruit trees		Vegetables		Oil plants		Chinese medicinal plants		Cotton	
	Affected area	Hazard loss (%)	Affected area	Hazard loss (%)	Affected area	Hazard loss (%)										
Dongwan	200	10	100	2	110	7.3	50	7	710	6	/	/	/	/	/	/
Hongshui	2838	20	8640	8	4850	20	/	/	545	8	120	6	5465	12	/	/
Ganquan	17700	12.0	15480	9.7	1850	11.4	8730	12.9	1440	7.6	2630	12.5				
Zaojiao	15400	11.4	14700	11	7320	12.5	4360	11.6	620	9.4	3990	14.3	/	/	/	/
Meichuan	20	8.3	/	/	104	8	/	/	/	/	/	/	3748	9		/
Weifeng	2200	8.2	300	3	300	2.1	8	5.5	3060	7	3500	9	30	3		
Shizi	6200	10	3100	9	321	5	223	2.2	1253	11.5	4710	18.8	/	/	/	/
Dongzhi	3500	10.3	8200	8.4	320	15.3	10500	11.2	4700	9.1	9750	16.2	/	/	/	/
Dangzhai	9500	7.48	28300	7.93	600	16.7	140	10.7	4882	5.4	130	15.8	/	/	/	/
Hongwansi	533	13	/	/	227	30	/	/	17	/	163	34	/	/	/	/
Huahai	2658	3.5	1516	4.1	/	/	4610	2.7	22367	11	/	/	30510	2.3	25820	26

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Qili	/	/	/	/	/	/	974	5	/	/	/	/	/	/	2534	25
Total	60749	10.38	80336	7.01	16002	12.83	29595	7.64	39594	8.33	24993	15.83	39753	6.58	28354	25.5

2.2 Prevention and treatment measures of pests and diseases used currently in the project regions

2.2.1 Prevention and treatment measures of pests and diseases of staple crops in the project regions

Despite of the varied natural conditions and different crops planted, the prevention and treatment measures and approaches are the same on the whole, which can be classified into agricultural measures, physical and mechanical, biological, ecological and chemical prevention and treatment. In above prevention and treatment measures, chemical prevention and treatment are still the mainstay in the effective control of pests and diseases, accounting for over 80%, and the agricultural measures accounts for about 10%, physical and mechanical methods account for 5% each.

Table 2-2-1 Prevention and treatment measures of pests and diseases mainly used currently in the project regions

	Prevention and treatment measures	Suitable crops
Agricultural measures	Selecting pest resistant varieties and seedlings	Suitable for all kinds of crops
	Plastic film mulching	Corn, potato, vegetables, cotton
	Crop rotation and succession	Suitable for all kinds of crops
	Cleaning the orchard and field	Fruit trees, vegetables
	Seed potato de-virus	Potato
	Planting corn lure strip around the cotton field	Cotton
Physical prevention and treatment	Setting moth-killing lamp, sweet lure and hanging yellow insect trap	Fruit trees, vegetables
	High-temperature seed soaking for sterilization and insects killing, using high-temperature tightly greenhouse with natural light in summer	Vegetables
Ecological prevention and treatment	Regulating shed and room temperature and humidity	Facility vegetable cultivation
Biological prevention and treatment	Protecting and making use of natural enemy	Suitable for all kinds of crops
	Preventing and treating pests and diseases with biological agents	Vegetables, fruit trees, Chinese medicinal plants
Chemical prevention and treatment	Seed dressing and coating	Wheat, corn, oil plants, cotton
	Applying chemicals in sowing furrow (hole) spreading pesticide-clay mixture	Corn, potato, vegetables, rape, Chinese medicinal plants
	Trapping pests with all kinds of poison baits	Suitable for all kinds of crops
	Fumigation with smoke agent	Facility vegetables
	Over ground mist spraying and underground root drenching	Suitable for all kinds of crops

2.2.2 Application of agricultural chemicals in the project regions at present

In order to make good use of and manage well the pest treatment by agricultural chemicals, especially the pesticides in the next step of the work in the project regions, we investigated the use of agricultural chemicals in part of the project towns (see table 2-2-2).

Table 2-2-2 Usage of agricultural chemicals in the project regions in 2010

Name of the project town	Chemical applying times for each season (times)	Chemical dosage (g/mu·time)		Chemical consumption in 2010		
		Bactericide	Pesticide	Chemical pesticides (ton)	Biopesticides (ton)	Biopesticides Percentage (%)
Dongwan town	3-4	100-120	40-50	5.9	0.3	4.84
Hongshui town	2-3	80-100	30-40	5.6	0.2	3.45
Meichuan town	2-3	80-100	40-50	3.4	0.1	2.86
Wenfeng town	2-3	40-50	30-40	4.2	0.1	2.33
Ganquan town	3-4	100-120	40-50	11.1	0.5	4.31
Zaojiao town	3-4	100-120	40-50	12.3	0.6	4.65
Shizi town	2-3	80-100	40-50	8.0	0.35	4.19
Dongzhi town	2-3	80-100	40-50	10.3	0.5	4.63
Hongwansi town	2-3	80-100	30-40	1.0	0.02	1.96
Dangzhai town	3-4	100-120	40-50	8.9	0.4	4.3
Huahai town	2-3	80-100	40-50	8.7	0.4	4.4
Qili town	3-4	100-120	40-50	3.7	0.18	4.64

Several description points for the data in the above table:

(1) The chemical applying times for the crops in each season in the table is the mean value. The actual situation is that the grain crops such as wheat and corn all received chemical coating, seed dressing and spreading pesticide-clay mixture, 1-2 times for the field growth period, 4-5 times for economic crops such as vegetables and fruit trees, 5-6 times for some varieties and even more for some varieties.

(2) The chemical dosage varies significantly among villages and townships due to the difference in their agricultural area and crop varieties planted. In particular, the annual agricultural chemical consumption is significantly larger in the project towns which grow vegetables and fruit trees as their mainstay.

(3) Chemical pesticides prevail in prevention and treatment of pests and diseases in the project regions, and the use of bio-pesticides accounts for less than 5% only.

2.3 Peasant interview

In investigation and survey period of the project, we had interviews with 51 peasant households at random in the project regions, and collected questionnaires from them to learn their views on the use of agricultural pesticides. The content of the questionnaire includes the educational level of the peasants, land they owned, crop varieties they planted, main pest varieties occurred as well as how they select the type of pesticides? How to determine the use dosage and the applying time? What are the precautions in the use of pesticides? How to preserve pesticides? How to dispose of the used chemical bottles and packaging bags? What are the trainings you expect to take? All surveyed peasant households wish to take training concerning the knowledge on the identification of pests and diseases, related prevention and treatment measures, proper use of pesticides and cultivation management. It can be said that what acquired from the interviews with the peasants indicated the true situations of the prevention and treatment of pests and diseases in the project regions at present (see Table 2-2-3).

From the interviews with the peasants, we learned that apart from the instructions acquired from agro-technical departments, the peasants rely on their experiences more for the prevention and treatment of pests and diseases, while on the purchase and selection of pesticides they rely on the recommendation of the seller in the local pesticide stores or the dealers. With regard to the use times and dosage, they mostly rely on their experiences and the labels and instructions of the pesticides. Furthermore, we also learned that the peasants lack some knowledge and usually use two types of pesticides or mix several types, and most peasants paid less attention to the pollution of pesticides to agricultural products and the environment and they had limited awareness of safe use intervals. In the field investigation, we can see discarded pesticide bottles and packaging bags everywhere. Nevertheless, in our investigation we also deeply perceived that all surveyed peasants expected that more trainings and on-the-spot meetings are held, latest technical materials and agricultural pesticides are distributed and recommended to solve various practical problems they encountered in their production. They also required the display of new technologies and the effect of new products in the form of demonstration field so as to spread and disseminate them to larger areas.

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Table 2-2-3 Table of the peasant interview content in the project regions

No.	Interview content	Questions designed and the number of people for each option							
		Option 1	People	Option 2	People	Option 3	People	Option 4	People
1	Use period (years)	2-5	2	6-10	11	11-20	34	21-30	4
2	Do you know about the “three certificates of the pesticides”	Yes	9	A little	42	/		/	
3	Where do you purchase the pesticides	Pesticide store	51	Factory direct sales	4	Peddlers	1	/	
4	How to select the pesticide	Agricultural technician recommendation	22	Dealer recommendation	18	By experiences (or neighbor recommendation)	17(5)	By reading label (or advertisement)	7(6)
5	How to decide the pesticide use time	By experiences (or notice)	23(3)	Instructions from the agro-tech department	20	Fixed time for pesticide use	13	By reading the label of the pesticide	5
6	How to decide the pesticide use dosage	By experiences	9	By reading pesticide label	32	Instructions from the agricultural machinery department	16	Asking the former users	6
7	How to measure the pesticide	By bottle cap	30	Using small packages	11	By scale or container of known volume	13	By rough estimation	3
8	Actual use dosage of the pesticide	Within the scope of label dosage	39	Higher than label dosage	12	Lower than label dosage	2	/	

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No.	Interview content	Questions designed and the number of people for each option							
		Option 1	People	Option 2	People	Option 3	People	Option 4	People
9	How to calculate the applying amount	g/mu	41	By dilution times	22	/		/	
10	How to decide the use times	By experiences	16	By recommendations	19	By instructions from the agriculture technicians	20	Whenever having time	2
11	Applying times for each crop	1-2 times	15	3-4 times	27	5-6 times	9	/	
12	Interval for each applying	Over 8 days	30	6-7 days	18	4-5 days	2	/	
13	Safe applying interval	As complying reference	16	No complying	11	Do not know how to comply with the safe use interval	14	Not clear	10
14	How to use pesticides	One pesticide for each time	21	Mixing two types of pesticides	10	Mixing several types of pesticides	19	Mixing multiple types of pesticides	2
15	Impact of weather on pesticide effect	Rainy	46	Blowing strongly	27	High temperature	11	/	
16	Whether protective measures are taken in applying pesticides	Wearing mouth muffle	21	Wearing mouth muffle and protective clothing	28	Washing hands and changing clothes after applying pesticides	24	No protections needed	3
17	What to do	Sending him/her to	22	Sending him/her to	29	Handling	2	/	

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No.	Interview content	Questions designed and the number of people for each option							
		Option 1	People	Option 2	People	Option 3	People	Option 4	People
	when someone were poisoned by pesticides	hospitals for emergency treatment		hospital for emergency treatment carrying the pesticide labels		according to the prescriptions on the pesticide label			
18	Preservation of remaining pesticides	Classified storage	31	Casually storing them	19	Discarding them	5	/	
19	Disposal of empty pesticide containers	Discarding them in the field	14	Burning or burying them	33	Having not thought about it	2	/	
20	Local trainings on pesticide knowledge	None	7	1-2 times	25	3-5 times	9	More than 5 times	6

Note: In order to learn about the actual situations of the peasants in using pesticides in the project regions, we used a questionnaire with 20 questions in total and 3-4 options for each question, which was filled by the peasants according to their actual situations. A total of 51 questionnaires were randomly released to 12 project regions, and all 51 filled questionnaires were retrieved. This table is the summarized results of the 51 questionnaires.

2.4 Evaluation of current situation of the management of pests and diseases in project area

By the on-the-spot investigation, survey and peasant household interview in the project regions, we noticed that the key agricultural cultivation using pest control in the project regions focused on various vegetables, melons and fruits, Chinese medicinal plants, mainly relying on chemical pesticide control, seldom using some traditional effective agricultural planting measures, physical measures and biological prevention measure. While in chemical preventions, except for relying on the instructions from agro-tech departments, most peasants solved the pest problems they encountered more with their experiences and with the help of pesticide dealers. Due to the perennial use of large amount of chemical pesticides and the lack of knowledge of pesticide, environment and health, the peasants caused high risks in the use of pesticide with low effective use of pesticides, and often caused phytotoxicity to all kinds of crops.

By investigation and survey, we also witnessed great importance attached by the government departments on the agricultural social and economic development in the regions, and great concern and support on pest control of all kinds of staple crops. In addition, the pest forecast and prevention techniques are improving year by year, but there are still problems concerning the use of chemical pesticides, which are summarized as follows:

(1) Being highly dependent on agricultural chemicals, especially prominent on vegetables with high commodity value and economic benefits, e.g. melons, fruits and other commercial crops;

(2) The use dosage of agricultural chemicals, especially pesticides sees a rising trend year by year;

(3) There lacks correct utilization and management on agricultural chemicals (bactericides, pesticides and herbicides) and other chemicals;

(4) There exist potential risks of pollution and toxicity concerning the random disposal of residue agricultural chemicals and discarded packages;

(5) Poor enforcement of policies and regulations and poor supervision on agricultural chemicals;

(6) The extension organizations, agricultural chemical dealers and peasants lack awareness on the integrated treatment of pests and diseases;

(7) The traditional training mechanisms can not solve the specific production problems and some newly emerged difficulties of individual peasant households;

(8) There lacks timely and sufficient information on agricultural pesticides.

3. Foreseeable trend of the agricultural pest occurrence after the implementation of the project

Because the construction content of this project all centered on the construction and improvement of the basic conditions, e.g. some agricultural infrastructures, conditional equipments and farmland consolidation undertaken in the economic development in all regions, the farmland in the project regions will be more standardized, the land will be more leveled off and the canal system will be more supportive. The proceeding of the project for the improvements and scientific treatments of various pests and diseases in the farmland ecological environment will inevitably lead to the evolvement of the existing agriculture and forestry pests and diseases. It is expected that after the implementation of the project the fruit tree pests and diseases will have the following changes: the frequently reoccurring pests and diseases will be under effective control due to the implementation of supporting technical measures; part of air-borne diseases (rust disease and powdery mildew) and soil-borne diseases (wilt, blight and nematode disease) will continuously occur and exert harm due to unique climate conditions and continuous cropping obstacles, but the harm will decrease to an extent; with the introduction of new cultivars (or seedlings) and transportation and distribution of vegetables, the risks for the invasion of alien species increased, new pests and diseases, e.g. codling moth (*Cydia pomonella*), woolly apple aphid (*Eriosoma lanigerum*), western flower thrip (*Frankliniella occidentalis*), *bemisia tabaci*, *Miridae* spp., potato gangrenosis, etc will continuously intrude and expand to cause harm.

3.1 Variation trend of the pests and diseases of wheat, corn and potato, etc.

The high quality and standard farmland construction, good water and fertilization management as well as the integrated prevention and treatment of pests and diseases are expected to take place. The occurrence of wheat subterranean pests, aphid (*Aphididae* spp.), red spider (*Tetranychus*), midge and wheat root disease and wheat viral diseases will reduce and their damage extent will decrease. As for the wheat stripe rust disease, because the wheat area with altitude above 1500 m in Tianshui of Gansu Province (Maiji District and Qinzhou District) and Taomin (Minxian County) is not only the base for wheat stripe rust disease to live through the summer but also the primary infection source for the winter wheat in its surrounding Chuanshui District of low altitude to catch disease in autumn, and the diseases to spread to the wheat area in all regions of Gansu Province and Eastern China. Therefore the stripe rust disease is still at the dominant position of wheat diseases occurred. Besides, the improvement of farmland irrigation conditions will cause change to the wheat field microclimate, thus may increase the occurrence areas of the wheat powdery mildew.

As for corn, the corn viral diseases spread by various aphid (*Aphididae* spp.) and plant hopper (*Laodelphax striatellus*) (mainly dwarf mosaic disease and red leaf disease), corn northern leaf blight and southern leaf blight as well as the corn head smut and the gall smut in corn seed field carried around by all kinds of aphid (*Aphididae* spp.) and plant hopper (*Laodelphax striatellus*) will decrease to an extent. The expansion of plastic film corn leads to good under-film soil moisture content and the high temperature increase rate of the soil, but also leads to the severe spread of subterranean pests, mainly wireworm (*Elateridae* spp.) and cutworm (*Agrotis segetum*), and the prevention becomes difficult due to the filmed soil. In addition, there has newly emerged corn top rot disease and corn twisted heart leaf in recent two years in Gansu Province (including the project practice area), and

because most peasants and grass-root agricultural technicians do not know their causes, they can not take effective solutions, and the occurrence area may further increase.

At present, the potato industry has become a feature industry with advantages. Due to the popularization of de-virus sweet potatoes, especially that of quality varieties, the occurrence of all kinds of viral diseases will sharply decrease. But because the reproductive stage of potatoes coincides with the rainy and hot climate conditions (three months of raining: July, August and September) in Gansu Province, the late blight is still the important constraint factor for potato production. In addition, the potato ring rot disease, black shank disease, tar spot disease and dry rot disease are on the rise, especially the occasionally outburst of dry rot disease in storage period will cause the rot incidents of large amount of cellar stored seed potato, which shall attract our great concern.

3.2 Variation trend of vegetable pests and diseases

There are two categories of vegetables in the project regions. One is the plateau summer vegetables, mainly the vegetables planted in the open of the plateau regions with altitude of 1000-2500 m, annual average air temperature of 4-12°C, average air temperature \square 25°C in July, which come into season in July-September to supply the vegetables in the off-market period in Southeast China coastal regions, the middle and lower reaches of Yangtze River and North China as well as the vegetable market in countries of Southeast Asian and Central Asian. These include cabbages, cauliflowers, celeries, young garlic shoots, pumpkins, carrots and daylilies. The other is the vegetables planted in solar heat green house and plastic shed facilities, which are mainly supplied to the spring and winter market in Gansu, and Xinjiang, Qinghai and Ningxia provinces in Northwestern China. These include cucumbers, tomatoes, peppers, eggplants and pumpkins.

With the implementation of the project, especially by the technical training provided to peasants and with the increase of their awareness of safe production, and also the good natural heat and light resources in Gansu province, the main recurrent pests and diseases of various vegetables (e.g. lepidoptera Cabbage worm (*Pieris rapae*), cabbage army worm (*Mamestra brassicae*), tobacco budworm (*Helicoverpa assulta*); sucking insects aphid (*Aphididae* spp.), leaf mite (*Tetranychidea* spp.); fungus diseases gray mold, powdery mildew and downy mildew, etc) will be under effective control and the quality and quantity of vegetable products will be also significantly improved and increased. However, due to continuous introduction of various new vegetable cultivars and consecutive-year planting of vegetables in all regions, some alien pests may invade the project implementation areas and some diseases mainly borne by soil, e.g. all kinds of root rot diseases, blight and wilt diseases will be more severe in cruciferae vegetables due to pathogenic accumulation. The early blight and late blight in solanaceae vegetables as well as the greenhouse whitefly (*Trialeurodes vaporariorum*), wilt disease and parasitic nematode, etc of melon or cucurbitaceae vegetables will continue occurring and causing damage. Particular attention shall be drawn that the vegetable continuous cropping obstacles under facility conditions have increasingly become the problem concerned widely in vegetable production. Meanwhile, due to changes of climate conditions in recent years, the cold injury caused by

low temperature in early spring and the occurrence of physiological obstacles resulted from various factors will be increasing.

3.3 Variation trend of pests and diseases in cotton and Chinese medicinal plants

The cotton is mainly planted in Huahai Township of Yumen City and Qili Township of Dunhuang City within the project regions. The cotton aphid (*Tetranychus cinnabarinus*), cotton leaf mite and cotton bollworm (*Heliothis armigera*) will be well controlled due to the implementation of the project, while the cotton wilt disease and cyanosis, for their difficulty in prevention and treatment, will still cause harm. In addition, the cotton miridae is on the rise in part of the cotton planting areas in China, which shall be closely monitored.

The Chinese medicinal plants have a long planting history in Gansu Province. In particular, Minxian County and Longxi County in the project regions have been named by the Special Product Committee of Chinese Association of Agricultural Science Societies as “Land of *Angelica sinensis* in China” and “Land of *Mikvetch* root in China” respectively. The pests and diseases in Chinese medicinal plants have their own characteristics of occurrence. Firstly, due to long-term natural selection, the adaptation to local environmental conditions and the disease source of host plant and the yearly accumulation of pest source, the genuine medicinal materials are severely affected. Secondly, due to special chemical composition of the medicinal plant itself, there are relatively many monophagy and oligophagy pests feeding, laying eggs on these special plants preferably, so there forms complicate varied pest systems in the production area of different Chinese medicinal plants. Thirdly, because most Chinese medicinal plants are biennial and perennial, there exist prominent problems of under-ground root and stem diseases and subterranean pests.

After the implementation of the project, thanks to improvement of peasants’ scientific and technological level and the implementation of the good agriculture practice of Chinese medicinal plants, the Ma-mouth disease in *Angelica sinensis*, brown blotch in *Gengelic sinensis*, downy mildew in *Mikvetch* root, powdery mildew in *Leguminosae* spp. and *Codonopsis pilosula*, rust disease in *Leguminosae* spp. will be reduced to an extent. But because there are a great variety of pests and diseases in Chinese medicinal plants with great difficulty in prevention and treatment, the root rot disease in *Angelica sinensis* and *Codonopsis pilosula*, subterranean pests, *Brachophagus* spp. will continue being the focus of prevention and treatment. In addition, what needs our special attention and concern is that after the distribution of the seedling of Chinese medicinal plants and the transformation of medicinal crops from wild type to cultivated type, there may be the occurrence and evolvement of new diseases and pests because the change in environment breaks the former ecological balance.

3.4 Variation trend of the pests and diseases of oil plant crops

The oil plants mainly include flax and rape, and their distribution in the project regions is as follows: Chinese cabbage type spring rape (*Brassica campestris*) in high-altitude regions, flax and winter rape in low-altitude regions. After the implementation of the project, the flax wilt disease and flax wilt disease and *falseuncaria kaszabi razowski* (also called flax phaloniid), which were severe in the past, will be alleviated. The *Sclerotinia sclerotiorum*

and rapepowdery mildew will also be well controlled. However, the flax root rot disease and the rape flea beetle and subterranean pests in seedling stage in spring rape areas will continue.

3.5 Development trend of pests and disease in (apple, walnut and grape) orchards

In the project implementation regions, the apple trees are mainly distributed in three towns, namely Ganquan, Zaojiao and Shizi. Old orchards are distributed in Ganquan and Zaojiao townships and new three-year old orchards are in Shizi township. The pests in old orchards are mainly scale insect (*Coccoidea* spp.) and red spider (*Tetranychus*). Diseases include apple scar skin disease (ASSD) and mould core disease, which are leaf diseases, Fruit diseases include apple scar skin disease and mould core disease. Limb disease includes apple cranker. New orchards generally suffer scale insect (*Coccoidea* spp.), red spider (*Tetranychus*) and leaf roller (Tortricidae spp.). After the implementation of the project, due to the implementation of the Pest Management Plan, all above pests and diseases will be alleviated, but the scale insect (*Coccoidea* spp.) and rot diseases will continue to cause harm because of the difficulty in prevention and treatment, accumulation of disease pathogens and the large insect population. Meanwhile due to environmental changes, especially increase of nursery gardens, great concern shall be given to the disease in seedling stage and the growth and decline trends of leaf-eating lepidoptera, and in particular special attention shall be paid to the alien invasive species, e.g. the hazardous pests woolly apple aphid (*Eriosoma lanigerum*) and codling moth (*Cydia pomonella*).

Walnut involved in this project is the planned 5000-mu high-quality walnut base at Ganquan Township. Walnut is mainly distributed in the Longnan area at upper reaches of the Jialing River (the Yangtze River valley of the Southeastern Gansu province), and features large planting area and a long history. According to our knowledge, the frequently occurring pests in the walnut planting regions include the *Atrijuglans hetaohei* that harms the fruits, the defoliators such as the *Culcula panterinaria*, *Cnidocampa flavescens*, *Nola distributa* walker as well as the *Batocera horsfieldi* that bores the limbs. The commonly seen diseases include the leaf disease powdery mildew, the fruit diseases black spot disease and anthracnose as well as the limb disease walnut branch blight. For the pests and diseases commonly seen at walnut, mature prevention and treatment methods have been in place for the fruit grower in the planting regions. However since the project region at Ganquan town is the newly constructed walnut introduction base, close attention and supervision shall be given to these frequently occurring pests and diseases after the implementation of the project.

The grape is the advantageous special products in Dunhuang and Yumen, where the climates of driness, limited rainfall, plenty of sunlight, large day-night temperature gap and high effective accumulated temperature make them the superior production places for high-quality fresh wine grape. At present, the main problems with the grape are the grape powdery mildew and grape gray and occasionally occurring grape downy mildew and grey mould. In fact, the powdery mildew and gray mold are two manageable diseases, but lack of disease prevention awareness of fruit growers makes it the main disease in grape production at present. By trainings provided to peasants in the project, the occurrence of these two diseases will be effectively kept under control. Attention shall be paid in the spread of the above two diseases, and also the possible occurrence of viral diseases in the transportation of nursery-grown plants.

In summary, through the analysis on the possible changes of the agriculture ecological environment in the project regions after the implementation of the project, we clarified the

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focus of our pest management work, and at the same time put forward our work direction and work target.

Table 3 Possible changes of pests and diseases in the project regions after the implementation of the project

Crops		Possibly alleviated or controlled pests and diseases	Pests and diseases that continue to exist and cause losses	Pests and diseases that may occur	Corresponding prevention and treatment measures
wheat		Subterranean pests, aphid (<i>Aphididae</i> spp.), red spider (<i>Tetranychus</i>), midge; full rot disease, loose kernel smut	Stripe rust disease, powdery mildew	Viral diseases	Preventing and treating the viral diseases by killing the transmitting vector aphid (<i>Aphididae</i> spp.)
corn		Corn borer, aphid (<i>Aphididae</i> spp.) ; corn leaf blight(southern leaf blight), head smut, gall smut, viral disease	Subterranean pests, red spider (<i>Tetranychus</i>)	Corn top rot disease, corn twisted heart leaf	Screening new prevention and treatment chemicals; eliminating the diseases leaves, popularizing the prevention and treatment techniques on site
potato		Aphid (<i>Aphididae</i> spp.), leaf beetle (<i>Chrysomelidae</i> spp.) ; viral disease	Late blight, early blight	Ring rot disease, black shank disease, tar spot disease, dry rot disease, potato gangrenosis	Popularizing the de-virus seed potatoes, using small seed potatoes; screening new prevention and treatment chemicals
vegetables	Facilities	Aphid (<i>Aphididae</i> spp.), liriomyza; downy mildew, gray mold, powdery mildew, anthracnose	Greenhouse greenhouse whitefly (<i>Trialeurodes vaporariorum</i>) ; wilt disease, blight ; nematode disease	Alien invasive species, e.g. western flower thrip (<i>Frankliniella occidentalis</i>), bemiesia tabaci; continuous cropping problem, low-temperature damage and other physiological diseases	Strengthening the quarantine measures; realizing crop rotation of different vegetables; strengthening cultivation management; scientifically applying fertilizers and formulating fertilization
	Open field	Cabbage worm (<i>Pieris rapae</i>), cabbage army worm (<i>Mamestra brassicae</i>), tobacco budworm (<i>Helicoverpa assulta</i>), diamond back moth (<i>Plutella xylostella</i>)	Aphid (<i>Aphididae</i> spp.), subterranean pests ; root disease, blight		

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cotton		Aphid (<i>Aphididae</i> spp.), leaf mite (<i>Tetranychidea</i> spp.), cotton bollworm (<i>Heliothis armigera</i>)	Cyanosis, wilt disease,	Cotton miridae	Screening new prevention and treatment chemicals
Chinese medicinal plants		Ma-mouth Disease in <i>Angelica sinensis</i> , brown blotch ; downy mildew in <i>Radix astragali</i> , powdery mildew, rust disease ; <i>Codonopsis pilosula</i> powdery mildew	Subterranean pests, <i>Brachophagus</i> spp. ; root rot disease of <i>Angelica sinensis</i> and <i>Codonopsis pilosula</i>	New pests and diseases brought about in seedling transportation and application of wild species	Realizing seedling quarantine, practicing quarantine cultivation management for the wild species, monitoring possible new emerging pests and diseases
oil plants	Flax	Flax oil leaking insect; flaxwilt disease	Root rot disease		
	Rape	Leaf miner; sclerotinia sclerotiorum, powdery mildew	Subterranean pests, flea beetle (<i>Halticidae</i> spp.)		
fruit trees	Apple	Aphid (<i>Aphididae</i> spp.), red spider (<i>Tetranychus</i>), borer pest, leaf roller (<i>Tortricidae</i> spp.) ; brown blotch, mould core disease, scar skin disease and mould core disease	scale insect (<i>Coccoidea</i> spp.); rot disease	Alien invasive species, e.g. apple woolly aphid, codling moth (<i>Cydia pomonella</i>) and newly emerged pests and diseases in the nursery garden	Strictly practicing quarantine inspection in production place for the introduced seedlings and the graft when being introduced, and practicing quarantine observation and monitoring after being introduced
	Walnut	/	/	<i>Atrijuglans hetaohei</i> , <i>Culcula panterinaria</i> , <i>batocera horsfieldi</i> , fruit anthracnose, black rot disease , branch rot disease	Practicing prevention and control with reference to the successful prevention and treatment measures in the producing place

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	Grape	Powdery mildew, gray mold and grey mould	Downy mildew and anthracnose	viral diseases	Breeding and cultivating virus-free seedlings, strengthening management, preventing virus transmitting and spreading
Forage grass(alfalfa)		Aphid (<i>Aphididae</i> spp.), <i>Thripidae</i> spp., <i>Miridae</i> spp., rust disease and powdery midew	Downy mildew and brown spot	<i>Alfalfa</i> Ascochyta disease	Strengthening seed management, selecting the disease and pest resistant varieties, screening new prevention and treatment chemicals

4. Policies, regulatory framework and organization duties

4.1 Policies on the plant protection and integrated pest treatment in Gansu province of China

As early as in 1950s, China put forward the concept of pest integrated prevention and treatment, and formulated on the national plant protection conference in 1975, the plant protection guidelines of “prevention first and practicing integrated prevention and treatment”. With the experience accumulated and lessons learned in the past several decades, we re-recognized and reevaluated the effect of agricultural chemicals, emphasized on the importance of keeping environment ecological balance, and conclude that chemical prevention and treatment shall be the last option in the integrated pest treatment, and efforts shall be made to use multiple measures in integrated implementation, and make the prevention and treatment of pests and diseases in line with the requirements of “economic, social and ecological” benefits. The state and localities have successively issued and brought into effect a series of laws, regulations, standards, methods, procedures and codes, and by the enforcement of the laws and regulations, the Integrated Pest Management gained further popularization and application.

(1) *Agricultural Product Quality Security Law of the People’s Republic of China* (by the Standing Committee of the National People's Congress in April 2006);

(2) *Pesticide Regulations of the People’s Republic of China* (by the State Council in January 2001);

(3) *Measures for the Implementation of Pesticide Regulation* (revised in the No. 9 decree of 2007 by the Ministry of Agriculture on 8th Dec. 2007);

(4) *Measures on Management of Pollution-free Agricultural Products* (by the Ministry of Agriculture and Administration of Quality Supervision, Inspection and Quarantine in April 2002);

(5) *Standards for Safe Application of Pesticides (GB4285-1989)* (by the State Administration of Environmental Protection in September 1986);

(6) *Standards for Safe Application of Pesticides (GB8321.2-1987)* (by the State Administration of Environmental Protection in September 1986) ;

(7) *Pesticide Application Guideline for Green Food Production (NY/T393-2000)* (by the Ministry of Agriculture in March 2000) ;

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

(9) *Determination of Organophosphorus Pesticide Residues in Foods (GB/T 5009.20-2003)*;

(10) *Guideline for Safety Application of Pesticides (1-8) (GB/TB8321.1□8321.8)* (by the Ministry of Agriculture)□

(11) *Regulations on Plant Quarantine* (by the State Council, issued in revision on 13th May 1992) □

(12) *Implementing Regulations on Plant Quarantine (Agricultural part)* (by the Ministry of Agriculture in May 1995);

(13) *Antitoxic Regulations for Storage-transportation, Marketing and Use of Pesticides* (GB 12475-2006) (by the Ministry of Agriculture);

(14) *Gansu Provincial Agricultural Product Quality Safety Regulations* (by the Standing Committee of the Gansu Provincial People's Congress in November 2008).

4.2 Supervision framework and organization duties

4.2.1 Pesticide supervision and management organization

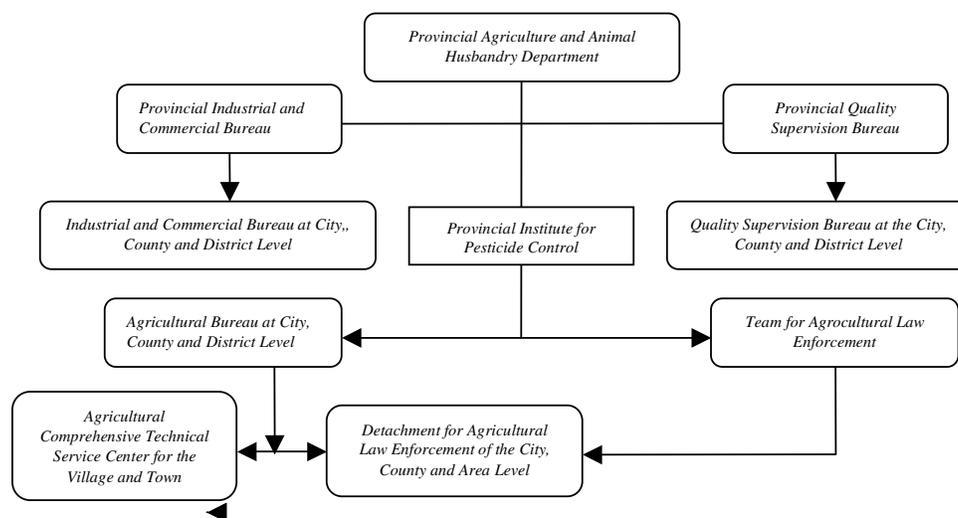


Fig. 4-2-1 Schematic diagram of agricultural supervision and management organizations

Duties of each organization:

Department of Agriculture and Animal Husbandry: Being responsible for the agricultural development planning and related agricultural affairs.

Industrial and Commercial Bureau: being responsible for the management of pesticides in trading.

Quality Supervision Bureau: being responsible for the management of pesticides in production.

Institute for the Control of Agrochemicals: being responsible for the application, use, supervision and management of pesticides as well as the formulation or participating in the formulation of pesticide safe use and the industry standard of the pesticide quality and pesticide residue and related affairs.

Institute of Law Enforcement: being responsible for the market supervision and management of agricultural chemicals.

Township Integrated Agro-tech Service Center: coordinate and assist in related law enforcement and the technical departments in the publicity, training and instruction on pesticide management and comprehensive pest management techniques.

4.2.2 Management organizations for the prevention and treatment of pests and diseases

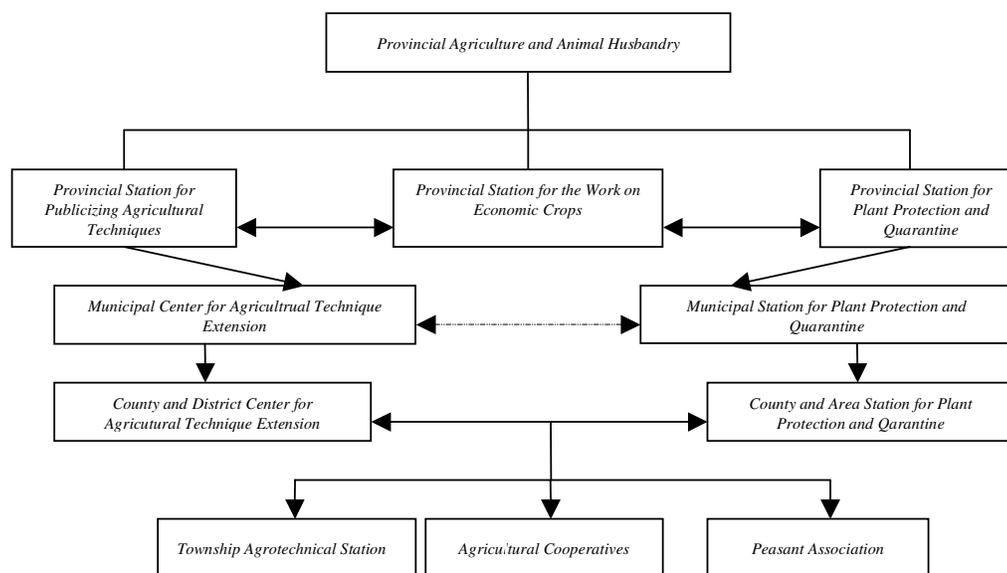


Fig. 4-2-2 Schematic diagram of the management organizations for the prevention and treatment of pests and diseases

Duties of each organization:

Provincial Department of Agriculture and Animal Husbandry: being in charge of the agricultural and animal husbandry work of the province, being responsible for the agricultural competent department at various levels in the province, organizing the prevention and treatment work of the crop pests and diseases.

Provincial Station for Plant Protection and Quarantine: conducting plant quarantine, regularly issuing long-term, mid-term and short-term forecast of crop pests and diseases, carrying on emergency prevention and treatment of major crop pests and diseases and the lasting control, publicity of instruments and the safe use of new pesticides; publicizing the pest management technique to peasants and providing related trainings to them.

Provincial Agro-tech Extension General Station: assisting in conducting related management work with the Department of Agriculture and Animal Husbandry, and being responsible for disseminating techniques.

Provincial Station of Economic Crops: being responsible for planting planning, technique popularizing and management of pests and diseases of the economic crops, e.g. vegetables, fruit trees, Chinese medicinal plants of the province.

City and County (District) Agro-tech Extension Center: being responsible for publicizing agricultural technique in its jurisdiction, being responsible for the organization, planning, coordination, supervision, decision-making and the formulation of work management system of the prevention and treatment of crop pests and diseases.

City and County (District) Plant Protection Station: being responsible for the organization and management, direction and supervision of the prevention and treatment of pests and diseases in its jurisdiction; coordinating, assisting in the technical publicizing, training and direction of the comprehensive management of pests and diseases and pesticide control in local regions with related law enforcement and technical departments.

Township Agricultural Technique Station: being responsible for supervision and forecasts of major pests and diseases in its jurisdiction and directing the prevention and treatment in a timely manner.

Agricultural cooperatives and peasant association: organizing and conducting prevention and treatment of pests and diseases in local regions.

4.2.3 Organization and institutions of pesticide residue detection

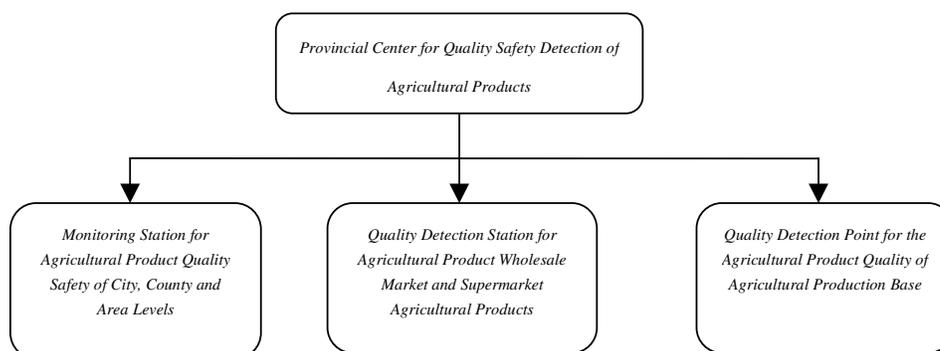


Fig. 4-2-3 Schematic diagram of organization and institutions of pesticide residue detection

Provincial Detection Centers for Agricultural Product Quality Safety: being responsible for the supervision and management of agricultural product quality safety of the province, and directing the supervision work of agricultural product quality safety of all cities, counties (districts).

Monitoring Centers (stations) of Agricultural Product Quality of the City, County and District: being responsible for the supervision and management work of local agricultural product quality safety.

Quality detection station for wholesale market and supermarket agricultural products: being responsible for the quality detection of agricultural product admittance to the market (supermarket).

Agricultural Product Quality Detection Point for Agricultural Product Production Base: being responsible for the quality detection of agricultural product admittance to agricultural product production base.

4.3 Description and evaluation of the management capability of pests and diseases

Gansu is an agricultural province. In order to advance the development pace of pollution-free agricultural products and green food, it has started to vigorously extend the application of integrated prevention and treatment techniques of pests and diseases, so as to gradually reduce the consumption of agricultural chemicals. However, due to limited technical force and insufficient investment of the extension departments at various levels, the popularizing of the non-chemical techniques, e.g. the physical and biological prevention and treatment, are rather sluggish, necessitating further enhancement of propagation trainings and extension application.

4.3.1 Main problems with the management of pests and diseases

(1) Backward prevention concept. The concept of healthy crop cultivation has not been implemented thoroughly in the prevention practice of crop pests, and there lack effective measures of conducting pest management and strengthening crop adversity resistance compliant to the ecological system concept.

(2) Poor supervision of pesticide market. There are too many pesticide dealing entities of small scale. With irregular restock channels, the pesticide market is orderless. The professionalism of the pesticide dealers is relative low. There is occasional occurrence of safety accidents of agricultural product resulted from improper use of pesticides and pesticide residue.

(3) Imperfect capability construction systems. The technical training work on integrated control techniques of crop pests is backward. At present, the peasants mainly rely on the instructions from the pesticide dealers for the prevention of pests, the introduction of advanced supervision and prevention techniques. The measures of the demonstration and extension and the corresponding organized training are still imperfect. It is still insufficient in the recognition on the peril of agricultural pests. The real-time supervision and early warning of agricultural pests are hard to attain in the regions.

4.3.2 Measures that shall be taken in the management of pests and diseases in the project regions

Due to limited technical force of and insufficient investment by agricultural extension department at various levels, sluggish extension of non-chemical prevention and treatment techniques, such as the physical and biological prevention and treatment, the prevention and treatment methods are rather simplex, and the prevention and treatment effects are not as expected. In addition, the non-chemical prevention and treatment only accounts for a small portion in the management of agricultural pests, so there needs further and broader extension training and application publicizing. The following work shall be strengthened in the implementation of the project:

1) Standardizing the pesticide market in the project regions with multiple measures. A mechanism to guarantee the agricultural production and the quality safety of agricultural products from the source, the pesticide business license system is planned to establish in the scope of the project regions. The pesticide entering the project regions will be

managed with archives and dealers' personnel will be regularly trained every year. The overall legal knowledge and professional qualities of the pesticide business persons will be improved. The comprehensive supervision in the whole process of pesticide purchase, sales and storage is strengthened, and the standing book and sales archives are established to supervise the pesticide business units. The real-name registration system for the purchaser will be established to ensure that the pesticide sale information can be queried and that the pesticide flow can be tracked. The joint law enforcement by industry & commerce, tax administration and agricultural administrative authorities will be strengthened to conduct the supervision and random inspection of the pesticide quality and ensure the safety of pesticide market;

2) The treatment level of harmful organism will be improved by providing trainings to the agro-tech extension personnel at the county and village levels;

3) The basic knowledge trainings on the identification, prevention and treatment of the harmful organisms will be carried out according to local practices and the peasants' needs;

4) The practical teaching materials will be compiled, assisted with necessary audio and video equipments;

5) The efforts will be increased to support the comprehensive prevention and treatment research and the demonstration and extension of major agricultural pests and diseases.

4.3.3 Construction on the prevention and treatment system of pests and diseases in the project regions

All cities, counties (districts) where the project towns are located have established the county level Agro-Tech Extension Centers. Some counties have even set up stations for plant protection and quarantine and in charge of the management and implementation of the prevention and management of agricultural pests in local regions. At present, a sound monitoring and early warning system has been established. At the same time, each forecast point has set up the monitoring points of varied numbers so as to provide timely monitoring of the dynamics of pest occurrence as well as the data support for the integrated prevention and treatment, and there are also professional technicians engaged in the integrated prevention and treatment of pests.

4.4 Pesticide management and distribution systems and the use of pesticides

4.4.1 Pesticide management

According to the *Administrative Regulations of the People's Republic of China on Pesticides*, the provincial agricultural administrative competent department shall assist the agricultural administrative competent department of the State Council to manage the pesticide registration in its jurisdiction, and be in charge of the pesticide supervision and management in its administrative areas. The corresponding agricultural administrative competent department of the city, county (district) level in its jurisdiction shall also be responsible the supervision of the pesticide production, sales and safe use in its administrative areas.

4.4.2 Pesticide distribution system

The pesticide production, sales in the project regions shall be managed by the corresponding competent department of local government according to the State and local

regulations, and the use of pesticide is in the form of self-purchasing from the market by the peasants;

The pesticide producer must register its products complying with the “Regulations on pesticide management”, in accordance with the safety, quality control conditions and the environment and pollution control conditions;

All pesticide dealers must obtain the business license to sell the pesticides, and they can only sell the pesticide type with all “three certificates”, and shall not sell the pesticide type explicitly forbidden on the market;

The package of the pesticide product must be labeled or provided with instruction book, with pesticide name marked, also the enterprise name (post code, address, contact number), product factory lot, the “three certificates”(registration number, production permission number and product standard number) of the pesticide as well as the pesticide effective components, contents, weight, formulation, product property, toxicity, application, instruction for users, production date, period of validity, signs for inflammability and toxicity, rescue measures and precautions for poisoning. Before delivery, the pesticide products shall pass the quality inspection and provided with the quality conformance inspection certificate for the product.

4.4.3 Proper use method of the pesticide

The proper use of pesticide shall be based on full understanding and scientific analysis on the pesticide properties, formulation characteristics, the biological properties of the protected subject as well as the environmental conditions. Proper type, formulation, use dosage, proper use method and applying time shall be determined accordingly.

Table 4-4-3 Proper pesticide use method in the project regions

No.	Method	Content
1	Proper selection of dosage	Based on accurate identification of the variety of the pests, the most economical, effective and safe pesticide type in line with the prevention and treatment target will be selected. In other words, the choice shall be rational and suitable to the case. For example, in the prevention and treatment of the pests of piercing and sucking type, e.g. aphid (<i>Aphididae</i> spp.), leaf mite (<i>Tetranychidea</i> spp.), plant hopper (<i>Laodelphax striatellus</i>) and scale insect (<i>Coccoidea</i> spp.), the systemic and contact pesticides are the best choice; for the pests of chewing type, the stomach poison and contact types are most suitable; the smoke agent and fumigant will attain the best effect for the shed or well closed conditions. Even for the same type of pesticide, different dosage can achieve distinctively varied prevention and treatment effects. In general, the missible oil types are the best, wetttable powders come next, and the powders are the last.
2	Proper applying time	In pivotal prevention and treatment period, applying pesticides according to prevention and treatment indexes to keep the harm incurred by pests under control before any economic loss emerges. In general, the prevention and treatment of pests shall be at young larva stage; the principle of “protecting crops first, treating pest next” shall be followed in prevention and treatment of pests.
3	Applying	Under the precondition of ensured prevention and treatment effect,

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	proper amount	and within the effective dosage scope of the pesticide, trying to select the low doage for prevention and treatment so as to achieve the results of not only effectively keeping the pests under control, but also producing no pesticide harm or environment pollution.
4	Proper applying method	Firstly, using different pesticide applying methods according to the formulation of the pesticide. In general, the spraying and sprinkling methods are usually used for the emulsion types and wettable powders; powder injection is always used for powders; spread and furrow application are for granular formulation; the types with strong systemic properties are suitable for powder injection, spraying, sprinkling, stem applying. Secondly, the pesticide applying methods can also be selected according to the diseased part, behavior of pests and pesticide formulation.
5	Applying pesticide alternatively	Some pests can become resistant to pesticides under continuous and repetitive application of the pesticides with the same reaction mechanism, so the prevention and treatment effect may be compromised. Therefore, the alternative use of pesticides can delay or overcome the generation of pesticide resistance and increase the useful life of pesticides. The systemic pesticides can easily generate pesticide resistance, so it shall be applied alternatively with the protective pesticides. For the pesticides, the organophosphorus, pyrethroid, carbamate and organic nitrogen all have different reaction mechanisms, the alternative use of them can achieve good killing effect.
6	Applying mixed pesticide	Several types of crop pests sometimes occur successively all at once in the same reproductive stage. Proper mixing of pesticides can generate the synergistic effects for all the types of pests. But the random mixing of pesticides shall be avoided. In general, the pesticides that tend to decompose under alkaline conditions can not be mixed with alkaline substances. When chemical reactions such as flocculation, precipitation and layering occur after mixing, the mixing shall be avoided.
7	Applying complying with the climate	The pesticides are generally applied in windless or breeze circumstances, and not suitable for windy, cloudy, rainy or to be raining weather. The latter can cause the pesticide blew away by the wind or drained away by the rain, thus reduce the effect. In a certain temperature scope, the pesticide effect will increase with the rise of temperature, so regardless of open planting or facility planting, the applying time shall be at 10 o'clock in the morning or 4 o'clock in the afternoon. Applying under intense sunlight or high temperature tends to cause pesticide harm.
8	Applying safely	According to the national pesticide management regulations, strictly controlling the application scope of high risk pesticide, forbidding the use of high residue level and “mutagenesis, carcinogenesis or teratogenesis” pesticides, earnestly implementing the regulations on the pesticide safe use and crop safety interval so as to avoid environment pollution and people and livestock poisoning.

5. Overall objective and tasks of the pest treatment plant in the project regions

5.1 Overall objectives

- (1) Integrating, demonstrating and publicizing the pest non-pollution prevention and treatment techniques, gradually decreasing the expenditures on agricultural chemicals;
- (2) Prohibiting the use of agricultural chemicals forbidden by the State, increasing the peasants 'scientific level of pesticide applying;
- (3) Increasing peasants' knowledge and applying ability of the Integrated Pest Management as well as their integrated prevention level;
- (4) Gradually standardizing the pesticide production, sales and promoting the safe production and sales of agricultural chemicals.
- (5) Ensuring no severe loss incurred by major crop pests in the project regions.

5.2 Basic principals and major tasks of the pest treatment plan in the project regions

5.2.1 Basic principles

Directed by scientific development perspective, thoroughly implementing the concept of "Communal plant protection" and "Green plant protection", adhering to the work guidelines of "Prevention first, practicing integrated prevention and treatment"; sticking to local management, each department performing its own functions, intensifying the efforts on the specialized prevention and treatment of major pests of the crops and green prevention and control, pushing forward sustainable control of pests and diseases; adhering to prevention and treatment according to the law, standardized management, increasing scientific prevention and treatment level; ensuring agricultural production safety, further increasing the quality safe level of the agricultural products.

5.2.2 Major tasks

- (1) Gansu Province will construct demonstration towns of integrated development rural economy, and at the same time strengthen the capability building of the peasants, peasant group, cooperative partners and related organizations in the project regions, and strengthen IPM concept, and increase the ability of implementing IPM;
- (2) Including the non-pollution management of pests and diseases into the training scope of the project regions, and increasing the peasant's knowledge and operation skills. Establishing institutional contacts among the peasants, IPM instructors and outsourced experts so as to ensure IPM long-term training and the implementation quality;
- (3) Propelled by the project, expanding the production scale of non-pollution agricultural products, green food and organic food and broadening the IPM application scope. At the same time, with the characteristic and advantageous industry as subject, establishing the demonstration of non-pollution prevention and treatment techniques, using unified sustainable agricultural production measures, publicizing the application of IPM technical procedures,

standardizing the pesticide safe application method, realizing the improvement of ecological environment and raising the peasants' living standard.

6. Recommended method of Pest Management Plan in the project regions

6.1 Objective of the recommended methods

The objective of the Pest Management Plan is to demonstrate and publicize the agricultural pest prevention and treatment, and the non-chemical prevention and treatment techniques, such as physical and biological prevention and treatment to the maximum in all project regions, minimize the expenditures on chemical pesticides, alleviate the environmental pollution, promote the quality of the characteristic and advantageous agricultural products, and boost the harmony between human and nature.

6.2 Main methods recommended in the Pest Management Plan

6.2.1 Agricultural prevention and treatment method

(1) Selecting fine pest-tolerant and resistant varieties; publicizing formulated fertilization techniques and rational irrigation, increasing use of organic fertilizer, practicing healthy cultivation techniques and increasing the pest tolerance of the crops.

(2) Conducting the rotation and succession of crops, field and orchid cleaning and conduct autumn sowing and winter irrigation so as to prevent the propagation of soil-borne diseases, control the habitat of pests and reduce the population base number of the pests living through winters and summers.

(3) Trimming fruit trees in appropriate ways to eliminate excessive buds and sprouts, and improving the ventilation among trees and light penetration through the crown by cutting off lower leaves;

(4) Timely cleaning up weeds in the growth period, creating the environmental conditions to the disadvantage of the breeding of pests and diseases.

6.2.2 Physical prevention and treatment method

The physical prevention and treatment method is to use the taxis of pests to light, color, odor and the special response to physical factors such as heat, radiation, high-frequency current, ultrasound, etc in the prevention and treatment of pests. It mainly includes the following measures:

(1) Using the photoaxis of pests to kill them. Using the lamp of frequency vibration and black light lamp to kill the agrotis ypsilon, cabbage army worm (*Mamestra brassicae*), cotton bollworm (*Heliothis armigera*), diamond back moth (*Plutella xylostella*), corn borer, cotton bollworm (*Heliothis armigera*), etc;

(2) Using the color taxis of pests to kill pests. Using yellow trap plate to kill the aphid (*Aphididae* spp.), white fly, liriomyza; using blue trap blue to kill the *Bemisia tabaci*, *Thripidae* spp. and leafhopper, etc.

(3) Using the taxis of pests and the sweet lure to kill the codling moth (*Cydia pomonella*), cabbage army worm (*Mamestra brassicae*), etc.

(4) Using the heat energy, such as hot water treatment of seeds to kill the pathogenic bacteria in the seed; using high-temperature close shed to control the downy mildew, gray mold and leaf mold, etc.

(5) Cutting off and burning the diseased branches and leaves, erasing the pest eggs and the under part old leaves from the plants.

6.2.3 Biological prevention and treatment method

The biological prevention and treatment method is to use beneficial insects and bacteria to prohibit the pests, for example to use the parasites, predators and pathogenic microorganisms in prevention and treatment of pests. It mainly includes:

(1) Natural enemy. It is a method of pest control with predator insects, for example to use predator enemy ladybug (*Coccinellidae*, spp.), lacewing (*Chrysopidae*, spp.), syrphids (*Syrphidae*, spp.) and assassin bug (*Reduviidae*, spp.), etc in control of the aphid (*Aphididae* spp.), leaf mite (*Tetranychidea* spp.), white fly, *Thripidae* spp.; to use *Typhlodromus occidentalis* and *phytoseiidea*, spp. in control of the *Eotetranychus pruni* and *Panonychus citri*; to use parasite natural enemy, e.g. trichogramma, *Encarsia formosa*, *Aphidiidae* spp. and *Apanteles glomeratus* in control of cotton bollworm (*Heliothis armigera*) and diamond back moth (*Plutella xylostella*).

(2) Biological agents and products. At present the mostly used bacterial products include *Bacillus thuringiensis* (Bt); fungi products, e.g. *Beauveria bassiana*, *Trichoderma* spp. and entomophthoralean fungi (*Erynia montana*), etc; viral products, e.g. N14, NPV; antibiotics, e.g. streptomycin, neomycin, agricultural antibiotic 120, validamycin and avermectins, etc. The sex pheromone bait is composed of set attractant and botanic pesticides, e.g. 10 μ g lvd (*ginkgetin*), 2.5 μ g *Flos daturae* alkaloid aqueous solution, 0.2 μ g Matrine aqueous solution, 0.5 μ g vertrine alcoholic solution, 0.5 μ g toosedarin emulsion and 2.5 μ g rotenone emulsion, etc.

(3) Create the environment suitable for the natural enemy, increase the number of natural enemy.

6.2.4 Chemical prevention and treatment method

Chemical prevention and treatment method is to use chemical pesticides in prevention and treatment of diseases, pests and weeds and other harmful organisms. The chemical pesticide has the advantage of being easy to use, wide range of pests in prevention and treatment, being rapid and effective in the prevention and treatment effect, being able to rapidly control the spread of pests, especially for the outburst pests, so it can be used as an emergency measure to attain effect instantly. However, simply using large amount of chemical pesticide will not only kill the natural enemy of pests, but also damage the field ecosystem, which will lead to the outburst of secondary pests, bring environment pollution and generate a series of side effects of poisoning and pesticide harm to human and livestock. In addition, using one type of pesticide in long-term will generate the pesticide resistance of the target pest. Therefore, how

to control the use of pesticides in chemical prevention and treatment so as to reduce its impact on environment pollution and human health is a key point in this project.

The following principles shall be adopted in the chemical prevention and treatment in the project regions:

1) By demonstration, the peasants in the project regions are convinced that to rationally use agricultural, physical and biological prevention and treatment, assisted with necessary chemical prevention and treatment can also achieve ideal pest prevention and treatment effect;

2) When the pest prevention and treatment index is reached, timely using efficient, low toxic pesticide to bring into play its best effect and keep the pests and diseases in an economically allowable scope;

3) When a major pest disaster occurs, a plant protection professional team for prevention and treatment is formed and dispatched to undertake joint prevention and treatment;

4) Non-pollution techniques of prevention and treatment shall be disseminated and used:

(1) Efficient, low toxic and low residual pesticide shall be used. See List 7.1 and Appendix 1 for the list of non-pollution pesticide recommended in this project;

(2) For the pest source area and the occurrence center with large pest population, low dosage pesticide with high efficiency shall be used in the young larva stage of pests to ensure each use of pesticide can attain the optimum effect, and the pesticide with killing effect to the natural enemy of pests is strictly prohibited at the late stage of the rampancy of pests;

(3) The pesticide applying interval shall be observed;

(4) Continuous use of one single pesticide for long-term is prohibited. The pesticides shall be used alternatively with different types;

(5) The safe pesticide applying instruments and methods shall be used to increase the pest usage efficiency and the pest prevention and treatment effect;

(6) The dissemination, education and training on safe and proper use of pesticide shall be strengthened, the pesticide use prescriptions shall be followed, cautions shall be take to keep safe, including properly wearing protective clothes, mastering the general knowledge on emergency treatment of pesticide poisoning, etc;

(7) Safe storage shall be ensured for the agricultural chemicals (e.g. away form children access and food, etc).

(8) Properly handle discarded pesticide bottles and packing, do not clean pesticide applying instruments in natural waters.

6.3 Integrated Pest Management strategy of staple crops in the project regions

With the improvement of the basic conditions, e.g. agricultural infrastructure, and farmland consolidation and with the evolvement of pests and diseases, we shall make adjustment to previous methods and strategies in the prevention and treatment of pests and

diseases to adapt them to environment and enable more sustainable rural social and economic development.

6.3.1 Wheat integrated management strategy

With the wheat stripe rust disease, powdery mildew, full rot disease, aphid (*Aphididae* spp.) as control targets, the pest resistant and tolerant varieties are introduced and used. In sowing, the triazole type pesticides are selected (e.g. tebuconazole, hexaconazole, triticonazole and carboxin etc) for seeds dressing to effectively reduce the harm incurred by wheat stripe rust disease, powdery mildew, loose kernel smut and full rot disease. In wheat growing period, the neonicotinoid type pesticides, e.g. acetamiprid, imidacloprid, nitenpyr, thiamethoxam, Bt, buprofezin, chlorpyrifos methyl and other efficient and low toxic pesticides are selected in prevention and treatment of wheat aphid and armyworm, which approach can not only reduce and control the direct harm to the wheat incurred by aphid (*Aphididae* spp.), but also effectively prevent the occurrence of the wheat viral diseases spread by aphid (*Aphididae* spp.). The high toxic organophosphorus pesticides are prohibited to protect and make use of the natural enemies. The balanced fertilizing and healthy cultivation techniques are used to reduce the occurrence and epidemic of pests and diseases.

6.3.2 Corn integrated management strategy

With the maize ear rot, gall smut, stem rot diseases, subterranean pests, tetranychus urticae as main control targets, the healthy cultivation techniques are taken for the prevention and treatment of pests, namely using pest disease resistant (tolerant) fine varieties, using seeds dressing method, crop rotation and succession, adding potash fertilizers, etc. As for heading stage pests, the natural control effect of natural enemies shall be brought into full play in the strategy making of prevention and treatment, meanwhile the Bt type and avermectins type bio-chemicals are used for the integrated treatment of various pests.

As for the corn top rot disease and the phenomenon of interior leaf twist that have already occurred in some corn planting area, we have screened out the chemicals that can effectively prevent and treat them - the agricultural streptomycin and Junduqing, meanwhile the agricultural prevention and treatment measures are taken, e.g. cutting open the connected leaf blades and interior leaves with a knife and leaving them to dry in dry environment so as to prohibit further spread of the diseases and ensure normal tasseling and pollination. The problems at present are that because the two diseases have seldom occurred in the past, the peasants and the agricultural technicians at the basic level have no clear knowledge of the two diseases. Therefore we need to hold on-site meetings and training classes to strengthen the knowledge and recognition of the two corn diseases to enable mastering of the prevention and treatment measures and prevent them from occurring.

6.3.3 Potato integrated management strategy

Potato late blight, early blight, viral disease and aphidas are taken as control targets while cautions shall be paid to possibly new emergence of ring rot disease, black shank disease and gangrenosis, etc. De-virus potato is popularized in particular to reduce the harm incurred by viral diseases. Making reference to the forecast and prediction of major occurring pests and diseases, the efficient and low-toxic pesticides are selected (cymoxanil-mancozeb, metalaxyl-

mancozeb, oxadixyl-mancozeb, enoyl-mancozeb, etc) for joint prevention and treatment of potato early and late blight by applying them strictly following prescriptions for several times alternatively to reduce and delay the generation of the pesticide resistance by the diseases. Close attention and supervision shall be given to the possibly new emerging potato pests and diseases and the in-door chemical screening work shall be conducted in advance so that effective measures and approaches can be taken once these diseases occur.

6.3.4 Strategy on pest treatment for vegetables

The vegetables are high value-added crops, and they are more closely connected with domestic and international markets. The fact that the vegetables have varied cultivation modes (e.g. sheltered field cultivation and open field cultivation), the occurrence of pests and diseases takes more complicated forms. So, the pest management of vegetables shall be conducted from the perspective of the whole ecosystem, comprehensively applying various prevention and treatment methods, e.g. agricultural, ecological, physical and chemical method. In this way we can create the environmental conditions adverse to the occurrence of pests and diseases and beneficial to proliferation of natural enemies, while maintaining the balance of agricultural ecosystem and biodiversity, reduce the loss incurred by various pests and diseases.

1) Using pest resistant (tolerant) varieties. The vegetable grower shall purchase vegetable seeds from the specialized dealers, using the fine and high-yield varieties that are adaptable to local cultivation and are pest resistant.

2) Crop rotation and succession. The methods such as rational rotation of crops, intercropping, relay intercropping and variety alteration, covering field with borrowed soil and shed building at different places are used to reduce accumulation of pathogenic bacteria and pest source so as to prevent and control the problems incurred by continuous cropping for several years. In crop rotation, the crops of the same family and genus are avoided. The pest endangering peak period shall be avoided by adjusting vegetable sowing period and transplantation period, so as to reduce the harm incurred by pests and diseases. The viral diseases of tomato and Chinese cabbage can be alleviated by evading high temperature in seedling stage.

3) Vigorous seedling cultivation. The seedlings are cultivated in other places, and the nutrition pot, plug seedling and the root-protecting raising covered by nutrient soil are used; the seedling period management is strengthened to raise the pest resistant ability of seedlings, and the weak and diseased seedlings are weeded out in transplantation to ensure strong transplanted seedlings.

4) Healthy cultivation management, cultivating vigorous seedlings. Various integrated measures are taken to strengthen the temperature, light, water, fertilizer and air management, so as to create good growth environment for the vegetables. For example the scientific formulated fertilizers are used, the organic fertilizers are increased, and the microelement fertilizer are complemented, so as to timely meet the growth needs of vegetables; the special environment of sheltered field is used to realize the ventilation and close cultivation measures to regulate the temperature and humidity; plastic film mulching and increased ventilation are used to increase soil humidity and decrease atmospheric humidity; the light regulation is

conducted by uncovering the shed according to different growth period of crops, so as to prevent and reduce the occurrence of various physiological diseases and increase their capability to resist low temperature and cold damage.

5) Implementing disease control by grafting. The seedling cultivation by grafting can effectively prevent soil-borne diseases and pests, increase the growth vigor of plants, boost their endurance to cold and dry conditions. For example, grafting cucumber with pumpkin as root stock can effectively prevent the occurrence of melon wilt diseases.

6) Applying physical prevention and treatment measures. (a) Setting insect proof net. Setting insect proof net in protective field can prevent fly insects from entering the shed, which can effectively control the harm brought by the aphid (*Aphididae* spp.), flea beetle (*Halticidae* spp.), Cabbage worm (*Pieris rapae*), diamond back moth (*Plutella xylostella*), *Spodoptera exigua*, *Liriomyza sativae* and *Spodoptera litura*, etc, thus effectively reduce the use of agricultural chemicals; (b) Seed treatment. Soaking seed with warm water and chemicals as well as seed dressing can kill most pathogenic bacteria and pest eggs; (c) Soil disinfection. Before planting vegetables in protected field, the soil is exposed under strong sunlight to kill part of pathogenic bacteria and pests in soil; before sowing and transplantation, the soil is treated by methods of spraying, irrigation, applying pesticide-clay mixture and fumigation, etc, which can effectively control the soil-borne diseases and subterranean pests; (d) Applying the light, color and odor taxis of pests. The light lamp and frequency trembler lamp are hung in the field or shed to lure or kill lepidoptera; the blue (yellow) trap plates are set to lure the white fly, *liriomyza*, aphid (*Aphididae* spp.) and *Thripidae* spp., etc.

7) The priority shall be given to biological agents in the application of various pesticides, for example the Bt, botanical pesticides, toosendanin, osthole and avermectins can be used in the prevention and treatment of the lepidoptera pests, e.g. diamond back moth (*Plutella xylostella*), Cabbage worm (*Pieris rapae*), tobacco budworm (*Helicoverpa assulta*) and cotton bollworm (*Heliothis armigera*), etc.

8) The quarantine measures shall be strengthened for the vegetable seeds and seedlings in the project regions, so as to prevent the invasive organisms such as *frankliniella occidentalis* and *bemisia tabaci*, etc in the introduction and transport of seeds and seedlings.

6.3.5 Pest treatment strategy of fruit trees

In the fruit tree integrated prevention, the first emphasis shall be on the plant quarantine, and the quarantine inspection shall be conducted for the introduced nursery-grown plants. For the existing orchards, the following measure shall be taken:

1) Strengthening the position of agricultural measures. (a) Strengthening fertilizer and water management, increasing the pest resistant ability of fruit trees. In particular increasing applying organic fertilizers and phosphatic fertilizers can markedly decrease the occurrence of the rot disease, ring spot, *alternaria mali* and powdery mildew, etc and worsen the nutrient conditions of sucking pests, e.g. leaf mite (*Tetranychidea* spp.), aphid (*Aphididae* spp.) and scale pests, etc. (b) Meticulously pruning, flower thinning, fruit thinning, reasonable burdening and strengthening tree vigor. (c) Practicing fruit bagging. Increasing fruit quality,

preventing the harm of various pests, e.g. the ring spot, borer pest and leaf folder, etc. (d) Cleaning the orchid. Eliminating the diseased and pest branches by pruning, burning or deeply burying the branches in a concentrated manner, so as to reduce the pest base number. (e) Eliminating the alternative hosts of apple trees (e.g. juniper) 5km away from the apple orchid, or cutting off the mycoecidium on the branches of juniper for concentrated burning to reduce or alleviate the harm of apple rust disease.

2) Actively taking biological prevention and treatment techniques. (a) Protecting and using natural enemies. There are abundant natural enemy resource in apple orchids, in particular the population of the lacewing (*Chrysopidae*, spp.), ladybug (*Coccinellidae*, spp.), predatory bugs and predatory mites are large and numerous, having noticeable pest control effect, so they shall be actively protected and used. There are three measures in this regard: one is to reduce the use of agricultural chemicals with broad spectrums, extend the use of biological agent, e.g. the *Bacillus thuringiensis*, etc in prevention and treatment of lepidopter pests, e.g. *Lithocolletis ringoniella* and *Carposina niponensis*, etc, the use of avermectins in prevention and treatment of apple leaf mite; the second is to advocate planting leguminous forage and green manure in orchid to provide good proliferation place for natural enemies, and bring into play their pest control effect. The third is to release natural enemies by manpower to increase the number of natural enemies in orchids. For example, releasing *Trichogramma* (trichogrammatid) in prevention and treatment of *Adoxophyes orana* and *Grapholitha molesta*, releasing predatory mites in prevention and treatment of fruit tree harmful mites. (b) Applying sex pheromones in killing pest. For example, applying sex pheromones in luring and killing peach, apple and pear *Adoxophyes oranas* and *lithocolletis ringoniella*.

3) Properly using agricultural chemicals. (a) Applying pesticides according to economical threshold. On the basis of accurate pest monitoring, conducting prevention and treatment according to economical threshold, avoiding applying pesticides blindly, and reducing the amount and times of pesticide applying. (b) Scientifically using agricultural chemicals. One is to rationally selecting pesticide by trying to select the variety exerting no harm to human, livestock and natural enemy and no pollution to environment and highly effective on target pests. The pesticide varieties commonly used in orchid include growth regulators, e.g. diflubenzuron and flufenoxuron, etc; bio-chemicals, e.g. insecticidal bacteria, *Bacillus thuringiensis*, polyoxin and avermectins; selective miticides, e.g. clofentezine and hexythiazox, etc; selective aphicides and scalecides, e.g. imidacloprid, buprofezin, etc. The second is to properly use agricultural chemicals. Before the burgeoning of fruit trees in spring and before the hibernant of insects, spraying pesticides of broad spectrum to kill the overwintering aphid (*Aphididae* spp.) eggs, harmful mite eggs and adults in the trees; spraying high concentration root-out bactericides to kill the overwintering rot disease, ring spot and *alternaria mali*. In the growth period, placing emphasis on selecting pesticides and miticides, e.g. the diflubenzuron in prevention and treatment of the leaf moth, the imidacloprid and buprofezin for the aphid (*Aphididae* spp.), the avermectins and propargite for the leaf mine, etc. In addition, cautions shall be paid in the improvement of pesticide applying method according to the behavior of pests, e.g. ground applying and stem applying, etc, decrease the harm to non-target organisms; alternatively using pesticides, rationally mixing pesticides for the purpose of delaying generation of pesticide resistance of the pests.

For the 5000-mu high-quality walnut base and the 150-mu seedling breeding base to be built in the Ganquan project region, since walnut is the newly introduced variety in this project region, close attention and monitoring shall be given to the occurrence of main pests and diseases in the walnut planting area. According to investigation, the main pests in the walnut planting regions include *atrijuglans hetaohei*, *culcula panterinaria* and *batocera horsfieldi*; the main diseases include anthracnose, black spot disease and branch blight, etc. Because there are successful prevention and treatment methods for these diseases in the walnut planting regions, we shall in the introduction of walnut, learn and know about the identification and the prevention and treatment measures of these main pests and diseases, borrow the successful prevention and treatment measures of the original planting regions to carry out effective prevention and control.

6.3.6 Pest treatment strategy of cotton and oil plants

Cotton is an strategic product concerning the national economy and people's livelihood. Its high and stable yield exerts direct influence to the development of national economy. Therefore the research on the occurrence patterns of cotton pests and diseases and related prevention and treatment techniques has always been the important subject of China's agricultural scientific research, and fruitful results have been achieved on the forecast and prediction of major pests and diseases, prevention and treatment indexes and strategies, chemical prevention and treatment and pesticide resistant treatment, biological prevention and treatment techniques, variety breeding and application, establishment of Integrated Pest Management (IPM) technical systems, etc. This project by borrowing existing research results, with the cotton aphid (*Tetranychus cinnabarinus*) (*Aphis gossypii*), cotton leaf mite, wilt disease and cyanosis as main control targets and the possibly new occurrence of cotton miridae as focus, will coordinate several prevention and treatment measures for non-pollution treatment. The use of new pesticides, e.g. biological pesticides, plant pesticides and sex pheromones will be the priority in pesticide selection.

The flax wilt disease is mainly dealt with by popularizing the use of disease resistant variety. The flea beetle (*Halticidae* spp.) and subterranean pests on rape seedlings in the spring rape regions are mainly prevented and treated by seed dressing and furrow application of pesticide-clay mixture with biological pesticides. Due to the shortage of prevention and treatment techniques of rape and flax in the project regions, we will emphasize the technique introduction and demonstration of flax wilt disease, rape flea beetle and subterranean pests.

6.3.7 Pest treatment strategy of Chinese medicinal plants

Chinese medicinal plants are the characteristic crops in the project regions. Their treatment strategy has always been the integrated prevention and treatment measures of "Prevention first, practicing integration of prevention and treatment". It includes:

1)1) Agricultural measures:

- (a) Rational application of crop rotation and succession, intercropping;
- (b) deep ploughing and intensive cultivation, orchid cleaning;
- (c) rational application of fertilizers and water, healthy cultivation.

2)2) Physical and mechanical prevention and treatment measures:

- (a) Man-power killing□
- (b) Light trapping and killing□
- (c) Warm water seed soaking.

3)3)Chemical prevention and treatment:

- (a) Rational, scientific and less pesticide applying,
- (b) Using efficient and low toxic, less residue pesticide, learning the key pesticide applying period according to the pest forecast;
- (c) Protecting the natural enemies.

For the possible occurrence of pests and diseases incurred by seedling transport and wild species utilization, we plan to take strict seedling quarantine systems. Quarantine cultivation management will be conducted for the wild Chinese medicinal plants to be developed and used, so as to observe possible emergence of new pests and diseases and carry out active prevention work.

6.3.8 Strategy for the treatment on the pests and diseases of pasture grass

The pasture grass in this project is mainly the cultivated alfalfa. According to the existing research results, the strategy for the treatment of its pests and disease is as follows.

1) Selecting pest and disease resistant (tolerant) varieties. At present, in domestic researches on the pest and disease resistant varieties of alfalfa, there have successfully bred and selected the varieties that resist alfalfa weevil, therioaphis trifolii and megachile rotundata and we will introduce and plant them experimentally after the implementation of the project.

2) Advocating ecological prevention and treatment. Scientifically applying fertilizer, proportionately and quantificationally applying phosphorus and potash fertilizers, so as to increase the pest and disease resistance of alfalfa; practicing rational close plating to increase ventilation and light transmission and avoid lodging; carrying out farmland management, e.g. cleaning the farmland in time after each cropping for the base reduction of pests and diseases.

3) Protecting and making use of natural enemies. As a leguminous pasture grass, alfalfa has large populations of varied insects in its ecological environment, also various kinds of predatory and parasite natural enemies of large quantities, which can effectively control the alfalfa weevil, therioaphis trifolii and megachile rotundata. Therefore before applying pesticides, cautions shall be taken to select the low toxic and residue pesticides that are most effective in killing pests and safest to natural enemies, so as to protect and make use of natural enemies to the largest extent.

4) According to research, cropping before the thriving of pests and diseases of alfalfa can effectively reduce the occurrence of the pests and diseases. Practice has proved that after alfalfa cropping the disease and pest base of the alfalfa is significantly decreased, and the amount of natural enemy rapidly recovered. We will popularize and apply this research result after the implementation of the project.

5) Necessary chemical prevention and treatment shall be carried out by using low toxic and effective pesticides and bactericides such as imidacloprid, buprofezin , abamectin,

tebuconazole、carbendazim、chlorothalonil and thiophanate methyl, etc according to pest and disease monitoring.

7. Application and management of pesticide in the project regions

7.1 Pesticide varieties and applying instruments recommended in the project regions

7.1.1 Pesticide types recommended

In the process of project implementation, the use of pesticides and agricultural measures, physical measures and biological measures shall be integrated to make the use complying with the economical, safe and effective principles. According to related laws and regulations of China, the IPM methods and the principles of integrated treatment, the list on the pesticides recommended in the project is as follows:

- Pesticides and miticides

(1) Biological agents and natural substance: *Bacillus thuringiensis*, *Spodoptera exigua* nuclear polyhedrosis virus (NPV), *Plusia agnate* nuclear polyhedrosis virus (NPV), *Plutella xylostella* granulosis virus (GV), *Ectropis obliqua* polyhedrosis virus (NPV), *Heliothis armigera* nuclear polyhedrosis virus (NPV), matrine, azadirachtin, nicotine, rotenone, celangulin, avermectins, spinosad, liuyangmycin, beauveria bassiana, pyrethrin and sulphur suspensions.

(2) Synthesized agents: buprofezin, chinomethionat, chlorpyrifos methyl, clofentezine, cyromazine, fenbutatin oxide, fluvalinate, green tebufenozide, tebufenozide, malathion, propargite, bioresmethrin, tetrachlorvinphos, temephos, pleocidin, spinetoram, hexythiazox, teflubenzuron, tetradifon, imidacloprid, thiamethoxam, thiacloprid, acetamiprid.

- Bactericides

(1) Inorganic bactericides: basic copper sulfate, copper oxychloride, copper hydroxide, cuprous oxide and lime sulfur mixture.

(2) Synthesized bactericides: carbendazim □ benalaxyl □ methirimol □ iprodione □ probenazole □ triticonazole □ benomyl □ bitertanol □ captan □ carbendazim □ chlorothalonil □ euparen □ diethofencarb □ dimethomorph □ fenpiclonil □ fludioxonil □ propineb □ mancozeb □ mepanipyrim □ propamocarb □ quintozone □ mildothane □ tolelofosmethyl □ vinclozolin

(3) Biological agents: validamycin, agricultural antibiotic 120, fungus polysaccharide, kasugamycin, polyoxin, ningnanmycin, *Trichoderma* spp. and streptomycin.

Base on the crop planting conditions in the project regions, we after screening, will recommend the information in the form of table for the reference of the peasants, on the trade name, formulation, content, prevention target, dosage, applying method, maximum times applied for crop and safe interval of various pesticide types (See Appendix 1).

7.1.2 Pesticide types prohibited in China

As given in the attached list, 23 pesticides are prohibited from production, sales and use in the *Notice on Cracking Down Illegal Production, Sales of Restricted Highly Toxic Pesticides and Standardizing Pesticide Use* (Nongnong Fa □2010□No. 2) jointly issued on 15th April 2010 by the Ministry of Agriculture, the Supreme People's Court, the Supreme People's Procuratorate, the Ministry of Industry and Information Technology, the Ministry of Public Security, the Ministry of Supervision, the Ministry of Transport, the State Administration for Industry and Commerce, the General Administration of Quality Supervision, the Inspection and Quarantine of the PRC, All-China Federation of Supply and Marketing Cooperatives.

- List of the pesticide prohibited in production, sales and use (23 types)

Benzene hexachloride (BHC), dichlorodiphenyl trichloroethane (DDT), toxaphene, dibromochloropropane, chlordimeform, dibromoethane, nitrofen, aldrin, dieldrin, mercury compounds, arsenic compounds, lead compounds, Bis-A-TDA, fluoroacetamide, gliflor, tetramine, sodium fluoroacetate, silatrane, methamidophos, parathion-methyl, parathion, monocrotophos, phosphamidon.

- List of pesticides prohibited in vegetables, fruit trees, tea trees and Chinese medicinal plants, etc (19 types)

Phorate, isofenphos-methyl, terbufos, posfolan-methyl, sulfotep, demeton, carbofuran, aldicarb, ethoprophos, phosfolan, coumaphos, fonofos, isazofos and fenamiphos are prohibited for use on vegetables, fruit trees, tea trees and Chinese medicinal plants. Omethoate is prohibited for use on cabbages. Dicofol and fenvalerate are prohibited for use on tea trees. Daminozide (alar-85) is prohibited for use on peanut plant. Terbufos is prohibited for use on sugarcane. Fipronil is prohibited for use on purposes other than cleaning and coatings of corn and part of dry farmland seeds.

All pesticide products can only be used in the scope approved in the pesticide registration, and the use out of the scope is prohibited.

7.2 Technical requirements for the pesticide-applying instruments used in the project regions

Pesticide is an indispensable means of agricultural production, and there must be good pesticide-applying instruments to enable scientific, rational and safe pesticide applying. Generally, the following aspects shall be taken into consideration in the selection of pesticide applying instruments or for the technical requirements.

1) The types of the pesticide-applying instruments are determined by comprehensively considering the prevention and treatment targets and sites, crop varieties and growth status, pesticide formulations, applying methods and prevention and treatment scale. For fruit trees, it shall also consider the fruit tree size, height, tree-to-tree inter-space as well as the adaptation of the instrument to be operated in the field and the tree-to-tree pass-through.

- ◆ Hand sprayer shall be used for pesticide spraying in a small area □
- ◆ Backpack motorized sprayer shall be used for pesticide spraying in large area, and the air-assisted mist sprayer shall be used in orchards;
- ◆ Lever sprayer shall be used in pesticide spraying in large area.

2) Proper spray-head shall be selected according to the prevention and treatment requirements of pests, diseases, weeds and other harmful organisms and the type of the pesticide applying instruments, the worn spray-head shall be replaced regularly.

◆ The fan-shaped sprayer shall be used in spraying herbicides and plant growth regulators, which is characterized by the fan-shaped plane of the mist sprayed, large mist drop of less drifting;

◆ The hollow conic spray-head shall be used in spraying pesticides and bactericides, which is characterized by thin mist drop that drifts easily and contacts the leaf blades from different directions;

◆ Different types of spray-heads shall not be used on the same spray lever.

3) The pesticide-applying instruments that are manufactured by formal producers and have quality certificates shall be used. In purchasing, the completeness of the packing conditions and the completeness of the random technical documents and accessories and fittings shall be checked according to the packing list.

4) The pesticide-applying instruments shall not be applied to multiple uses. Generally, the sprayer used for spraying pesticides or bactericides shall be cleaned first before being applied for spraying other pesticides or bactericides; the sprayer used for spraying herbicides generally shall not be used in applying other kinds of agricultural pesticides.

7.3 Ability of users to use and dispose pesticides

According to the evaluation on measures currently used in the project regions, it indicates that at present the pesticide dealers and peasants varied in the pesticide product treatment ability in the acceptable risk scope (e.g. safe storage, using safe instruments, possessing protective clothes, safe treatment of discarded pesticides and their packages). The trainings plan is recommended for the peasants and chemical dealers to resolve this problem. Nevertheless, the local supervision and evaluation plan will regularly supervise the chemical safe use and treatment ability of the peasants and chemical dealers. Further trainings will be provided in the regions of unsafe chemical operation measures.

7.4 Environmental, professional/health risks

7.4.1 Environmental risks

1) Main environmental risks in the use of pesticide in the project regions:

(1) The pesticide residue causes the deterioration of water quality, the potential risks reduce the number of aquatic organisms (e.g. fishes and aquatic insects);

(2) spraying pesticide and chemical spilling around drinking water source cause the pollution of water supply;

(3) the use of highly toxic pesticides impacts the non-target species (especially bees, birds, livestock and natural enemy of pests);

(4) long-term over-amount use of certain pesticide causes the pesticide resistance of pests, diseases and rats;

(5) soil pesticide residue causes pollution of soil;

2) Measures reducing the above risks include:

(1) providing trainings to the peasants and chemical retailers concerning the possible impact of specific pesticides on environment, recommending better spraying instruments and methods;

(2) Cooperating with the area town government and agricultural technical department, standardizing , supervising and monitoring the spraying operation to ensure the clean of water source;

(3) Recommending the safe spraying instruments with national certification in the project regions;

(4) Using efficient, low toxic and low residue pesticides;

(5) Publicizing and applying biological prevention and treatment measures, reducing the usage amount of chemical pesticides as far as possible

(6) Using a series of non-pollution prevention and treatment measures (agricultural, physical, biological and low toxic pesticides) to ensure the pest resistance not to increase.

7.4.2 Professional/health risks

1) The professional/health risks generated in pesticide application mainly include:

(1) The gas emitted in pesticide formulation and spraying with no protective measures causes harm to human body;

(2) When not wearing protective clothes, the pesticides sprayed and spilled cause skin burn injury;

(3) The location for pesticide spraying is close to the drinking water source, causing pollution to drinking water, or there occurred chemical spilling near the drinking water source.

2) Measures reducing the above risks include:

(1) Provide trainings on the knowledge of pesticide safe use, delivery, storage and waste handling to the peasants and pesticide dealers. The main training contents include: the professional/health impact possibly incurred by certain pesticides; recommended operation and spray methods; approved spray instruments and use method; wearing safe clothes (long sleeve clothes, muffles, caps, gloves, length pants and shoes); what weathers to spray pesticides; how to safely store agricultural chemicals; how to safely dispose pesticide wastes and packages, etc.

(2) Supervise and investigate into the implementation of above measures; when the measures are poorly implemented, publicizing and trainings shall be strengthened;

8. Strengthening of the pest management ability in the project regions

8.1 Policy related matters

8.1.1 Objective of policy-making and issuance of government documents

1) State level: Adjusting the list of pesticides prohibited in China according to international standards; formulating related laws and regulations to strictly restrict the production and sales of highly toxic pesticides; supporting and promoting IMP extension by project implementation.

2) Local government level(project implementation area): Making the list of prohibited pesticides, and strengthening supervision, law enforcement and management; assisting peasants in registration of safe food, non-pollution food, green food, enable their access to the market with relatively high market price.

3) Peasant level (project implementation area): Implementing the standard of IPM technique and non-pollution production technique of the advantageous and characteristic industry in the project practicing area; helping the peasants mastering IPM technique by training and demonstration, raising their environment protection and non-pollution awareness.

8.1.2 Strictly abiding by the following regulations

- 1) FAO code of conduct on the distribution and use of pesticides;
- 2) FAO code of conduct on the packaging and storage of pesticides;
- 3) FAO code of conduct on the norms of outer packing of pesticides;
- 4) FAO code of conduct on the disposal of site residue pesticides, pesticide packing containers;
- 5) Standard on the discharge of pesticide pollutant formulated by the State Environmental Protection Administration of China (SEPA);
- 6) Regulations on pesticide control issued by the Ministry of Agriculture (MOA);
- 7) The loan originator department shall strictly stipulate that the loans can only be used on the effective, low toxic and low residue pesticide registered and recommended by the project.

8.2 Management objective

8.2.1 Raise the awareness of policy implementation

The awareness of implementing Integrated Pest Management is strengthened by the implementation of this project. It is indicated in the following aspects:

- 1) The daily use amount and frequency of the chemical pesticides in the project regions decreased;
- 2) The unregistered pesticides are prohibited in the project regions;
- 3) The highly toxic pesticides are replaced by low toxic pesticides in the project regions (WTO I pesticides);
- 4) The FAO regulations ((or equivalent laws in China)) on pesticide restriction, distribution and application are followed ;

5) The FAO guidelines ((or equivalent laws in China)) on pesticide packaging and storage are followed;

6) The FAO guidelines ((or equivalent laws in China)) on pesticide labels and application are followed;

7) The FAO guidelines ((or equivalent laws in China)) on the discarded pesticides and packins are followed;

8) The corresponding FAO guidelines are followed when there are no equivalent guidelines in China;

9) The Pest Management Plan of constructing the integrated development demonstration town project of rural economy using load of the World Bank is implemented.

In addition, encouraging the city, county (area) and town government to advance and support the IPM method by discussing and implementing the project (especially the long-term benefit).

8.2.2 Strengthening the construction of plant protection ability at the basic level

The plant protection ability at the basic level was strengthened by the implementation of the project. It is indicated in the following aspects:

1) Providing trainings to the plant protection specialists at the county, city and district level;, the agricultural technical extension personnel at the town level and the peasant technicians and science and technology demonstration household at the basic level;

2) In the process of project implementation, the plant protection personnel has learned and mastered the IMP method and the peasants has also acquainted themselves to the IMP method.

3) Through the implementation of the project, the relations of the plant protection among the area, town and village are strengthened, and the implementation of the Pest Management Plan is strengthened.

8.3 Management ability, organization arrangement and mutual cooperation

By establishing specialized organizations, designating specialized personnel and close cooperating with the quarantine department of pest prevention and treatment at various levels, the implementation of the project will strengthen the management ability of plant protection, and control the sales and use of pesticides. The project will be implemented through following approaches:

1) The project management office appoints designated personnel to supervise the implementation process of the Pest Management Plan;

2) Making the pest supervision, monitoring and evaluation methods to monitor and evaluate the pest management technique used in the project;

3) The project office will establish the cooperative relations with the quarantine department of crop pest prevention and treatment and the pest research institute, so as to

update and enrich the pest prevention and treatment knowledge and increase the pest integrated management ability;

4) The plant protection specialists at the province, city and county (area) levels will strengthen the implementation of technical trainings for the agro-tech extension personnel and peasants of the town (area) and village (town);

5) Strengthening the exchange of the pest prevention and treatment experiences and the prevention and treatment techniques among the city, county (district)() and village (township) of the project regions, sharing the achievements.

8.4 Training and human resource development

The training and human resource development is an important work to strengthen the construction of pest management ability, the following suggestions are provided according to the duties of different departments involved in this work and the personnel levels.

1) The business administrative departments of the county (district) and village (town), the plant protection and agro-tech extension personnel are regularly provided with trainings, so as to ensure effective implementation and supervision of various regulations on pesticide business, management and sales.

2) The plant protection and agro-tech personnel at the county (district) and village (town) levels provides trainings on the pest management method to the peasants in the form of field school;

3) The knowledge on the newly emerged pests and diseases and their non-pollution prevention and treatment techniques can be acquired by inquiring and consulting the plant protection specialists of various levels, and related special task project can be arranged by relevant research institutes;

4) According to the practical conditions of the ecological characteristics and the occurrence of the staple crop pests and diseases in the project implementation region, formulating related training materials as early as possible, supplemented with necessary audiovisuals.

8.5 Trainings for the peasants

The peasants are the main project implementers. Providing trainings to the peasants is the main content of the pest and disease prevention and treatment work, the trainings will increase the IPM knowledge of the peasants, plant protection skills, and increase their mission consciousness of protecting the environment and participating in the IPM activities.

8.5.1 Training forms

The trainings for the peasants can be arranged in the participative and flowing forms:

1) Participative training: the peasant field school shall be established in the project implementing area, the instructors are mainly composed of the agriculture extension personnel at the village (town) level and peasant technicians who have received special trainings and

have plentiful experience of pest management; according to the field practical conditions of different stages of the pests and diseases of local agriculture and forestry crops, the peasants are pertinently instructed and trained on how to well identify, prevent and treat the pests and diseases by the field instructors, so that the peasant students are trained of the technical knowledge and the organizing, communicating and management skills.

2) Flowing training: the project group periodically or aperiodically organize the flowing training team composed of the specialists from the agricultural research institutes, universities and colleges as well as the agricultural management and extension organizations, to all the field schools of the project implementing region or the village (town) and countryside, so as to provide trainings and pass on the latest IPM concepts, latest pest prevention and treatment techniques and related policies and regulations on pesticide safe use techniques and pesticide sales and marketing to local agro-tech publicity personnel, peasant technicians, peasants and pesticide dealers.

8.5.2 Training content

1) Training target: Agro-tech personnel, plant protection special cadre, peasant technicians, peasants, pesticide dealer of the county (district), village (town) will be given the following training:

2) Training content:

- ✓ Morphological characteristics and identification of pests and diseases;
- ✓ Harm characteristics and loss incurred by different pests and diseases;
- ✓ Occurrence regularity of main pests and diseases;
- ✓ Identification of natural enemies;
- ✓ Field sampling of pests and diseases and estimation method of occurrence density;
- ✓ Control threshold of pests and diseases;
- ✓ Control measures of pests and diseases, including: agricultural, physical, biological and chemical prevention and treatment methods;
- ✓ Pesticide selection and safe use techniques;
- ✓ Safe storage and disposal of agricultural chemicals and their packing wastes.

8.6 Training plan

The training work plan shall include two parts, namely the training plan for the instructors and the work plan for the peasant field school. The specific plan is as given in Table 8-6-1:

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Table 8-6-1 Schedule of annual training work plan (2012-2017)

Training type	Training content	Training target	Project regions		Trainer number each time	Annual training times	Training forms	Implementing organizations
Instructor Training plan	Latest IPM concept, Project Pest Management Plan, latest technique on the pest non-pollution prevention and treatment of related crops, pesticide safe use technique and related policies and regulations on pesticide marketing and sales.	The agro-tech extension personnel and plant protection special cadres, etc at the city, county (district) and village (town) levels	Baiyin City	Jingyuan County	9	2 centralized training each year.	Flowing training	PMO
				Jingtai County				
			Dingxi City	Longxi County	9			
				Minxian County				
			Tianshui City	Maiji Area	9			
				Qinzhou Area				
			Pingliang City	Lingtai County	6			
			Qingyang City	Xifeng Area	6			
			Zhangye City	Ganzhou Area	9			
				Sunan County				
Jiuquan City	Yumen County	9						
	Dunhuang County							
Peasant filed school	Identification of main pests and diseases, prevention and control measures; pesticide safe use technique and disposal of discarded	The peasant technicians, peasants, pesticide dealers in the	Jingyuan County	Dongwan town	60	Once every month in crop growth period from April to September times every	Participative training	PMO
			Jingtai County	Hongshui town	50			
			Longxi County	Wenfeng County	40			
			Minxian County	Meichuan town	40			
			Maiji District	Ganquan town	60			

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Training type	Training content	Training target	Project regions		Trainer number each time	Annual training times	Training forms	Implementing organizations
	pesticides and packings	village (town) of project regions	Qinzhou District	Zaojiao town	60	year		
			Lingtai County	Shizi town	60			
			Xifeng District	Dongzhi town	60			
			Ganzhou District	Dangzhai town	60			
			Sunan County	Hongwansi town	50			
			Yumen County	Huahai town	60			
			Dunhuang County	Qili town	60			

Remarks:

- 1) The requirement of the instructor training plan: 2 peasant technicians are arranged to participate in the training from each city, county (district) of the project regions, the training is conducted 2 times every year, 3 days for each training, 57 persons in each training, 114 persons trained every year , 570 persons trained for 5 years;
- 2) The requirement of the peasant field school training plan: 6 rounds of training every year, 40-60 persons in each training, 660 persons trained in 12 project regions every year, 3300 persons trained for 5 years.

9. Monitoring and evaluation of the project

9.1 Content of project monitoring

During the project implementation process, the implementation of the pest integrated management plan in the project regions, the pesticide use mode, the crop quality and yield, the dynamics of main pests and diseases and the natural enemy population as well as the impact of the project implementation on environment shall be supervised on site. The specific monitoring content is as follows:

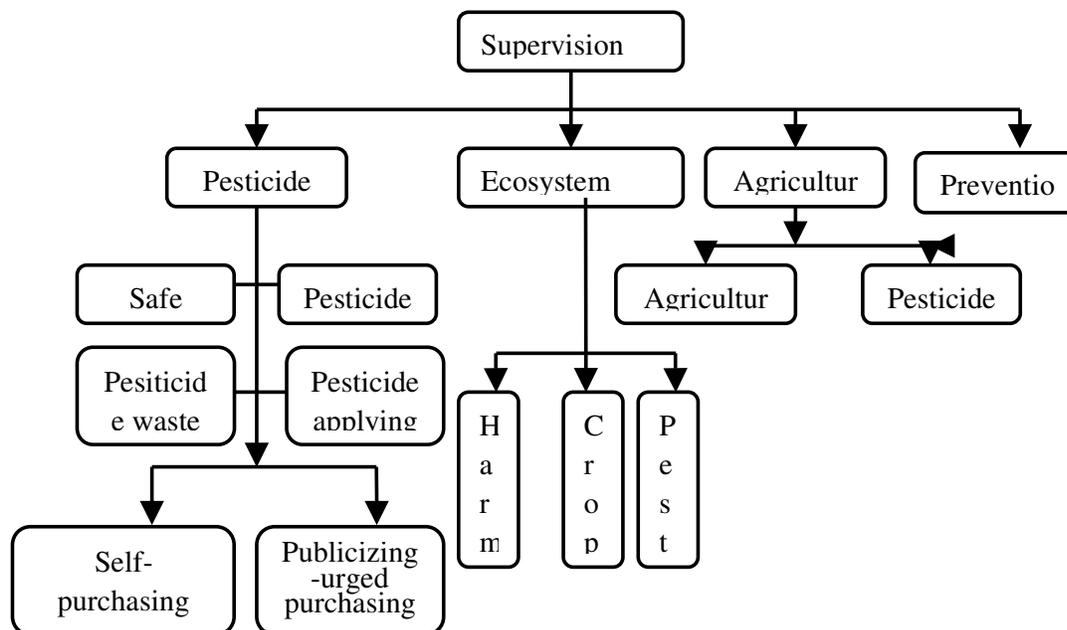


Fig. 9-1-1 Schematic diagram of project monitoring content

9.2 Project supervision management content

During the supervision and inspection period of the World Bank supervision team, the on-site monitoring shall be performed in the proceeding to the following work:

- Pesticide registration;
- Use of Class-I pesticides;
- Issuance of policies;
- Performance of local monitoring procedure and result analysis aid.

9.3 Monitoring and supervision plan

9.3.1 Pest management monitoring plan

9.3.1.1 Implementation of the monitoring plan

The monitoring work shall be jointly carried out by the agricultural publicity & service center of the city, district (county) level, the project office and the owner in each town of the

project implementing region. Once the pests and diseases are detected, it shall be reported and dealt with immediately. The World Bank dispatched personnel shall assist in the contraction of the appropriate monitoring system and sampling procedure as early as possible, and provide trainings in the implementation and analysis of monitoring system.

9.3.1.2 Setting up monitoring points and monitoring crops

According to the crop planting pattern and the characteristic crop planting conditions in the project demonstration town, the project shall at least set up the following monitoring points:

- 1) 1)The intensive monitoring crops in Dongwan Township of Jingyuan County of Baiyin City are the vegetables;
- 2) The intensive monitoring crops in Ganquan Township of Maiji District are the fruit trees;
- 3) The intensive monitoring crop in Zaojiao Township of Qinzhou District is the potato;
- 4) The intensive monitoring crops in Meichuan Township of Minxian County are Chinese medicinal plants.
- 5)5) The Shizi Township of Lingtai County are the oil plants;
- 6) The intensive monitoring crop in Dongzhi Township of Xifeng District is wheat□
- 7) The intensive monitoring crop in Dangzhai Township of Ganzhou District is the corn□
- 8) The intensive monitoring crop in Qili Township of Dunhuang County is the cotton.

9.3.1.3 Data collection and sampling method

See Table 9-3-1-3 for the monitoring content, data collection of key monitoring and the sampling method.

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Table 9-3-1-2 Staple crop planting area (in mu) in townships involved in the monitoring point

Crop	Wheat	Corn	Potato	Fruit trees	Vegetables	Cotton	Oil plants	Chinese medicinal plants
Dongwan town	2000	5000	1500	200	19500	/	2000	/
Ganquan town	41266	27895	2650	19565	3492	/	1562	/
Zaojiao town	38500	24500	8400	9650	1680	/	9600	/
Meichuan town	240	/	1300	/	/	/	/	41650
Shizi town	38600	28030	6150	6500	5800	/	16920	/
Dongzhi town	68000	25350	800	36396	10800	/	28000	/
Dangzhai town	11695	46769	6002	1231	15209	/	500	/
Qili town	107	499	/	19485	4151	10136	/	/

Table 9-3-1-3 List on monitoring evaluation for the pests and disease of staple crops in the project regions

Name of monitoring point	Key Crop of monitoring	Pesticide using status				Ecosystem status of farmlands				Production and quality status				Monitoring expenses (10'000 yuan)
		Type	Time	Using amount (kg)	Monitoring times	Incidence of disease	Pest number	Natural enemy number	Monitoring time	Production	Production value	Pesticide residue	Monitoring times	
Dongwan town	Vegetables				1				4				2	3.0
Ganquan town	Fruit trees				1				4				2	3.0
Zaojiao town	Potato				1				4				2	3.0

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Name of monitoring point	Key Crop of monitoring	Pesticide using status				Ecosystem status of farmlands				Production and quality status				Monitoring expenses (10'000 yuan)
		Type	Time	Using amount (kg)	Monitoring times	Incidence of disease	Pest number	Natural enemy number	Monitoring time	Production	Production value	Pesticide residue	Monitoring times	
Meichuan town	Chinese medicinal plants				1				4				2	3.0
Shizi town	Oil plants				1				4				2	3.0
Dongzhi town	Wheat				1				4				2	3.0
Dangzhi town	Corn				1				4				2	3.0
Qili town	Cotton				1				4				2	3.0

Remarks:

1. Monitoring method on “Pesticide using status”: 2 villages were selected for each monitoring point. In the harvest period of the supervised crop, collecting the information on the pesticide types, using amount and frequency and the disposal status of unused pesticides and packing by means of questionnaires and investigations, and conducting statistics and summarizations;

2. Monitoring method on “Ecosystem status of farmland”: 1 demonstration village was selected for each monitoring point. An investigation on the types of pests and diseases, occurrence status of each pest and disease as well as the types and number of natural enemies was conducted for the seedling, adult plant, fruiting and harvesting stages of the supervised crop respectively. 4 investigations were conducted for each crop every year;

3. Monitoring method on “Production and quality status”: 1 representative village was selected for each monitoring point. In the harvest period of the supervised crop, production was measured for 3 representative farmlands, and the crop production value and quality were investigated; at the same time the soil and agricultural product were sampled for pesticide residue determination.

9.3.1.4 Monitoring evaluation system

1) Degree of using the integrated management and control measures of pests and diseases.

- ✓ The number of peasant household participating in the use of integrated management and control measures of pests and diseases;
- ✓ The crop area where the integrated management and control measures of pests and diseases are used;
- ✓ The number of peasants who can identify main pests and diseases/natural enemies;
- ✓ The number of peasants who participated in the pest integrated management plan training;
- ✓ The main pest control effect after using the pest integrated management and control measures.

2) Degree of pesticide safe use

- ✓ The use times of pesticides on staple crops or fruit trees every year;
- ✓ The type and amount of pesticides used on staple crops per mu every year;
- ✓ The expenses of pesticide used on staple crops per mu every year due to pest prevention and treatment;
- ✓ The number of peasants who implemented pesticide safe use and disposal (safe storage, using labor protection appliances);
- ✓ The times of agricultural products refused due to high pesticide residue;
- ✓ The human and livestock poisoning accidents caused by the use of pesticides.

3) Agricultural product yield and quality status

- ✓ The yield of the staple crops after the implementation of the pest integrated management plan of the project;
- ✓ The quality status of the staple crops (including quality and pesticide residue) after the implementation of the pest integrated management plan of the project;
- ✓ The yield and profit status of the staple crops after the implementation of the pest integrated management plan of the project.

4) Degree of the impact on the agricultural ecosystem

- ✓ The occurrence area and harm degree of main pests and diseases of the staple crops in different demonstration regions;

- ✓The species and number changes of the beneficial creatures (including predatory insects and parasite insects, etc) per unit quadrat on the crops implemented with the pest integrated management plan;

- ✓Degree of impact on wild creatures, bees, waters and soil, etc after using the Pest Integrated Management and control measures.

5) Other indexes

- ✓Times of visits paid by agricultural chemical product salesman to the project regions;
- ✓Times of agricultural chemical products advertised on the media (TV, broadcasting station and newspaper);
- ✓Times of pesticide product brand appearing in the project regions by retail channels;
- ✓Times of the acceptable pesticide product exhibited.

9.3.2 Supervision plan

9.3.2.1 Implementation of supervision plan

The project office of various levels shall be responsible for ensuring the conduct of regular supervision activities. The project office of various levels and the agro-tech extension service center shall supervise and inspect the implementation of the Pest Management Plan during the pest occurring peak period, and cooperate with the World Bank supervision team in the supervision and inspection work on the project. The World Bank team shall be composed of experienced pest specialists, the supervision and inspection can be conducted 1-2 times every year, generally better in the pest occurring peak period every year.

9.3.2.2 Specific content of supervision and inspection

1) Pesticide use status

- ✓ Inspecting whether the pesticides sold by the dealers or used by the peasants in the project demonstration regions are registered and the pesticides recommended in the Pest Management Plan;
- ✓ Inspecting the Class-I pesticides are sold/used in the project regions;
- ✓ Inspecting the pesticide registration list to check the registration status of new pesticides;
- ✓ Inspecting whether the peasants have taken protective measures in the pesticide use;
- ✓ Inspecting the disposal status of the peasants on the discarded pesticides and packing.

2) Policy aspects

- ✓ The subsidy by the government (if any) in the use of pesticides;
- ✓ The implementation of policies and regulations on the pesticide use and the extension of the pest integrated management technique by local government.

3) Implementation of on-site monitoring plan

✓ Conducting evaluation on the implementation of the on-site monitoring plan of various counties undergoing inspection by the World Bank supervision team;

✓ Assisting related personnel in the project county to solve any problems generated in the implementation of on-site monitoring plan;

✓ Providing timely trainings to related personnel in the project regions concerning the on-site monitoring, data analysis and result interpretation and making adjustment in time where improvements shall be made in the pest treatment.

9.3.3 Duties

The Agro-Tech Extension & Service Center at various levels shall be responsible for providing the pest integrated management techniques, and also the duties of related direction, supervision, monitoring and trainings. The project office at various levels and the interest and risk sharers are obligated to detect and report the occurrence of pests and diseases, implement the requirements under the Pest Management Plan.

9.3.4 Special technology requirement

The Agro-Tech Extension & Service Center shall provide the technology and method of pest integrated management.

10. Appropriation budget

The Pest Management Plan is an important constituent part of the project of constructing the integrated development demonstration town of rural economy with loans provided by the World Bank in Gansu Province. The main tasks and objectives of this plan and its technical path of implementation have its special characteristics, which shall be integrated into the daily work of the project office as an independent unit of the overall project. Meanwhile, in order to ensure the effective implementation of the plan, 1-2 special-subject projects shall be established to carry out special-task research on major pests and diseases existed in the characteristic industry in the project regions, so as to resolve the prominent problems in the non-pollution agricultural product production. The appropriation budget includes the total management expenses of the project office and the agricultural departments, covering technical training, publicizing, pesticide safe and rational use, pest monitoring and early warning, supervision and monitoring, special-subject research and management. The total budget appropriation is 6 million yuan, in which 4.8 million (80%) is from the Project of Constructing the Integrated Development Demonstration Township of Rural Economy with Loans Provided by the World Bank in Gansu Province of China, the rest 1.2 million yuan (20%) is from the agricultural project of each project region by overall planning. The detailed expense budget is as follows:

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Table 10-1-1 Training expense budget of the Pest Management Plan in the project regions (2012-2017)

Training level	Training target	Project regions		Training persons (person/time)	Training period (d)	Training form and times	Training year	Training expenses (yuan/day·time)	Total expense (10,000 yuan)	Implementing organization
Trainings for instructors	The plant protection research and extension personel in the city, county (area)	Baiyin City	Jingyuan County	9	3	2 centralized trainings regularly every year	5 years from 2011 to 2017	200.0	34.2	PMO
			Jingtai County							
		Dingxi City	Longxi County	9						
			Minxian County							
		Tianshui City	Maiji District	9						
			Qinzhou District							
		Pingliang City	Lingtai County	6						
		Qingyang City	Xifeng District	6						
		Zhangye City	Ganzhou District	9						
			Sunan County							
Jiuquan City	Yumen County	9								
	Dunhuang County									

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Peasant field training	Peasant technicians, peasants, pesticide dealers in the village (town) of the project regions	Dongwan town of Jingyuan County	60	1	Once each month during the crop growth period from April to September, 6 times every year. Local participative training	5 years form 2011 to 2017	150.0	297.0	PMO
		Hongshui town of Jingtai County	50						
		Wenfeng County of Longxi County	40						
		Meichuan town of Min County	40						
		Ganquan town of Maiji District	60						
		Zaojiao town of Qinzhou District	60						
		Shizi town of Lingtai County	60						
		Dongzhi town of Xifeng District	60						
		Dangzhai town of Ganzhou Area	60						
		Hongwansi town of Sunan County	50						
		Huahai town of Yumen County	60						
		Qili town of Dunhuang County	60						
Total		717	4	8	5		331.2		

Remark:

Table 10-1-2 Expense budget for the research, specialist training, training material, supervision, monitoring and management (2012-2017)

Budget subject	Target	Time/place/times/	Expenses	Total	Implementing	Supervision
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		conference session/persons	(10, 000 yuan)	(10, 000 yuan)	organization	organization
Symposium sponsored in the project	The World Bank commissioner, the project office of the province, city, county and town, the specialists, related agricultural department personnel	Held in the project regions when the project starts, 1 day each session, 70 participants.	4.0	4.0	Provincial project office	The World Bank organizations
The pest integrated treatment strategy and action plan summary communication conference	The project office of the city, county (district) and village (town), the plant protection department personnel, the peasant technicians and the demonstration household representatives and the pesticide dealer representatives, etc.	1 summary communication conference will be held in all project regions at the end of the year, 1 day for each session, 60 participants.	35, 000 yuan×5 years	17.5		

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Training materials, CD, wall map (prevention calendar) and equipment consumptions	Agricultural research institutes and universities, the specialists and professors from the plant protection, agro-tech extension departments and other special departments	The compilation of 8 series of training materials of characteristic industry pest integrated management shall be completed before the implementation of the project, and the burn fo CDs, design of wall map shall be carried out successively.	Teaching material: 8 sets×3585 pieces×yuan; CD, Wall map: 2.868 pieces×2×6 yuan	63.1		
The Pest Management Plan special research (vegetables, fruit trees, etc)	Special research universities possessing research basis and technical reserve to a certainty	According to the major plant protection problems existed in the agricultural production of the project regions, conducting the “main characteristic industry pest integrated treatment techniques integration and demonstration extension” special-subject research, summarizing and proposing method to solve the problems, and conducting demonstration extension	1-2 special funds are recommended in the project regions, 0.8-1 million yuan, period 3-5 years	96.0		
Specialist technical consultation service	Renowned plant protection, pesticide, ecological specialists and professors from domestic and abroad agricultural research institutes and universities	3-4 related specialists are invited twice every year to all project regions during the crop growth period, to provide on-site tour instructions and flowing trainings. 7-10 times each time	2 times×30,000 yuan /time×5 years	30.0		

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Instructor service fee	The instructors for the peasant technicians, peasants and pesticide dealers participating in the training in the project regions	According to the training plan, 57 persons are trained in each project region, 6 trainings every year, 1 day every training, 30 times altogether every year, 200 yuan subsidies per person/time	57 persons×6 times×1 day×5 years×200 yuan/day times	34.2		
Pest monitoring and inspection evaluation and pesticide supervision management	The designated monitor appointed by agricultural technical and plant protection departments	2 persons per village (town) are appointed for 8 villages (towns). 7 investigations are conducted every year, 200 yuan per person time; 16 samples (soil and agricultural products) for residue determination every year, 1600 yuan for each sample.	8×2 persons×200 yuan/person time×5 years; 16×1600 yuan/sample×5 years	24.0	County (District) Project Office	The World Bank and Provincial Project
Total				268.8		

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Appendix 1 The project of “Constructing the Integrated Demonstration Town of Rural Economy with Loans Provided by the World Bank
List of non-pollution pesticides recommended for use

Appendix 1-1 Insecticides/miticides

Pesticides		Applicable crops	Prevention and treatment target	Applying amount per mu-time or dilution ratio	Applying method	Maximum times applied on each crop	Safe interval
Common name	Formulation and content						
Avermectins	1.8% emulsifiable oil	Fruit trees	Red spider (<i>Tetranychus</i>)	20-30mL	Spray	2	7
		Cotton	Red spider (<i>Tetranychus</i>)	30-40mL		2	21
		Leafy vegetable	Diamond back moth (<i>Plutella xylostella</i>)	33-50mL		1	7
		Cucumber	liriomyza sativae	20-30ml		3	2
		Cowpea				5	
Acetamiprid	20% emulsifiable oil	Cucumber	Aphid (<i>Aphididae</i> spp.)	2000-2500 diluent	Spray	3	2
		Chinese medicinal plants				1	14
		apple				1	30
Effective cyfluthrin	2.5% emulsifiable oil	Cotton	Cotton bollworm (<i>Heliothis armigera</i>)	25-35mL	Spray	3	15
		Leafy vegetable	Cabbage worm (<i>Pieris rapae</i>), aphid (<i>Aphididae</i> spp.)	26.7-33.3mL		2	7
Cyhalothrin	2.5% emulsifiable oil	Wheat	Wheat aphid, <i>Mythimna separate</i>	12-20mL		2	15
		Cotton	Cotton bollworm (<i>Heliothis armigera</i>)	20-60mL		2	30

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Pesticides		Applicable crops	Prevention and treatment target	Applying amount per mu·time or dilution ratio	Applying method	Maximum times applied on each crop	Safe interval
Common name	Formulation and content						
		Leafy vegetable	Diamond back moth (<i>Plutella xylostella</i>), aphid Cabbage worm (<i>Pieris rapae</i>)	25-50mL		3	7
		Fruit trees	Aphid (<i>Aphididae</i> spp.), borer pest	4000-5000 diluent		2	21
		soybean	Borer pest	12~20mL		2	30
		Leafy vegetable	Diamond back moth (<i>Plutella xylostella</i>), aphid (<i>Aphididae</i> spp.), Cabbage worm (<i>Pieris rapae</i>)	25~50mL		3	7
Cypermethrin	10% emulsifiable oil	Peach	<i>Carposina niponensis</i>	2000~4000 diluent	Spray	3	7
		Leafy vegetable	Cabbage worm (<i>Pieris rapae</i>), diamond back moth (<i>Plutella xylostella</i>)	25~35mL		3	Brassica chinensis 2 Chinese cabbage 5
		Tomato	Aphid (<i>Aphididae</i> spp.), cotton bollworm (<i>Heliothis armigera</i>)			2	1
diflubenzuron	25% wettable powder	Wheat	<i>Mythimna separate</i>	6-20g	Spray	2	21
		Apple	Inchworm, moth, borer pest	1000~2000 diluent		3	7
Imidacloprid	20% solvents	Cabbage	Vegetable aphid	75~150mL	Spray	2	7

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Pesticides		Applicable crops	Prevention and treatment target	Applying amount per mu·time or dilution ratio	Applying method	Maximum times applied on each crop	Safe interval
Common name	Formulation and content						
		Tomato	White fly	225~450mL			3
Clofentezine	Suspension concentrate 50%	Apple	Red spider □ <i>Panonychus ulmi koch</i> □	5000-6000 diluent □ 83-100mg/L □	Spray	2	30
Diflufenican	Suspension concentrate 5%	Cabbage	Diamond back moth □ <i>Plutella xylostella</i> □	16.7-33.3mL	Spray	3	3
Fenbutatin oxide	Wettable power 50%	Tomato	Red spider	20-40g	Spray	2	7
Chlorpyrifos methyl	Emusifiable concentrate 40%	Cotton	Cotton bollworm □ <i>Helicoverpa armigera</i> □	100ml~175ml	Spray	3	30
		Cabbage	Cabbage Pieris rapae □ <i>Pieris rapae</i> □	60ml~80ml		3	7
Teflubenzuron	Emusifiable concentrate 5%	Leaf vegetables	Cabbage worm □ <i>Pieris rapae</i> □, Diamond back moth □ <i>Plutella xylostella</i> □	45-60mL	Spray	2	10
Hexythiazox	Emusifiable concentrate 5%	Cotton	Red spider □ <i>Tetranychus urticae</i> Koch, <i>Panonychus ulmi koch</i> □	50-66ml	Spray	2	30
		Apple		1500-2000 diluent (25-33mg/L)		2	30

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Pesticides		Applicable crops	Prevention and treatment target	Applying amount per mu·time or dilution ratio	Applying method	Maximum times applied on each crop	Safe interval	
Common name	Formulation and content							
tau-Fluvalinate	Emulsifiable concentrate 10%	Cotton	Cotton bollworm□ <i>Helicoverpa armigera</i> □, Pink bollworm□ <i>Pectinophora gossypiella</i> □, Tetranychus urticae Koch, aphid	25-50ml	Spray	3	14	
		Leaf vegetables	Cabbage worm□ <i>Pieris rapae</i> □					
Propargite	73% emulsifiable oil	Corn	Mites	80-100mL	Spray	3	30	
		Cotton		50-70 mL			3	21
		Apple		2000~3000 diluent			3	30

Appendix 1-2 Bactericides/nematicides

Pesticides		Applicable crops	Prevention and treatment target	Applying amount per mu·time or dilution ratio	Applying method	Maximum times applied on each crop	Safe interval
Common name	Formulation and content						

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Pesticides		Applicable crops	Prevention and treatment target	Applying amount per mu-time or dilution ratio	Applying method	Maximum times applied on each crop	Safe interval
Common name	Formulation and content						
Chlorothalonil	45% fumigants	Cucumber	Downy mildew	110~180g (applied in shed or greenhouse)	Fumigation	4	3
	75% wettable powder	Corn	Leaf blight and southern leaf blight, rust disease	111~133g	Spray	3	14
		Tomato	Early blight	145~270g		3	7
	40% colloidal suspension agent	Chinese medicinal plants	Leaf spot	1125~2250mL	Spray	3	30
Fenarimol	6% wettable powder	Apple	venturia inaequalis □ Anthracnose □ Powdery mildew	1000~1500 diluent	Spray	3	14
		Pear	venturia inaequalis	1000~1500 diluent	Spray	3	14
Imibenconazole	15% wettable powder	Pear	Pear venturia inaequalis	3000~3500 diluent	Spray	3	28
Iprodione	50% wettable powder	Apple	Zonate spot, brown blotch	1000~1500 diluent	Spray	3	7
	25% suspension agent	Leafy vegetable	Sclerotiniose	140~200mL	Spray	2	50
Mancozeb	80% wettable powder	Apple	Alternaria mali, ring spot	800 diluent	Spray	3	10
		Tomato	Early blight	167g			15
		Water melon	Anthracnose	2490~3750g			21

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Pesticides		Applicable crops	Prevention and treatment target	Applying amount per mu-time or dilution ratio	Applying method	Maximum times applied on each crop	Safe interval
Common name	Formulation and content						
Procymidone	50% wettable powder	Cucumber	Gray mold, Sclerotiniose	45~50g	Spray	3	1
		Grape	gray mold	75~150g		2	14
		Rape	Sclerotiniose	30~60g		2	25
Thiophanate methyl	50% wettable powder	Apple	ring spot, anthracnose	400~600 diluent	Spray	3	14
		Vegetables	Powdery mildew, anthracnose, gray mold, Sclerotiniose	1000~1500 diluent	Spray	2	14
		Peach	Brown rot	600~800 diluent	Spray	2	14
		Grape	Brown blotch, anthracnose, gray mold	600~800 diluent	Spray	2	21
		Wheat	Smut, Fusarium head blight	100~150g	Spray	2	30
Thiabendazole	60% wettable powder	Mushroom	Fugal disease, evenly mixing in the sawdust before bag packing	200~400mg/kg Sawdust (Sawdust bad cultivation method)	Mixing application	1	65

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Pesticides		Applicable crops	Prevention and treatment target	Applying amount per mu-time or dilution ratio	Applying method	Maximum times applied on each crop	Safe interval
Common name	Formulation and content						
			Fungal disease, spraying on basswood section plane in hypha growth period (applying interval: 30 days)	400~667 diluent (Basswood section plane cultivation method)	Spray	3	55
Triflumizole	30% wettable powder	Cucumber	Powdery mildew	15~20g	Spray	2	2
Vinclozolin	50% wettable powder	Cucumber	Gray mold	75~100g	Spray	2	4
1) oxadixyl + 2) mancozeb	64% wettable powder	Cucumber	Downy mildew	170~200g	Spray	3	3
Captan	50% wettable powder	Tomato	Early blight □ leaf mold	937.5~1406.25 g/hm ²	Spray	-	-
		Cucumber	Anthraco nose	937.5~1406.25 g/hm ²	Spray		
		Hot pepper	Anthraco nose	937.5~1406.25 g/hm ²	Spray	-	-
		Apple	Ring spot	625~1250mg/kg	Spray	6	15
		Grape	Downy mildew	833~1250 mg/kg	Spray	-	-
		Maize	Seedling blight	67.5~78.5g/100kg seeds	Seed pelleting	1	-
	450g/l exposurer suspended						

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Pesticides		Applicable crops	Prevention and treatment target	Applying amount per mu-time or dilution ratio	Applying method	Maximum times applied on each crop	Safe interval
Common name	Formulation and content						
Carbendazim	90%water dispersible granules	Rape	Sclerotiniose	1125~1500g/hm ²	Spray	-	-
	80%water dispersible granules	Tomato	Early blight	750~960 g/hm ²	Spray	-	-
	25% wettable powder	Rape	Sclerotiniose	900~1200 g/hm ²	Spray	-	-
		wheat	Fusarium graminearum	750~1125 g/hm ²	Spray	-	-
		Rape	Sclerotiniose	1125~1500 g/hm ²	Spray	-	-
	500g/l suspending agent	Apple	Ring spot	625~833.3g/kg	Spray	-	-
Propineb	70% wettable powder	Cucumber	Downy mildew	150~214g	Spray	3	5
		Tomato	Early blight□late blight□Downy mildew	125~214g	Spray	3	7
Fludioxonil	2.5% suspending agent	Cotton	damping off	600~800g/100kg seeds	Seed dressing	1	-
Chunleimeisu	2%water aqua	Tomato	Leaf mold	140~175ml	Spray	3	4
Pyrimethanil	40% suspending agent	Cucumber	Gray mold	62.5~93.8g	Spray	2	3

Appendix 1-3 Herbicides/ plant growth regulators

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Pesticides		Applicable crops	Prevention and treatment target	Applying amount per mu-time or dilution ratio	Applying method	Maximum times applied on each crop	Safe interval
Common name	Formulation and content						
Acetochlor	90% emulsifiable oil	Soybean	Annual grass (Gramineae spp.) and part of broad leaf weeds	58~72g	Spray	1	Spraying after sowing and before emergence
		Corn		900~1500mL	Soil spray	1	Spraying once after corn sowing and before emergence
Alachlor	48% emulsifiable oil	Corn	Annual grass (Gramineae spp.) and part of broad leaf weeds	200~400mL	Soil spray	1	Soil spraying after seed sowing and before sprouting, avoiding the use in rainy, sandy soil and high ground level regions
		Cotton		150~250mL			
		Soybean		300~467mL			
Benazolin	50% emulsifiable oil	Rape	Chickweed, malachium aquaticum, stellaria alsine and latifoliate weeds	27~30ml	Spray	1	Spraying 7 days after rape transplantation
Phenamide	70% wettable powder	Rape	Annual grass (Gramineae spp.) and latifoliate weeds, etc	200~270g	Spray	1	Spraying during the period from rape initial turning green to early leaf spreading of early spring
Diclofop-methyl	36% emulsifiable oil	Wheat	Wild oats, barn yard grass, crab grass and other weeds	130~185mL	Spray	1	Spraying in the 3-5 leaf stage of wild oats
		Beet		130~185mL			Spraying in the 2-4 leaf stage of weeds

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Pesticides		Applicable crops	Prevention and treatment target	Applying amount per mu-time or dilution ratio	Applying method	Maximum times applied on each crop	Safe interval
Common name	Formulation and content						
Penoxsulam	80% water dispersible granule	Corn	Latifoliate weeds	3.75~5g	Spray	1	Spraying after emergence
		Soybean					Soil spraying before emergence of soybean
Fluometuron	80% wettable powder	Cotton	Annual grass (Gramineae spp.) and latifoliate weeds	130~150g	Soil spray	1	Spraying after sowing and before emergence
Fluroxypyr	20% emulsifiable oil	Wheat	Latifoliate weeds	50~70mL	Spray	1	Spraying in returning green stage of winter wheat and 2-4 leaf stage of spring stage
Haloxypop-R-methyl	10.8% emulsifiable oil	Rape	Annual weeds (Gramineae spp.)	20~30ml	Spray	1	Spraying 3-5 leaf stage of rape
		Soybean		28~32ml			Spraying in seedling stage of soybean
Metolachlor	72% emulsifiable oil	Corn	Annual grass (Gramineae spp.), cyperaceae and latifoliate weeds	90~180mL	Spray	1	Spraying in seedling stage
		Soybean		100~180mL	Soil treatment		Spraying before sprouting, avoiding the use in rainy, sandy soil and high under ground water regions

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Pesticides		Applicable crops	Prevention and treatment target	Applying amount per mu-time or dilution ratio	Applying method	Maximum times applied on each crop	Safe interval
Common name	Formulation and content						
Thifensulfuron-methyl	75% dry suspension agent	Corn	Latifoliate weeds	2~3g	Spray	1	Spraying in seedling stage of corn
		Wheat					Spraying in jointing stage of wheat
Avadex BW	40% emulsifiable oil	Wheat	Wild oats	150~200mL	Soil treatment Spray	1	Spraying 5-7 days before sowing of spring wheat
Tribenuron	75% dry suspensions	Wheat	Latifoliate weeds	0.9~1.7g	Spray	1	Spraying in jointing stage of wheat
Trifluralin	48% emulsifiable oil	Corn	Annual grass (Gramineae spp.) and latifoliate weeds	75~100mL	Soil treatment Spray	1	Spraying before sowing and rake the soil smooth
		Soybean		125~175mL			
Sethoxydim	20% missible oil	Cotton	Annual grass (Gramineae spp.) cotyledon weeds	85~100mL	Spray	1	Spraying in the seedling stage of plant and 3-5 leaf stage of weeds
		Peanut		70~100mL			
		Soybean		100~200mL			
		Rape		65~120mL			
		Beet		100mL			
		Fiberflax		66~85mL			
	12.5%oil emulsion	Cotton		66~100mL			
		Peanut					
		Soybean					
		Beet					

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Pesticides		Applicable crops	Prevention and treatment target	Applying amount per mu-time or dilution ratio	Applying method	Maximum times applied on each crop	Safe interval
Common name	Formulation and content						
Florasulam+2, 4 drops of Michael essien ester vision	45.9% suspending agent	Wheat	latifoliate weeds	30~40mL	Spray	1	Spraying in the seedling stage of wheat
Florasulam+flumetsulam	17.5% suspending agent	Wheat	latifoliate weeds	3~4.5mL	Spray	1	Spraying in the seedling stage of wheat
Thidiazuron	50% wettable powder	Cotton	Cotton to take off the leaves	20~40g	Spray		Spraying in 70% cracking of cotton boll
Trifluralin	48% emulsifiable oil	Corn	Annual grass (Gramineae spp.) and latifoliate weeds	75~100mL	Soil treatment Spray	1	Spraying before sowing and rake the soil smooth
		Soybean		125~175mL			

Appendix 2 Questionnaire on pesticide use status

Essential information of the interviewee:

Name: _____ Sex: _____

Age: _____ Level of education: _____

Number of family members: _____ Farmland area (mu) : _____

Address: _____ Province _____ City/county

_____ District _____ Village

Investigation date: day _____ month _____ year _____

Investigation on pesticide use status

1. Please list 1-5 crops you planted this year in descending order according to their planting area.

Crops					
Area((mu))					

2. Planting area of last year _____.

3. Please fill in the table the area of each land you own and the crop name planted each season.

Crops planted each season		Spring	Summer	Autumn	Winter
Land No.					
1	(mu)				
2	(mu)				
3	(mu)				
4	(mu)				
5	(mu)				

Please mark “√” for your choice

4. Have you ever used pesticides ?

1) Yes () 2) No ()

5. How many years have you been using pesticides ?

1) Less than 1 year () 2) 2-5 years () 3) 6-10 years ()

4) 11-20 years () 5) 21-30 years () 6) Over 30 years ()

6. Do you know about the “three certificates of pesticides”? Which of the following are the “three certificates of pesticides”?

- 1) Pesticide registration ()
- 2) Certificate of quality ()
- 3) Production license ()
- 4) Pesticide transport license ()
- 5) Business license ()
- 6) Product standard ()

7. How do you usually purchase your pesticides ?

- 1) From pesticide store ()
- 2) Through factory direct sales ()
- 3) From the vendor ()
- 4) Other channels (please specify)

8. How do you select your pesticides ?

- 1) By agricultural technician’s recommendations ()
- 2) By dealer’s recommendations ()
- 3) Previous using experiences ()
- 4) Having a try after reading the label ()
- 5) Recommendations from relatives and neighbors ()
- 6) Reading books, periodicals, newspapers and advertisements ()

9. How do you decide the pesticide using time ?

- 1) By own experience ()
- 2) From the notice issued by the village ()
- 3) By instructions of the agriculture technical department ()
- 4) There are relatively fixed using time ()
- 5) According to the using time on the pesticide label ()
- 6) Other (please specify)

10. How do you usually decide the pesticide using amount ?

- 1) By own experiences and estimations ()
- 2) According to the prescription on the pesticide label and the user’s instructions ()
- 3) The amount instructed by the agriculture technical department ()
- 4) Asking previous users

11. How do you measure the pesticide when preparing the pesticide solution?

- 1) Using containers of unknown volume ()

- 2) Using scale or container of known volume ()
- 3) By small packages of medicament ()
- 4) Measuring with the pesticide cap ()
- 5) Pouring into the sprayer directly according to experiences ()
- 6) Other (please specify)

12. What is your usual using dosage of pesticides ?

- 1) Lower than the dosage on the label ()
- 2) Within the dosage scope on the label ()
- 3) Slightly higher than the dosage on the label ()
- 4) More than 2 times higher than the dosage on the label ()

13. How do you calculate the applying amount of pesticide ?

- 1) According to the preparation amount of “g/mu” ()
- 2) According to the “times” ()
- 3) According to the preparation amount of “g/mu” for the wheat and rice, etc. ()
- 4) According to the “times” for the fruit trees and vegetables, etc. ()
- 5) According to the preparation amount of “g/mu” for the wheat, rice and vegetables, etc.()
- 6) According to the “times” for the wheat, rice, fruit trees and vegetables, etc.()
- 7) Other (please specify)

14. How do you decide the pesticide using times ?

- 1) By own experiences ()
- 2) According to the prescriptions on the pesticide label()
- 3) By the instructions of the agriculture technical department()
- 4) To ensure effect, applying every 2-3 times or whenever having time()
- 5) Other (please specify)

15. How many times to apply pesticide for the growth period of each crop ?

- 1) 1-2 times ()
- 2) 3-4 times ()
- 3) 5-6 times ()
- 4) More than 7-8 times ()

16. What is the time interval for each pesticide applying?

1) 2-3 days () 2) 4-5 days () 3) 6-7 days () 4) More than 8 days ()

17. Do you know about the concept of safe interval of pesticide applying?

1) Yes, I know about the concept, and implement it as reference ()

2) Yes, I know the concept, but have not implemented it ()

3) I know the concept, but do not know how to implement it specifically ()

4) Not clear ()

18. How do you use the pesticides ?

1) Using one type of pesticide each time ()

2) Using two types of pesticides together ()

3) Using several types of pesticides ()

4) One or several types of pesticides in combination with a bactericide ()

5) One or several types of pesticides or bactericides in combination with a herbicide ()

6) Other (please specify)

19. Will you take the weather into consideration in applying pesticides?

1) Never () 2) Occasionally () 3) Sometimes () 4) Yes ()

20. What following weathers will affect pesticide applying?

1) Rainy () 2) Windy () 3) High temperature () 4) Other (please specify)

21. How do you prevent and treat the subterranean pests, powdery mildew and rust disease, etc of the wheat ?

1) Seed dressing with pesticide and bactericide ()

2) Pesticide spreading, root drenching or bactericide spraying ()

3) Pesticide and bactericide spraying ()

4) Other (please specify)

22. What pesticide do you use in prevention and treatment of the subterranean pests, powdery mildew and rust disease, etc of the wheat?

1) Seed dressing with isofenphos methyl+triadimefon ()

2) Seed dressing with triadimefon ()

3) Triadimefon spraying ()

4) Phoxim seed dressing ()

5) Other (please specify)

23. Have the wheat ever had phytotoxicity in seed dressing with isofenphos methyl+triadimefon or triadimefon?

1) Yes () 2) No () 3) There occurred seedling emerging delay of the wheat () 4) The rate of emergence decreased () 5) Other (please specify)

24. Have there occurred any phytotoxicity in other pesticide applying?

1) Yes () 2) No ()

25. If there occurs crop phytotoxicity, what do you think are the main causes?

1) Pesticide quality problems ()

2) Improper instruction on the pesticide label or lacking of information ()

3) Insufficient instructions of the agricultural department ()

4) Weather causes ()

5) Own using problems () { Overdosage () Wrong using time ()

Applying to wrong crops () Mixing of multiple pesticides () }

26. Have there held any trainings on pesticides in your local places in recent three years ?

1) No () 2) 1-2 times () 3) 3-5 times ()

4) More than 5 times () 5) I don't know ()

27. How many times do you attend the training on pesticides in average every year ?

1) Never () 2) 1-2 times () 3) 3-5 times () 4) More than 5 times ()

28. What following type of training have you attended ?

1) Agricultural training class () 2) Area, village and group training () 3) Field on-site instructions () 4) Peasant field school () 5) Evening school () 6) Agricultural broadcasting and television school ()

7) Other (please specify)

29. What is your attitude toward the peasant field school for the trainings on safe and scientific using of pesticides ?

1) Very willing to attend () 2) Will attend if other people do ()

3) I don't care much whether to attend or not () 4) Not necessary to attend ()

30. What is your attitude towards the safety protection measures in the process of applying pesticides?

- 1) Not necessary() 2) Having not considered it()
- 3) Mouth-muffle shall be worn() 4) Mouth-muffle and protective clothes shall be worn()
- 5) After pesticide applying, hand washing and clothes changing and washing shall be conducted immediately()

31. What should you do if person poisoning accident occurred in pesticide applying?

- 1) Handling according to the instruction on the label() 2) Consulting the pesticide manufacturer through telephone() 3) Consulting relevant specialists through telephone()
- 4) Sending her/him to hospital for emergency treatment ()
- 5) Sending her/him to hospital for emergency treatment carrying the pesticide label()

32. What do you usually do when the prevention and treatment effects are not so good after applying one type of pesticide ?

- 1) Increasing the dosage() 2) Purchasing other pesticide according to the recommendation from pesticide dealers()
- 3) Purchasing other pesticide by looking up relevant materials by myself()
- 4) Consulting plant protection technicians() 5) No good options()

33. How do you dispose your unspent pesticides ?

- 1) Storing them by classification() 2) Disposing them ()
- 3) Storing them casually for future use() 4) Giving them to other peasant for use()

34. What is your opinion towards the shelf life marked on the pesticide label?

- 1) Having not noticed it() 2) The overdue pesticide can be used all the same()
- 3) Paying attention to the valid period when buying the pesticide, and do not buy overdue ones()

35 How do you dispose the used packing of pesticides ?

- 1) Discarding them directly in the field() 2) Having not considered it()
- 3) Collecting them and disposing them to trash can() 4) Collecting them and burning them off()
- 5) Collecting them and burying them deeply underground() Recycling them to the pesticide dealers or their distribution department()

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36. Have you ever received the unified prevention and treatment of pests organized by the government ?

- 1) Yes() 2) No()

37 What is your attitude towards the unified prevention and treatment of pests and diseases organized by the government ?

- 1) Very supportive of it() 2) Having not considered it() 3) Not supportive of it()

38. If the government organized unified prevention and treatment of pests and diseases, how much is the pesticide cost per mu acceptable to you?

- 1) below 100 yuan() 2) 100-150 yuan() 3) 150-200 yuan() 4) 200-250 yuan() 5) More than 250 yuan()

39. What is your attitude towards the unified purchase of certain pesticides to distribute them to peasants?

- 1) Very supportive of it() 2) Having not considered it() 3) Not supportive of it()

中文原文	英·翻· (用·色·注·不太明确)	曹小姐·核	·客·
ATESC : ··技·推广服·中心	Agro-Tech Extension & Service Center	□□	
FAO : ·联合国粮···	Food and Agriculture Organization	□□	
GB : 国(家)·(准)	Guobiao	Chinese standard	
IPM : 有害生物·合管理	Integrated Pest Management	□□	
PMO : ·目管理·公室	Project Management Office	□□	
PMP : 病虫害管理·划	Pest Management Plan	□□	
PPMO : 省·目· ;	Provincial Project Management Office	□□	
CPMO : 市(·)·目· ;	City/County Project Management Office	□□	
Cm : ···目管理人· ;	County level project managements	□□	
Ct : ··技·人· ;	County level technicians	□□	
Tt : ··技·人· ;	Town level technicians	□□	
Fm : ·目···合体或骨干··代表	Project peasant household union or backbone peasant	□□	

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	household representatives		
▪ 草料	Forage	□□	
中 ▪ 材	Chinese medicinal crops	Chinese medicinal plants	
苗木	Nursery-grown seedling	Nursery stock	
支柱 ▪ ▪	pillar industry	□□	
剩余 ▪ ▪ 力	surplus labor power	surplus labor	
城 ▪ 一体化	city and countryside integration	□□	
可持 ▪ ▪ 展	sustainable development	□□	
▪ 田整治	farmland consolidation	□□	
病虫害管理 ▪ 境 ▪ 估	Evaluation on the Pest Management Environment	Environmental evaluation on the Pest Management	
平均降雨量	Average percipitation	□□	
有效 ▪ 温	Effective accumulated temperature	□□	
无霜期日数	Frost-free period	□□	
平均蒸 ▪ 量	Average evaporation capacity	Average evaporation	
耕地面 ▪	Agricultural acreage	□□	
▪ ▪ 人口	Agricultural population	□□	
人均耕地面 ▪	Per capita area of cultivated farmland	per capita arable land	
粮食 ▪ ▪ 量	Total grain output	□□	
生 ▪ ▪ ▪	Total output value	□□	
年人均收入	Annual per capita income	□□	
畜禽 ▪ 料	livestock or poultry feeds	□□	
▪ ▪ 作物	Economic crops	□□	
主要 ▪ 作物	Staple crops	□□	
全膜双 ▪ 沟播	whole covering on double ridges and planting in catchment furrows	Ditch sowing corn in double ridges mulched with plastic film	
覆膜起 ▪ 方式	film-covering and ridge-forming method	□□	
地下害虫	Subterranean pests	□□	
吸 ▪ 虫	midge	□□	
▪ 蜘蛛	red spider	Red spider (Tetranychus)	
粘虫	armyworm	<i>Mythimna separate</i>	
蚜虫	Aphid	Aphid (<i>Aphididae</i> spp.)	
玉米螟	European corn borer	European corn borer (<i>Ostrinia furnacalis</i>)	

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棉 · 虫	cotton bollworm	cotton bollworm (<i>Heliothis armigera</i>)	
黄地老虎	cutworm	cutworm (<i>Agrotis segetum</i>)	
棉蚜	Cotton aphid	Cotton aphid (<i>Aphis gossypii</i>)	
棉 · 蜘蛛	cotton red spider	cotton red spider (<i>Tetranychusurticae</i> spp.)	
叶甲	leaf beetle	leaf beetle (<i>Chrysomelidae</i> spp.)	
小菜蛾	plutella xylostella	diamond back moth (<i>Plutella xylostella</i>),	
斑潜 ·	leafminer	leafminer (<i>Liriomyza sativae</i>)	
白粉虱	whitefly	Greenhouse whitefly (<i>Trialeurodes vaporariorum</i>)	
· 蛴	Grub	□□	
地老虎叶甲	cutworm	□□	
金 · 虫	wireworm	wireworm (<i>Elateridae</i> spp.)	
梨木虱	psylla pyrisuga forster	<i>psylla pyrisuga</i>	
介壳虫	scale insect	scale insect (<i>Coccoidea</i> spp.)	
卷叶蛾	leaf roller	leaf roller (<i>Tortricidae</i> spp.)	
苹果蠹蛾	carpocapsa pomonella	<i>Carpocapsa pomonella</i>	
食心虫	Borer pests	□□	
黄条跳甲	Striped flea beetle	Striped flea beetle (<i>Phyllotretacruciferae</i> spp.)	
黑 · 油菜叶甲	entomoscelis suturalis weise	<i>Entomoscelis suturalis weise</i>	
油菜茎象甲	ceuthorrhynchus asper	<i>Ceuthorrhynchus asper</i>	
潜叶 ·	leafminer	leafminer (<i>Agromyzidae</i> spp.)	
条 · 病	stripe rust disease	□□	
白粉病	powdery mildew	□□	
全 · 病	Full rot disease	□□	
病毒病	viral diseases	□□	

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玉米 ▪ 黑穗病	Maize head smut	□□	
瘤黑粉病	gall smut	□□	
穗腐病	Ear rot disease	□□	
茎基腐病	stalk rot disease	□□	
青枯病	bacterial wilt	□□	
棉花黄萎病	Cotton verticillium wilt	□□	
棉花枯萎病	fusarium wilt	□□	
茎基腐病 (黑痣病、立枯病)	stem base rot diseases(pigmented naevus, seedling blight)	stem base rot diseases (tarspot, damping off)	
▪ 疫病	Late blight	□□	
早疫病	early blight	□□	
▪ 腐病	Ring rot disease	□□	
黑 ▪ 病	black shank disease	□□	
▪ 痂病	scab disease	□□	
霜霉病	Downy mildew	□□	
灰霉病	Grey mold disease	□□	
炭疽病	anthracnose	□□	
疫病	epidemic disease	blight	
黄萎病	greensickness	□□	
枯萎病	wilt disease	□□	
根 ▪ ▪ 虫病	root knot nematode	□□	
▪ 病	rust disease	□□	
甘草褐斑病	liquorice brown patch disease	brown patch disease of <i>Glycyrrhiza uralensis</i>	
党参	odonopsis pilosula	<i>Odonopsis pilosula</i>	
黄芪	Milkvetch root	<i>Leguminosae</i> spp.	
根腐病	root rot disease	□□	
当 ▪ 麻口病	Ma-mouth Disease in <i>Angelica sinensis</i>	Linen mouth Disease in <i>Angelica sinensis</i> ,	
苹果腐 ▪ 病	Apple rot disease	Apple cranker,	
梨黑星病	pear scab disease	□□	
干腐病	dry rot disease	□□	

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褐斑病	brown blotch	☐☐	
斑点落叶病	Alternaria mali roberts	☐☐	
桃流胶病	peach bleeding disease	☐☐	
葡萄霜霉病	grape downy mildew	☐☐	
葡萄白粉病	grape powdery mildew	☐☐	
胡麻枯萎病	flax droop disease	flax blight disease	
向日葵霜霉病	sunflower downy mildew	☐☐	
油菜菌核病	Sclerotinia rot of colza	☐☐	
胡麻立枯病	flax wilt disease	☐☐	
胡麻炭疽病	flax anthracnose	☐☐	
辛硫磷	Phoxim	☐☐	
毒死蜱	chlorpyrifos	☐☐	
▪ 虫 ▪	acetamiprid	☐☐	
三 ▪ ▪	triadimefon	☐☐	
戊 ▪ 醇	tebuconazole	☐☐	
丙 ▪ ▪	propiconazole	☐☐	
克·▪·▪衣·	enamaine seed dressing	Carbofuran-diniconazole seed coating agent	
▪ 衣 ▪	seed coating	☐☐	
三氟·▪·菊·	cyhalothrin	☐☐	
▪ 虫 啉	thiacloprid	☐☐	
丙 ▪ 磷	profenofos	☐☐	
阿 ▪ 菌素	avermectins	☐☐	
▪ ▪ 灵	pyridaben	☐☐	
▪ ▪ 菊 ▪	cypermethrin	☐☐	
甲霜灵 ▪ ▪	metalaxyl mancozeb	☐☐	
▪ 氧化 ▪	copper hydroxide	☐☐	
吡虫啉	imidacloprid	☐☐	
噁霜灵 ▪ ▪	hymexazol mancozeb	☐☐	
代森 ▪ ▪	mancozeb	☐☐	
氟菌霜霉威	triflumizole propamocarb	☐☐	
多 ▪ 霉素	spinosad	☐☐	
▪ ▪ 菊 ▪	decamethrin	☐☐	
甲基硫菌灵	thiophanate methyl	☐☐	
多菌灵	carbendazim	☐☐	

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百菌清	chlorothalonil	□□	
霜 · · · ·	cymoxanil mancozeb	□□	
霜霉威	propamocarb	□□	
· · · 啉	dimethomorph	□□	
三乙 · 酸 ·	fosetyl-Al	□□	
多硫 · 浮 ·	polysulfide suspending agent	□□	
· · · 啉胍	alkene moroxydine	□□	
· 用 · 霉素	streptomycin	□□	
· 霉胺	pyrimethanil	□□	
甲霜灵	metalaxyl	□□	
· 抗120	agricultural antibiotic 120	□□	
· 多威	methomyl	□□	
· 戊菊 ·	fenvalerate	□□	
甲基托布津	thiophanate methyl	□□	
石硫合 ·	lime sulfur mixture	□□	
腐必清	pine taroil	□□	
福美砷	asomate	□□	
甲基立枯磷	tolclofos-methyl	□□	
· 作倒茬	Crop rotation and succession	□□	
· 薯脱毒	Seed potato de-virus	□□	
高温浸 · · 菌 · 虫	High-temperature seed soaking for de-virus and insecticide	High-temperature seed soaking for sterilization and insects killing	
自然光高温 · 棚	natural light high-temperature close shed	high-temperature tightly greenhouse with natural light	
播 · 沟 (穴) 用 ·	Applying chemicals in sowing furrow (hole)	□□	
撒施毒土	spreading pesticide-clay mixture	□□	
熏 · 病虫	Smoking pests	Fumigation	
地下灌根	underground root drenching	□□	
地上 · ·	Over ground mist spraying	□□	
土 · 病害	soil-borne diseases	□□	
枯萎	Wilt	□□	
· 虫病	nematode disease	□□	

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苹果 ▪ 蚜	woolly apple aphid	woolly apple aphid (<i>Eriosoma lanigerum</i>)	
西花 ▪ ▪	western flower thrip	western flower thrip (<i>Frankliniella occidentalis</i>)	
烟粉虱	bemisia tabaci	<i>Bemisia tabaci</i> (Gennadius)	
盲椿象	miridae	<i>Miridae</i> spp.	
▪ ▪ 薯坏疽病	potato gangrenosis	□□	
小麦根病	wheat root disease	□□	
麦 ▪ 病毒病	wheat viral disease	□□	
矮花叶	dwarf mosaic disease	□□	
▪ 叶病	red leaf disease	□□	
灰 ▪ 虱	plant hopper	plant hopper (<i>Laodelphax striatellus</i>)	
玉米大斑病	corn leaf blight	corn northern leaf blight	
玉米小斑病	Corn southern leaf blight	□□	
▪ ▪ 薯 ▪ 腐病	potato ring rot disease	□□	
▪ 江中下游	the middle and lower reaches of Yangtze River	□□	
菜青虫	cabbage caterpillar	Cabbage worm (<i>Pieris rapae</i>)	
甘 ▪ 夜蛾	cabbage army worm	cabbage army worm (<i>Mamestra brassicae</i>)	
烟青虫	tobacco budworm	tobacco budworm (<i>Helicoverpa assulta</i>)	
▪ 翅目害虫	lepidoptera pests	lepidoptera	
刺吸性害虫	sucking insects	□□	
叶 ▪	leaf mite	leaf mite (<i>Tetranychidea</i> spp.)	
真菌性病害	fungous diseases	Fungus diseases	
寄生 ▪ 虫	parasitic nematode	□□	
棉花叶 ▪	cotton aphid	cotton aphid (<i>Tetranychus cinnabarinus</i>)	
当 ▪	angelica sinensis	<i>Angelica sinensis</i>	
▪ 食性	Monophagy	□□	
寡食性	oligophagy	□□	
黄芪籽蜂	brachophagus huonche Liao et Fan	<i>Brachophagus</i> spp.	
白菜型春油菜	Chinese cabbage type	Chinese cabbage	

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	spring rape	type spring rape (<i>Brassica campestris</i>)	
胡麻短 ▪ 卷蛾	falseuncaria kaszabi razowski	flax wilt disease and <i>falseuncaria kaszabi</i> <i>razowski</i>	
苹果 ▪ 果病	apple brown blotch	apple scar skin disease (ASSD)	
霉心病	rosette disease	mould core disease	
▪ 枝蛾	walnut sun moth	walnut sun moth (<i>Heliodinidae</i> , spp.)	
云斑天牛	batocera horsfieldi	<i>Batocera horsfieldi</i>	
葡萄灰霉病	white rot disease	Grey mould	
散黑穗病	loose kernel smut	□□	
枝枯病	branch rot disease	□□	
中 ▪ 人民共和国 ▪ ▪ 品 ▪ 量安全法	Law of the People's Republic of China on Agricultural Product Quality Safety	Agricultural Product Quality Security Law of People's Republic of China	
中 ▪ 人民共和国 ▪ ▪ 管理条例	Regulations on the Control of Agricultural Chemicals of the People's Republic of China	Pesticide Regulations of the People's Republic of China	
▪ ▪ 管理条例 ▪ 施 ▪ 法	Measures for Implementing the Regulation on Pesticide Administration	Measures for the Implementation of Pesticide Regulation	
无 ▪ 染 ▪ ▪ 品管理 ▪ 法	Measures on Management of Pollution- free Agricultural Products	□□	
▪ ▪ 安全使用 ▪ 准	Standards for Safety Application of Pesticides	□□	
▪ 色食品 ▪ ▪ 使用准 ▪	Green food — Pesticide application guideline	Pesticide Application Guideline for Green Food Production	
食品中 ▪ ▪ 最大残留限量	Maximum residue limits for pesticides in food	□□	
食品中有机磷 ▪ ▪ 残留量的 ▪ 定	Determination of Organophosphorus Pesticide Residues in Foods	□□	
▪ ▪ 合理使用准 ▪	Guideline for Safety Application of Pesticides	□□	
植物 ▪ 疫条例	Regulations on Plant Quarantine	□□	
▪ ▪ ▪ 运、 ▪ 售和使用的防毒 ▪ 程	Antitoxic Regulations for Storage-transportation,	□□	

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	Marketing and Use of Pesticides		
甘 · 省 · 品 · 量安全条例	Ganshu Provincial Agricultural Product Quality Safety	Ganshu Provincial Agricultural Product Quality Safety Regulations	
· 牧 ·	Office of Agriculture and Animal Husbandry	Department of Agriculture and Animal Husbandry	
工商局	Industrial and Commercial Bureau	□□	
· · 局	Quality Control Bureau	Quality Supervision Bureau	
· · 所	Institute for drug control	Institute for the Control of Agrochemicals	
省 · 技推广 · 站	Provincial Agro-tech Extension General Station	□□	
省 · 作物工作站	Provincial Work Station of Economic Crops	□□	
· · 合作社及 · 民 · 会	Agricultural cooperatives and peasant association	□□	
· 残 · · · · 机构	Organization and institutions of pesticide residue detection	□□	
· · 品批 · 市 · 及超市 · · 品 · 量 · · 站	Quality detection station for gricultural product wholesale market and supermarket agricultural product	Quality detection station for wholesale market and supermarket agricultural products	
· · 品生 · 基地 · · 品 · 量 · · 点	Agricultural product quality detection point for agricultural product production base	Agricultural product quality detection point in agricultural product production base	
· 虱	plant hopper	□□	
内吸性 · 虫 ·	systemic pesticides	□□	
触 · 性 · 虫 ·	contact pesticides	□□	
低 · 幼虫期	young larval stage	young larva stage	
交替用 ·	Applying pesticide alternatively	□□	
有机氮 ·	andorganic nitrogen types	organic nitrogen	
有机磷 ·	organophosphorus types	Organophosphorus	
· 除虫菊 · ·	pyrethroid types	pyrethroid	
氨基甲酸 · ·	carbamic acid ester types	carbamate	
三致	mutagenesis, carcinogenesis or	□□	

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	teratogenesis		
瓢虫	ladybug	ladybug (<i>Coccinellidae</i> , spp.)	
草蛉	Lacewing	lacewing (<i>Chrysopidae</i> , spp.)	
食蚜	Syrphidae	syrphids (<i>syrphidae</i> , spp.)	
▪ ▪	assassin bug	Assassin bug (<i>Reduviidae</i> , spp.)	
▪ ▪	thrips	<i>Thripidae</i> spp.	
西方盲走	typhlodromus occidentalis	<i>Typhlodromus occidentalis</i>	
植	phytoseiid mites	<i>phytoseiidea</i> , spp.	
李始叶	eotetranychus pruni oudemans	<i>Eotetranychus pruni</i>	
全爪叶	citrus red mite	<i>Panonychus citri</i>	
赤眼蜂	trichogramma	Trichogramma (trichogrammatid)	
▪ 蚜小蜂	encarsia formosa	<i>Encarsia formosa</i>	
蚜	aphidius sp.	<i>Aphidiidae</i> spp.	
黄	yellow braeonid wasp	<i>Apanteles glomeratus</i>	
▪ 云金杆菌	thuringiensis	<i>Bacillus thuringiensis</i>	
白僵菌	beauveria bassiana	<i>Beauveria bassiana</i>	
木霉菌	trichoderma	<i>Trichoderma</i> spp.	
虫霉菌	entomophthoralean fungi	entomophthoralean fungi (<i>Erynia montana</i>)	
新植霉素	neomycin	□□	
井	jinggangmycin	validamycin	
性	sex pheromone bait	□□	
▪ 帝 (▪ 杏素)	lvdi (ginkgetin)	□□	
洋金花生物碱水 (洋金花)	flos daturae alkaloid reagent (flos daturae)	<i>Flos daturae</i> alkaloid aqueous solution	
苦参碱水	alkaloids of sophora flavescens	Matrine aqueous solution	
藜苦碱醇溶液	chenopodium alcohol-alkali solution	vertrine alcoholic solution	
楝素乳油	azadirachtin emulsion	toosedarin emulsion	
▪ 藤	rotenone emulsion	□□	
己	hexaconazole	□□	
▪ 虫胺	nitenpyram	□□	
▪ 虫	thiamethoxam	□□	
霜	cymoxanil-mancozeb	□□	

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甲霜	metalaxyl-mancozeb	□□	
霜	oxadixyl-mancozeb	□□	
	enoyl-mancozeb	□□	
嫁接防病	disease control by grafting	□□	
甜菜夜蛾	spodoptera exigua	<i>Spodoptera exigua</i>	
美洲斑潜	liriomyza sativae	<i>Liriomyza sativae</i>	
跳甲	flea beetle	Flea beetle (<i>Halticidae</i> spp.)	
斜夜蛾	spodoptera litura	□□	
灯光	light trapping	light trapping and killing	
甜菜夜蛾核多角体病毒	spodoptera exiguanuclear polyhedrosis virus	Spodoptera exigua nuclear polyhedrosis virus (NPV)	
夜蛾核多角体病毒	nuclear polyhedrosis virus of plusia agnata	Plusia agnate nuclear polyhedrosis virus (NPV)	
小菜蛾粒体病毒	granulosis virus diamond of back moth	Plutella xylostella granulosis virus (GV)	
茶尺蠖核多角体病毒	nuclear polyhedrosis virus of ectropis obliqua	Ectropis obliqua polyhedrosis virus (NPV)	
棉虫核多角体病毒	cotton bollwormnuclear polyhedrosis virus	Heliothis armigera nuclear polyhedrosis virus (NPV)	
苦参碱	matrine	□□	
印楝素	azadirachtin	□□	
烟碱	nicotine	□□	
藤	rotenone	□□	
苦皮藤素	celangulin	□□	
阳霉素	liuyangmycin	□□	
除虫菊素	pyrethrin	□□	
硫磺浮	sulphur suspensions	□□	
氟菊、	cyfluthrin ,	□□	
氟菊	cyhalothrin	□□	
苯菊	bifenthrin	□□	
甲菊	fenpropathrin	□□	
氟丙菊	acrinathrin	□□	
硫双威	thiodicarb	□□	
丁硫克百威	carbosulfan	□□	
抗蚜威	pirimicarb	□□	
异丙威	mobucin	□□	
速威	tsumacide	□□	
百虫	dipterex	□□	

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▪ ▪ 畏	Dichlorphos DDVP)	□□	
▪ 拉硫磷	carbofos	□□	
乙 ▪ 甲胺磷	acephate	□□	
▪ 果	dimethoate	□□	
三 ▪ 磷	triazophos	□□	
▪ 螟硫磷	sumithion	□□	
倍硫磷	fenthion	□□	
二 ▪ 磷	Diazinon	□□	
▪ 胺硫磷	phosmet	□□	
▪ 幼 ▪	Chlorbenzuron	□□	
氟 ▪ ▪	chlorfluazuron	□□	
氟 ▪ ▪	hexaflumuron	□□	
氟虫 ▪	flufenoxuron	□□	
除虫 ▪	diflubenzuron	□□	
▪ ▪ ▪	buprofezin	□□	
抑食 ▪	RH5849	□□	
虫 ▪ ▪	tebufenozide	□□	
▪ ▪ 灵	pyridaben	□□	
四 ▪ ▪	clofentezine	□□	
▪ ▪ ▪	fenpyroximate	□□	
三 ▪ ▪	azocyclotin	□□	
炔 ▪ 特	propargite	□□	
▪ ▪ ▪	hexythiazox	□□	
苯丁 ▪	fenbutation oxide	Fenbutatin oxide	
▪ 甲 ▪	monoformamidine	semiamitraz	
双甲 ▪	amitraz	□□	
▪ 虫 ▪	monosultap	□□	
▪ 虫双	dimehypo	□□	
▪ 螟丹	cartap	□□	
甲胺基阿 ▪ 菌素	methylaminoavermectin	□□	
▪ ▪ 胺	cyromazine	□□	
氟虫 ▪	fipronil	□□	
▪ 虫 ▪	chlorfenapyr	□□	
丁 ▪ ▪	diafenthiuron	□□	
碱式硫酸 ▪	alkali copper sulfate	Basic copper sulfate	
氧化 ▪ ▪	cuprous oxide	□□	
王 ▪	copper oxychloride	□□	
▪ 氧化 ▪	copper hydroxide	□□	
代森 ▪	zineb	□□	
福美双	thiram	□□	
乙磷 ▪	phosethyl-Al	□□	
▪ 菌灵	thiabendazole	□□	

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三·醇	triadimenol	□□	
··醇	diniconazole	□□	
·菌·	myclobutanil	□□	
乙霉威·硫菌灵	diethofencarb-thiophanate	□□	
腐霉利	procymidone	□□	
异菌·	iprodione	□□	
·····淋···	dimethomorph-mancozeb	□□	
霜·····	cymoxanil -mancozeb	□□	
··丙基苯酚	o-allylphenol	□□	
氟·淋	flumorph	□□	
·酸·淋胍	moroxydine hydrochloride	□□	
·霉灵	hymexazol	□□	
·菌·	thiodiazole-copper	□□	
咪·胺	prochloraz	□□	
咪·胺··	prochloraz-manganese chloride complex	□□	
抑霉·	imazalil	□□	
氨基寡糖素	amino-oligosaccharin	□□	
·胺·	imibenconazole	□□	
春·王·	Kasumin-Bordeaux	□□	
·····	oxazolidon -mancozeb	□□	
脂肪酸·	copper fatty acid	Fatty acid copper	
松脂酸·	copper resinate	□□	
··菌·	azoxystrobin	□□	
菇·蛋白多糖	fungus polysaccharide	□□	
春雷霉素	kasugamycin	□□	
多抗霉素	polyoxin	□□	
宁南霉素	ningnanmycin	□□	
六六六	Benzene hexachloride (BHC)	□□	
滴滴涕	dichlorodiphenyl trichloroethane (DDT)	□□	
毒·芬	toxaphene	□□	
二··丙·	dibromochloropropane	□□	
·虫·	chlordimeform	□□	
二·乙·	dibromoethane	□□	
除草·	nitrofen	□□	
艾氏·	aldrin	□□	
狄氏·	dieldrin	□□	
汞制·	mercury compounds	□□	
砷·	arsenic compounds	□□	
··	lead compounds	□□	
·枯双	Bis-A-TDA□□	□□	

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氟乙·胺	fluoroacetamide	□□	
甘氟	gliftor	□□	
毒鼠·	tetramine	□□	
氟乙酸·	sodium fluoroacetate	□□	
毒鼠硅	silatrane	□□	
甲胺磷	methamidophos	□□	
甲基·硫磷	parathion-methyl	□□	
·硫磷	parathion	□□	
久效磷	moncrotophos	□□	
磷胺	phosphamidon	□□	
甲拌磷	phorate	□□	
甲基异柳磷	isofenphos-methyl	□□	
特丁硫磷	terbufos	□□	
甲基硫·磷	Posfolan-methyl,	□□	
治螟磷	sulfotep	□□	
内吸磷	demeton	□□	
克百威	carbofuran	□□	
涕·威	aldicarb	□□	
··磷	ethoprophos	□□	
硫·磷	phosfolan	□□	
·毒磷	coumaphos	□□	
地虫硫磷	fonofos	□□	
··磷	isazofos	□□	
苯·磷	fenamiphos	□□	
三···醇	dicofol	□□	
一年生禾本科	Annual growth gramineae	Annual grass (<i>Gramineae</i> spp.)	
·叶·草	broadleaf weeds	latifoliate weeds	
返青	Returning green	□□	
分蘖初期	Early tillering stage	□□	
耙匀	Leveling even with harrow	Rake the soil smooth	
拔·期	Jointing stage	□□	

