

APPLICATION OF IPM IN PREVENTING INTERGRATED CASHEW PESTS AND DISEASES IN THE CENTRAL COASTAL ZONE OF VIETNAM

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Cashew (*Anacardium occidentale* L.) is a perennial industrial crop grown more than 50 countries over the world, of which Vietnam has planted fairly widely for the last years. The world cashew market is rather stable and has a good tendency. The cashew consumption countries are mostly developed ones such as: American, Germany, England, and Japan... These countries can neither grow cashew nor apply import tax to cashew nut. While the cashew nut supplier limits, the African countries often have prolonged drought spells. On the other hand, the cashew nuts are produced in the tropical regions, specially in the coastal tropics. This is the comparative advantage in some countries.

Therefore, the cashew business of Vietnam has quickly increased in the area, yield and production. In 2004, the cashew area in Vietnam obtained 350,000 ha, of which 130,000 ha was high-yield cashew lines with the average yield of 1.1 tons/ha, increased 61.3 % compared to the one in 1997 and the raw cashew production of 350,000 tons; the cashew area in 2007 was above 400,000 ha. To forecast, at the end of 2010, the total cashew areas are 450,000 ha for the intensive grafting cashew cultivation with the average yield of 1.4 tons/ha (high - yield regions of above 2.0 tons/ha), which make it feasible to increase the production of 500,000 tons/year and the cashew kernel of 140,000 tons/ha.

Like other crops, the cashew growth is not only damaged by a certain disease and pest but also attacked to min at the same time by many diseases and insects, some of which have a close relationship together (same increase or same decrease). They can either damage on a certain stage of the cashew growth or prolong during the process of cashew life. Consequently, the preventive cashew pests and diseases to be carried out integrately include many measures (IPM).

IPM on cashew is an integrated pest management strategy to reduce the application of plant protection chemicals, ensure safe environment, ecology and community health, which contributes to the sustainable agriculture production through the harmonious collaboration of various preventive measures. The measures of cultivation and biology in IPM are the first priority ones. The measure of plant protection medicine is necessarily used to survey, monitor pests on field and calculate economic benefits.

1. Cultivation methods

1.1. Selecting vigour cashew seedling

To select a vigour seedling for planting, attention should be paid to ensure technical requirements in the nursery:

- Prior to sowing, seeds should be treated with warm water (2 portion of boiled water and 3 portion of cold water, temperature of about 52-55⁰C) or some kinds of fungicides such as Benomyl, Mancozeb, Roval

- Land for sowing seeds or used in plastic bags as containers should be treated with fungicides, then covering with nylon canvas for 10 days. After opening canvas, evenly mixing land prior to making plastic bags for 3 days.
- The nursery should be established in a cool and dry place.
- Always maintained at reasonable sowing density.
- Irrigation sources for the nursery should be clean and have no heavy metals.
- Grafting root: vigour tree, strong and straight growth with the height of 40-45 cm and no pests and diseases, which meets the standards for grafting root.
- Grafting shoot: selecting buds mature enough about physiology, no insects and diseases and taken from vigorous parent's plants.
- Grafting practice: when grafting, operations should be carried out softly and exactly to reduce unnecessary wounds which are easily damaged by insects and diseases.
- Taking care of seedling in the nursery: After grafting, nursery should be continuously controlled to detect timely insects and diseases. Thence, recommending properly preventive measures, putting down balanced fertilizer and irrigation ensure the standards of seedling at the stage of planting. Standards for grafting cashew seedlings:
 - + At the age of plants: 6 - 8 months
 - + The plant length from top grafting shoot to top growth is 15 cm with 8-10 leaves, plant diameter of 5 mm.
 - + Vigorous plants, no insects and diseases.

1.2. Cultural practices

- Land should be cleared (including wild plant residues, bushes, weed...) at pre-planting, then sprinkling powdered lime on the ground and overturning earth prior to digging pits to wipe out insects and diseases.
- Digging pits: attention should be paid to set top-soil on one side and sub-soil on the other side and pits should be dry for 7- 10 days so that the soil fungus are exposed to sunlight and die, then, mixing muck and phosphate on the top-soil and filling up pits (taking notice of applying decompose muck, avoiding fresh manure keeping inside fungus, bacterium, pathogenic residue).
- Cashew cultivation: plants should be cultivated softly to avoid young plant damage and stump can be covered with straw, hay at post-planting in order to keep humidity but should be covered with the spacing of 10-15 cm to reduce insects and diseases. To restrict wounds due to rain and wind, sticks should be bound against the plants at post-planting.

1.3. Practices of cashew care:

Cashew is a long-duration industrial crop which can even live nearly 100 years. Therefore, it is very necessary to take care of and fertilize for the cashew and the operation should be

carried out annually. To prevent cashew insects and diseases, the measures should be done as following:

- Pruning: In the initial stage, shade needs to be formed truncated cone to facilitate for care and protection.
- After harvesting, residues and weeds in the nursery should be annually cleared and the parts of the damaged cashew are burned or deeply buried into the ground. Cutting hidden branches in the plant shade, no bearing fruit branches make it ventilated for cashew orchard to limit the growth of the insects due to no shelter (the operation should be carried out 2 times/year, after harvest and at the end of the dry season).
- Wild bushes should be cleared around the cashew orchard to reduce the shelter of pests and diseases.
- No intercropping is secondary host of cashew pests and diseases in the orchard.
- On the flat or small sloping lands, after clearing residues and weeds in the cashew orchard, overturning earth can be carried out in the orchard with the shade distance of 1m because collision with plant can cause wounds. The operation has a good effect on annihilating soil pests and diseases, limiting weeds and making soil soft, which creates the condition for the good plant growth and development. This can be done once per year at the end of dry season.
- At the beginning and the end of the rainy season, cashew should be properly fertilized with N-P-K. Muck and decomposed organic manure (every stump of 10-20 kg) for the plant growth and development and resistance to pests and diseases. When fertilizing, slots should be dug around the plant shade (at open shade and chessboard shape at close shade) to avoid broken roots easily damaged by fungal infections.
- At the dry season or at the period of blooming and fruit setting, plants should be irrigated. However, water is a spreading medium of pests and diseases, so irrigation should be paid attention to the following points:
 - + Spout should not be used with strong flow to push directly away the stump, which roots up.
 - + Spout should not used to spray on the plant shade at the period of blooming and fruit setting.
 - + Sources for irrigation and sanitation are clear, avoiding polluted areas for irrigation
 - + Technologies for saving irrigation can be applied such as drip irrigation with fertilizing and spraying chemicals.
- To protect cashew stem borer, lime water can be applied to weep the stump of 1 m from the ground. The operation should be regularly done once per year at the beginning of the dry season. The solution of Bordeaux 1% can be also applied to weep the stump

2. Preventive pests and diseases with the physical measures

- If low and local damaged pests and diseases are detected, it is necessary to collect egg hatches, kill young and mature insects. Cut diseased leaves and branches then buried or burned
- In the winter - spring season (from November to March of the following years), smoking out should be periodically done for 7- 10 days in the cool evening and in the early morning to drive away mirid bug, pupal, cocoon, coleopterous insect, butterfly of leaf insects... Notice: burning at the start of wind direction, put them scattered in the cashew orchard, avoid burning and spreading the cashew tree.

3. Pest protection

There are a lot of insects and pests on the cashew tree, which is both harmful to pests and useful with us. However, the pests are in small quantities and very susceptible to plant protection chemicals, so they are easily died and often recover in slowly qualities. If many pests appear on the cashew tree, chemical measures need not be applied to prevent cashew insects and diseases. Therefore, we need to detect and have protection measures or multiply the pests, then release the cashew orchard. This measure is cheap and safe to environment and crop production.

Some kinds of pests often see on the cashew tree: bug with yellow eyes, yellow ant, coleopterous insect, ladybird, dragonfly, spider... and some kinds of fungus: white fungus...

4. Some of the cashew insects and diseases and preventive measures

To prevent effective and integrated cashew pests and diseases, it is very necessary to identify morphology, damage symptom, growth cycle of some pests and diseases

4.1. Cashew pests

Table 1. Some of major cashew diseases in the central coastal region.

No.	Name of pests	Scientific name	Damaged parts	Common level
1	Red lappet (red caterpillar)	<i>Criculla trifenestrata</i>	leaf	++
2	Leaf miner	<i>Acrocercop</i> Sp.	young leaf	+++
3	First long division (shoot borer)	<i>Alcides</i> Sp.	young shoot	+++
4	Stink bug (red bug)	<i>Helopeltos antonii</i>	young shoot, bloom, fruit	+++
5	Green citrus aphid	<i>Hypomeces squamorus</i>	young leaf	++
6	Ash weevil	<i>Myllocerus</i> Sp.	young leaf	++
7	Leaf webber	<i>Lamida</i> Sp.	leaf, bloom, fruit	++
8	Fruit borer (seed borer)	(<i>Lepidoptera</i>)	seed	+++
9	caterpillar	<i>Euproetis</i> Sp.	young leaf	++
10	Straight – bodied	<i>Plocacdesrus</i>	stem	+

No.	Name of pests	Scientific name	Damaged parts	Common level
	prionid (brown capricornbeetle)	<i>osbesus</i>		
11	Black spanworm (black caterpillar)	(<i>Lepidoptera</i>)	Leaf	++
12	Wedworm (badworm moth)	<i>Oiketicus</i> Sp.	young leaf, fruit	+++
13	Leaf roller	(<i>Totricidae</i>)	leaf, bloom, fruit	+++
14	Black citrus aphid	<i>Toxoptera aurantii</i>	young shoot, bloom, fruit	++
15	Stinkbug long brown crurd (long brown bug)	<i>Anonploenemic</i> Sp.	young leaf, shoot	++
16	Teminer	<i>Isoptera</i>	stem	++

Note: +++: very common ++: common, +: less common

4.2. Cashew diseases:

Table 2. Some of major cashew diseases in the central coastal region.

No.	Name of diseases	Microorganism damage	Damaged parts	Common level
1	Common scab (root collar rot)	<i>Phytophthora palmivora</i> , <i>Phythium</i> , <i>Furarium</i> , <i>Sclerotium</i> , <i>Rhizoctonia</i>	young tree root collar	++
2	Anthraxis	<i>Colletotrichum gloeosporioides</i>	leaf, bloom. Shoot and fruit	+++
3	Disease and non competitive (Fig pink disease)	<i>Corticium salmonicolor</i>	branch, stem	+++
4	Sooty mold	<i>Capnodium</i> Sp., <i>Meliola</i> Sp.	leaf	++
5	Moist disease (gummosis)	<i>Diplodia</i> Sp., <i>Pellicularia salmonicolor</i> , <i>Ceratocystis</i> Sp.	stem, branch	++
6	Leaf spot disease	<i>Pestalotia</i> Sp.	leaf	+++
7	Cluster	-	stem, branch	+
8	Lichen	-	stem, branch	+
9	Red seaweed spot	-	Leaf	+++

Note: +++: very common ++: common, +: less common

The component of cashew insects and diseases is much diversified and complex, especially at the period of bud and bloom. Therefore, intergratedly preventive cashew insects and diseases should be done to bring high benefits. Apart from the condition of each different orchard,

individual measures can be focused to increase economic benefits and protect ecological environment.

4.3. The stages should be noticed in preventing intergrated cashew pests and diseases:

4.3.1. The basic stage:

From the planting to the third year, the cashew trees continuously grow and appear many shoots, so the prevention of leaf insects and shoot miners should be done. After developing a spell of leaves, the cashew trees stop growing for a time, and then the top growth of young shoot arises for a new spell of leaves. The stage should be done to spray chemicals with kinds of ones such as: Sherpa, Supracide, Fenbis... Continuous spraying for 2 times, 7- 10 days/ times.

4.3.2. The stage of fruit setting:

(1) After harvest (from May to July)

Clearing orchard, pruning and burning diseases branches.

Applying lime + clay or the solution of Bordeaux 1:4:15 sweep the stump of 1 m from the ground or Validacin to prevent pink fungus.

(2) The stage of young shoot (from August to December)

The cashew trees in the stage give 1-3 spells of young shoots, so many damage pests and diseases occur: shoot borer, leaf insect, pseudococcus.... and pink fungus, anthracnosis.....

Applying insecticides : Sherpa, Decis, Bitox, Confidor....

Applying chemicals for disease prevention : Bordeaux 1%, COC 85, Champion, Ridomil, Bavistin...

(3) The stage of bloom and fruit setting: (from January to April)

This is the most important and effective prevention stage which seriously damages. Leaf insects include such as: leaf miner, red caterpillar, ash weevil, anthracnosis causing dry bloom and falling young fruit, fig pink disease.

Pruning can be combined with insecticides and growth stimulant and leaf manure:

Applying insecticides : Sherpa, Decis, Bitox, Confidor...

Applying chemicals for disease prevention: Bordeaux 1%, Bavistin, Champion, Ridomil, Antracol... Specially, Alietle having high effect on the kinds of diseases, mainly dry and young fruit diseases .

Growth stimulant: Atonix, Dekamon, HQ101.

Leaf manure: Flower, Multipholiate, KNO₃

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