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Studying and Evaluating People's Awareness of Environmental Protection in Using Plant Protection Drugs: A Case Research in Cai Lay District, Tien Giang Province - Vietnam

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Abstract: *Along with the social – economic development, agricultural activities have strongly been, especially in the provinces of the Mekong Delta in Vietnam. It cannot be denied that the agricultural activities have much contributed to the development of the region, however, intensive agriculture accompanying with a lot using herbicides and pesticides could affect the environment including human health. Therefore, this research has been implemented in order to assess status as well as awareness of people in using plant protection drugs in Cai Lay district – Tien Giang province, and thence proposing solutions for promoting the people's awareness in the region. The results gained from the research implementation showed that: agricultural acitivities acompanying with using plant protection drugs have been strong in Cai Lay district; some environmental components and places in the studied region have sign of contamination although with slight level; and awareness of people on enviropnmental protection and plan protection drugs use is quite would, but it could be improved if there are better policies and programs regarding environmental protection from the government developed and applied.*

Key words*: Agricultural activities, awareness, environmental protection; plant protection drugs.*

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I. Introduction

Cai Lay district is one of 11 administrative units at district level of Tien Giang province, the district has 16 administrative units at commune level, of which: 14 administrative units are inland and 02 administrative units belong to the island. Economic structure of the district include agriculture, industry and service, however, agriculture is still dominated and most income of people in the district is from agricultural activities. In recent years, the agricultural sector of Cai Lay district has developed towards the direction of commodity production. As a reason, a large amounts of plant protection drugs has been used in cultivation. It cannot be denied that the use of plant protection drugs has brought high production productivity to the famers and contributed to improvement of people's lives in the region. However, along with the positive aspects there could be also limitations generated in the use of of fertilizers, pesticides and growth stimulants to increase crop yields, especilally in the case of it's abuse and non - proper application. In addition, the handling packaging and containers of plant protection drugs after use and non – thorough treatment of livestock waste and wastewater in aquaculture have also exacerbated the level of environmental pollution, adversely affecting public health as well as the sustainable development of the district. In fact, there is almost no managemnt solutions including treatment and collection for plant protection drug packaging, bottle and containers in Cai Lay district. These types of hazardous waste are discarded by people in the fields, gardens and places closed to water bodies. Therefore, it is necessary to have a scientific and systematic study of the current situation of using plant protection drugs and people's awareness of environmental protection in the region, and this is also the main reason for the topic: "*Studying and evaluating people's awareness of environmental protection in using plant protection drugs: A case research in Cai Lay district, Tien Giang province - Vietnam"*, has been implemented

II. Literature Review

2.1. Overview of plant protection drugs

2.1.1. Concept of plant protection drugs

Commonly in Vietnam, the phrase "Plant Peotection Drugs" mean all pesticides and herbicides that have the effect of preventing, destroying or controlling harmful organisms including vectors that cause disease in humans and animals, or other harmful insects in the production, processing, storage, export, marketing of food, agricultural products, parasites. However, in this research the concept of plant protection drugs can be

understood as are preparations originating from chemicals, plants, animals, microorganisms and other preparations. In agriculture field, plant protection drugs are used for controlling organisms which may be harmful to plant resources. The protection drugs in this research also include the substances which are used to regulate plant growth, dispel or attract harmful organisms to plant resources to destroy.

2.1.2. Classification of plant protection drugs

According to Nguyen Van Tam (2017), there were 436 active ingredients in the market with thousands of different trade names on plant protection drugs. However, all of plant protectio drugs using in Viet nam can be classified into 5 main categories based on the use of the drug as follows:

- Category of Pesticides with main ingredients include: Chlorinated organic compounds (*hydrochloric acid*); Phosphorus compounds (*phosphoric acid esters*); Carbamic salts; Natural and artificial pyrethroids; and Dinitro phenol.
- Category of Herbicides that have main ingredients of: Nitro aniline; Carbamic and thiocarbamic salts; Heterocyclic nitrogen compound (*triazine*); Dinitrophenol and phenol derivatives.
- Fungicides which have such main ingredients as: Inorganic fungicides (based on copper sulfate and mercury); Organic fungicides (*dithiocarbamat*); Fungicides through roots (*benzimidazoles*); and Antibiotics (products from microorganisms).
- Rat poisoning agents: Anticoagulants (Hydroxy coumarins);
- Stimulants including Growth inhibitors (quatermary compound), Stimulating sprouting (*Carbamates*), Stimulating fruit drop (*cyclohexmide*).

2.2. The environmental issues related to plant protection drugs

It cannot be denied that using plant protection drugs has brought a number of positive aspects such as improving agricultural production productivity, increasing income for farmer in part and society in general etc. However, accompanying positive aspects, the use of plant protection drugs has also generated many problems related to the natural environment and the social – economic environment as well. Non – proper using plant protection drugs and shortage of understanding environmental protection could affect the environment: polluting soil, surface water and groundwater; polluting the ambient air environment; issues related to urban beauty.

2.2. Overview of awareness and level of awareness

2.2.1. Concept of awareness

According to the Wikipedia (2019), awareness is a relative concept, it may be focused on an internal state, such as a visceral feeling, or on external events by way of sensory perception. It is analogous to sensing something, a process distinguished from observing and perceiving. Awareness or "to sense" can be described as one that occurs when the brain is activated in certain ways. The concept of awareness in this study can be understood as the ability to perceive, identify and sense the matter and things related to environmental protection in using plant protection drugs.

2.2.2. Level of awareness

The concept of level of awareness in general and level of awareness about using plant protection drugs and environmental protection in part is quite abstract. Understanding and feeling about a certain issue depends on many factors of the subjects such as age, gender, activity fields, positions,... However, the objective of this research is to be outlined overall picture of the knowledge of the farmers and people related to plant protection drugs in Cai Lay district, since then proposing measures to improve the understanding of the people in protection of health themselves and environmental protection in agricultural activities. Therefore, the concept of the level of awareness in this study include: the ability to comprehend; understand the elements and characteristics of the drugs used; and the ways to effectively protect the environment.

III. Research content and methods

3.1. Research contents

In order to achieve the objectives of the project, the following research contents have been taken during implementtion of the research.

- Generally assessing the status of agricultural activities in Cai Lay district, Tien Giang province: The issues studied in this content include the relationship between the natural and sociao – economical conditions and agriculture, the types of agriculture in the studied region
- Studying and assessing the real status of using plant protection drugs and methods used by farmers to handle the plant protection drug waste.
- Studying and evaluating awareness of farmers and people related to the use of plant protection drugs in the studied area..

- Proposing measures to enhance the efficiency of environmental protection and promoting people's awareness in using plant protection drugs in the region: Based on data and information gained from the research, measures related to legal regulations on environmental protection and treatment, education and training causes, supporting tools as well as encouraging subjects have being initiated.

3.2. Research Methods

In the process of implementing the research, there have been many methods used in order to perform the proposed contents, the methods include internal works in conjunction with field survey. Details of the methods and data collected during the research implementation are as follow:

- Synthesis and data collection method: The data and information related to cultural and social characteristics of Cai Lay district as well as the relationship between natural conditions and agricultural development of the region have been collected. The sources of the documents have been from libraries, newspapers, radio, internet, research works of domestic and foreign authors
- Field surveying combined with interviewing relevant subjects: The data and information such as status of agriculture activities, methods and behavour of people directly using herbicides and pesticides; and awareness of people to environmenal protection, have been collected by face to face interview or filling given questionaire. The number of interviewees identified to conduct survey have been calculated by the formula of Yamane (1973), as follows: $n = N * (1 + Ne^2)^{-1}$. Therefore, the total number of interviewees is about 98 people, the interviewees have been randomly chosen and are representative of people related to using plant protection drugs in the district
- The equipments and materials which have been used in the research implementation are: motorcycles used for transportation; maps and GPS are used to identify routes and location of places and households that need to be surveyed in the studied area; and recorders have been used for recording images as well as answers of the interviewees..

IV. Results and Discussion

4.1. Natural socio-economic conditions and agricultural activities of Cai Lay district

Cai Lay district is located in the economic - urban western area of Tien Giang province. It has a natural area of 29,599 ha and is divided into 16 administrative units, one of the district's strengths of the district is agriculture. District topography is relatively flat, average elevation is 0.9 - 1.1m and there is no clear slope direction. The soil is formed by sedimentation of the Mekong River. The mechanical composition of all types of alluvial soil in the area is heavy, high clay content. The population of the district in 2017 was 187,690 people with an increase of 0.38% per year, the average population density is 634 people per km^2. cultivation activity plays an important role in the social - economic structure of the district (cultivation land area account for 80% of the natural area, 99% of the agricultural land area), the main products are rice and fruit trees, the total cultivated area is about 23,611 ha.

Cai Lay district has 14,312 hectares of specialized gardens, which are concentrated in Ngu Hiep, Tam Binh, Long Trung and Long Tien communes and scattered in some communes in the southern part of the district. The island of Ngu Hiep commune is considered a cradle of durian trees, granted by the National Office of Intellectual Property - Ministry of Science and Technology. Durian is considered the most important fruit tree in the district with the area of 6,121 hectares, accounting for 68% of the area of fruit trees in the studied area. Cai Lay district is considered a district with the highest amount of durian in the country with total output about 109,000 tones/year. Rice paddy of the district accounts for 28% of cultivated area with a total cultivated area of 9,202 ha and mainly distributed in the northern communes of National Highway 1A. However, the rice cultivated area tends to decrease by 0.5% per year due to the increase of specialized land (Nguyen Van Tam, 2017).

4.2. The status of using plant protection drugs and methods of handling it's waste in the studied area

4.2.1. The use of plant protection drugs in Cai Lay district

4.2.1.1. Kind of plant protection drugs used in cultivation of the region

For the purpose of having data and information related to using plant protection drugs and methods of handling the waste generated from drug's use, the research has conducted field surveys and interviewed some objects relative to the agricultural activities in the region. The results obtained in the research process showed that there are about 34 brand names of plant protection drugs used and mainly for eliminating pests and fungus, only one kind is stimulant. Details of the kind of drugs used in the studied area are presented in the table 4.1 below.

Table 4.1. List of drugs used in the studied area

No.	*Name of drugs*	*Aims of use*	*Active agents*	*Packing types*	*Size/weigh*
1	Actara 25wg	Killing pests	Thiamethoxam	Package	1g
2	Agri-fos 400	Killing pests	Phosphorous	Package	100g
3	Amater 150sc	Killing pests	Indoxacarb	Bottle	50ml
4	Amistar top 325sc	Treating disease	Zoxystrobin; Difenoconazole	Bottle	100ml
5	Antracol 700wg	Treating disease	Propineb	Package	100g
6	Anvill 5sc	Treating disease	Hexaconazole	Bottle	100ml
7	Bassa 50ec	Killing pests	Fenobucarb	Bottle	450ml
8	Bifentox 30nd	Killing pests	Fenvalerate; Dimethoate	Bottle	100ml
9	Beam 75wp	Treating disease	Tricyclazole	Package	100g
10	Canfidor 100wg	Killing pests	Imidacloprid	Bottle	100ml
11	Catex 3.6ec	Killing pests	Abamectin	Bottle	100ml
12	Cheer 29wg	Killing pests	Dinotefuran	Package	6.5g
13	Chess 50wg	Killing pests	Pymetrozine	Package	15g
14	Chief 260ec	Killing pests	Chlorfluazuron; Fipronil	Package	15g
15	Comcat 150wp	Stimulator	lychnis Viscaria	Package	5g
16	Dupont 250ec	Killing pests	Picoxystrobin	Package	2,2g
17	Eddy 72wp	Killing pests	Coprous oxide; Coprous oxide	Package	300g
18	Filia 525se	Treating disease	Propiconazole; Tricyclazole	Bottle	100ml
19	Fuan 40ec	Treating disease	Isoprothiolane	Bottle	480ml
20	Help 400ec	Treating disease	Azoxystrobin; Difenoconazole	Package	10ml
21	indo super 150sc	Killing pests	Indoxacarb	Package	50ml
22	Kasumin 2l	Treating disease	Kasugamycin	Bottle	450ml
23	Kinalux 25ec	Killing pests	Quinalphos	Bottle	480ml
24	Nativo 750wg	Killing fungus	Trifloxystrobin; Tebuconazole	Package	6g
25	Peran 50ec	Killing pests	Permethrin	Bottle	100ml
26	Regen 800wg	Killing pests	Fipronil	Bottle	100ml
27	Ridomil gold 86wg	Preventive S.	Metalaxyl; Mancozeb	Container	5000ml
28	Rocksai	Treating disease	Propiconazole	Bottle	200ml
29	Schesyntop 500wg	Killing pests	Pymetrozine; ChlorpyrifosEthyl	Package	25g
30	Snail 700wp	Killing pests	Niclosamide	Package	35g
31	Sofit 300 ec	Killing grass	Pretilachlor	Bottle	100ml
32	Takumi 20wg	Killing pests	Flubendiamide	Package	4g
33	Tilt super 300ec	Treating disease	Propiconazole Difenoconazole	Bottle	100ml
34	Virtako 40wg	Killing pests	Chlorantraniliprole; Thiamethoxam	Package	3g

Although the type of the drugs used for cultivation and care of plants in the studied area is quite diverse, with a total of about 34 types of drugs, but all of these drugs are on the permitted list of Ministry of Agriculture and Rural Development of Viet Nam.

4.2.1.2. The ways of using plant protection drugs in the studied region

The field investigation and interviewing objects who directly do agricultural practices in the studied area showed that there is difference in ways of using plant protection drugs and the selection of using kind of the drugs by people mainly through: watching television; instructions of managers or the agents selling the drugs; advertisment companies supplying or distributing the drugs; and through word of mouth among the people. Specific rate of people selecting kind of plant protection drugs is based on sources of supplying information and it is as follow: 35% of farmers using drugs based on information gained from watching television, instruction on packing and so on; 40% are guided by technicain, managers, training coures; and the remaining 25% from other sources of information such as word of mouth, advertising by agents or drug suppliers.

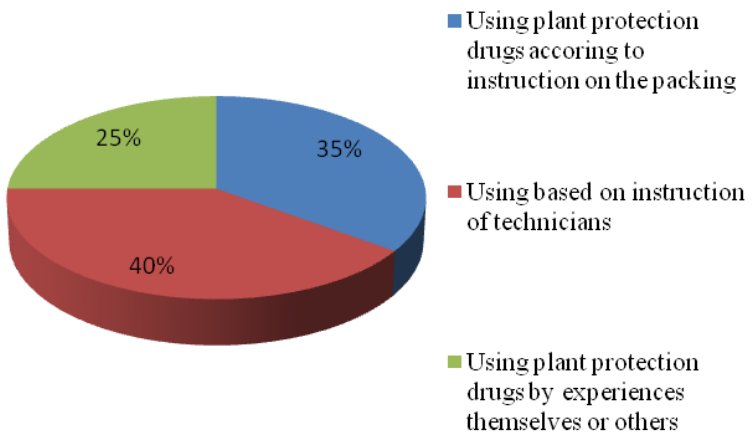

Figure 4.3: The proportion of people using kind of plant protection drugs according to instruction from information sources

One of the reasons leading to inefficient use of plant protection drugs in the region is the dose of the drugs used. If plant protection drugs are used beyond the required dosage, it will not only be economically expensive but also its residues would harm the environment, especially soil and water environments. The results gained from the research have shown that the number of farmers properly using the drugs according to dose used is less than the number of farmers who has improper use of plant protection drugs. Details of the proportion of farmers using the drugs in relation to the dose used are presented in the figure 4.4.

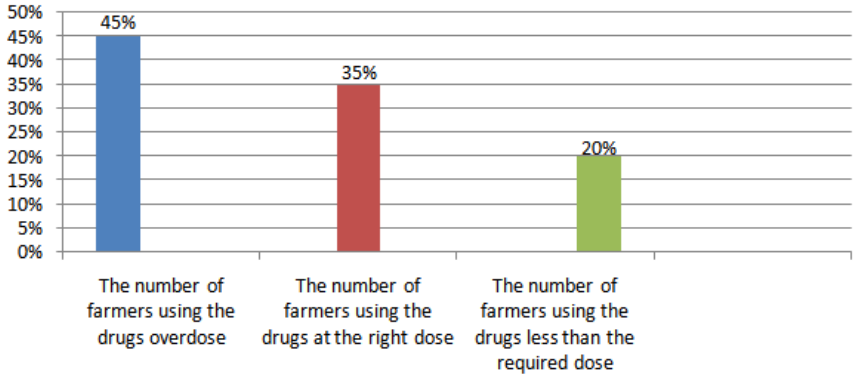

Figure 4.4. The proportion of farmers using plant protection drugs according to dosage

The results of the research implementation have also exposed the fact that: people using the drugs overdose because they are willing to have higher crop productivity. In contrast, all of the farmers who use the drugs less than it's required dose due to they would like to save cost of cultivation.

4.2.1. Methods of farmers handling waste of the drugs after use in the studied area

In order to get data and informations reagarding the ways of people handling the bottles, packing or containers of the drugs after use in the studied area, the research has conducted investigation and survey by interviewing the stakeholders with visual observation in fields. The ressults of the research showed that up to 48% of the drugs' packing and bottles discarded at the scene; about 15% of the waste were collected and stored for selling as junk; and only 37% had been rinsed for reuse.

The results of the study on the way of people handling packing, containers and bottles after use in the research area are prented in the figure 4.5.

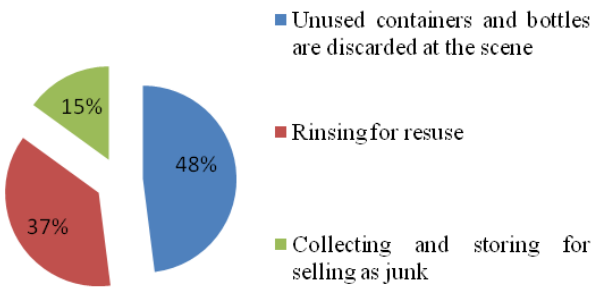

Figure 4.5: Forms of handling drug's packaging and containers after use

4.3. People's awareness on using plant protection drugs and environmental protection

4.3.1. Results of surveying people's awareness of using plant protection drugs

In order to have basis and data for analysing and assessing the people's comprehension and awareness on environmental protection in general and using the drugs in particular, the research has implemented surveys by distributing questionnaires in combination with interviews in the field, the interviewees were representative of 03 groups of people: groups of people who are suppliers of the drugs; group of farmers; and residents of the communities. The collection of information from the groups is done through direct interviews or filling questionnaires. Details of the contents and results of the survey are presented in the tables below**.**

Table 4.2: Ratio of informations related to using plan protection drugs and environment from sources.

No	Groups of people	Sources of information			Notes
		Mass media (newspapers, radio, television, posters, advertising)	*Friends, experiences,..*	*Experts, managers and training classes*	
01	People directly using the drugs	30%	25%	45%	
02	The drug's suppliers/agents	65%	-	35%	
03	Residents	70%	20%	-	10% Not given

Table 4.3: People's viewpoints of the drug's use and environment

No.	Group of people	Using the drugs affects the environment?		Notes
		Yes	No	
01	People directly using the drugs	65%	35%*	*If used correctly according to instruction
02	Suppliers/agents of plant protection drugs	70%	30%*	*if used correctly according to instruction
03	Residents.	85%	15%**	** Not given

From the research results presented in the tables above, it can be seen that: all interviewed groups having knowledge and informations related to using plant protection drugs and environment from many sources, from media to direct communication. Among the sources of information, mass media is one of the most important sources from which people could get knowledge regarding environmental protection and proper use of plant protection drugs as well. Regarding viewpoint of stakholders about whether use plant protection drugs affect the environment or not, most interviewees have thought that use of the drugs affect the environmenta with quite high ratio, especially in the group of residents (85%). However, there is 35% of people who directly use the drugs regarded 'no affect' if proper use.

4.3.2. Results of surveying people's awareness on handling waste of plant protection drugs

For the purpose of assessing people's awareness as well as viewpoints on handling the waste generated from use of plan protection drugs in the studied region, the research had implemented survey combined with public rural appraisal in the Cai Lay district. The contents requiring in the appraisal focus on the such issues as: people's knowledge regarding waste and hazardous waste; viewpoints of the local people on the ways being

used to handle the packing of plant protection drugs; and people's assessment on the efficiency of managemental authorities in the region. The results gained from the research are presented in the table 4.4 below.

Table 4.4: Results of survey on people's awareness of methods treating hazardous waste

No.	Target groups	Having elementary knowledge on waste generated from drugs		Assessing the methods used to handle the waste by the farmers		Assessing the efficiency of the authorities	
		Yes	No	Suitable	Not suitable	Yes	No
01	Drug's suppliers	80%	20%	25%	75%	55%	45%
02	Farmers	65%	35%	70%	30%	68%	32%
03	Communities	60%	40%	65%	35%	35%	65%

From the data presented in the table 4.4 above, it can be seen that the supplier group has elementary knowledge regarding plant protection drugs quite high with 80% of total interviewees; the ratio of interviewees having elementary knowledge regarding plant protection drugs is quite similar in the rest two target groups; and there is quite big difference of assessing the suitability of the methods being used by the farmers to handling the waste generated from use of plant protection drugs, and the communities do not highly assess the effeciency of works of the managemental authority in the region.

According to the KAP model (Knowledge – Attitude – Practice), knowledge will shape and influence people's thinking and behavior and based on the research results which are illustrated in the figure 4.6, it can be seen that there is difference regarding knowledge and actions among the target groups: 80% people of drug's suppliers have elementary knowledge of plant protection drugs when the two others have 65% and 60%; viewpoints, including attitude and practice, of the ways being used by farmers to handle the waste are quite different, especially in the group of the drug's suppliers with only about 25% of the interviewees positively assessed. Despite there still is controversy related to relationship between knowledge of plant protection drugs and actions used to handle the wastes generated among the research members, it could be generally assessed that people with a lot of knowledge about something that will lead themselves having suitable attitudes and corresponding actions to that thing.

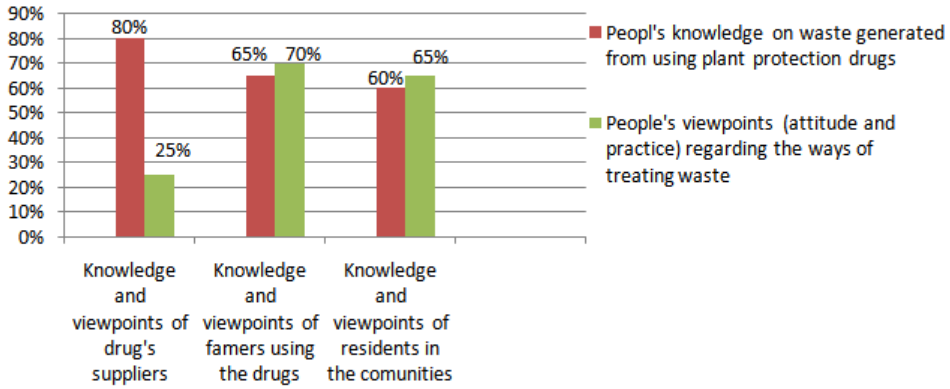

Figure 4.6: Knowledge and viewpoints of target groups in the research

4.4. Analysing and assessing the people's awareness on environmental protection in using plant protection drugs

Based on the data and information gained from the research implementation, it could be assessed as follow:

- People's knowledge and understanding regarding environmental proptection in using plant protection drugs in all groups of interviewees is mainly obtained from mass media; a large number of people belong to the groups drug's suppliers and farmers have the knowledge through trainng cources and consultancy of experts.
- In all the groups of interviewees, the proportion of people recognising the ways being used by farmers to handle the waste generated from the use of plant protection drugs as not suitable is quite high, with 75% in the group of drug's suppliers, even up to 30% of the farmers recognised the methods which are used by them to handle the waste as not suitable.
- Information and data obtained during the study also showed that users' knowledge and attitudes about the use of plant protection drugs decide to handle packaging and bottles after it's use.
- The role of the authorities regarding management of environment and plant protection drugs in the Cai Lay

district is not highly assessed by all interviewees, especially people who are directly related to the drugs.

Although the research results showed that awareness and actions of the target groups related to environmental protection in using plant protection drugs in the Cai Lay district are quite high and quite similar in some issues, but there are still some differences in perceptions and actions among the groups. From the results obtained in the research process, it can confirm that the causes of awareness (knowledge, attitude and action) of the groups of people related to the use of plant protection chemicals in the studied area include: accessibility and awareness of target groups on information; professional qualifications and characteristics; economic conditions as well as exposure to work; and the effectiveness of the environmental management system in the region.

4.5. Proposed solutions for enhancing people's awareness of environmental protection in using plant protection drugs

In order to enhancing the people's awareness on environmerntal protection in using plant protection drugs in Cai Lay district, it is necessary to apply solutions in combination with legal, administrative and educational policies. The proposed solutions could be implemented as follow:

- Developing a strategy to use plant protection drugs/chamicals in accordance with the current status of the agricultural activities in the district with such orientations as: reducing risks in using the chemicals; improving the effectiveness of the drug's use in terms of techniques, economic production and environmental protection; ensuring safety in the drug's use; and raising awareness, understanding and social responsibility among the users
- On basis of the Law on Plant Protection it has been issued and developed a list regulating the use of plant protection drugs for the studied area
- Strengthening inspection of plan protection drugs use and application of new technical advances; Reinforcing and enhancing power of the specialized inspection system for plant and environmental protection. Clearly define authority and responsibilities of the goverments of the commune and ward level in managing, supervising and inspecting the use of agricultural chemicals in general and plant protection drugs in part.
- Developing and reinforcing the organization and policies of the network of plant protection services in the region.
- Promulgating a suitable set of training materials on management, production, business and use of plant protection drugs, training programs for new technical processes and technical advances.
- More considering the contents, the program of training agricultural extension workers, farmers and agents selling pesticides in accordance with urban agricultural conditions in Cai Lay district.
- Organizing propaganda and advocacy for environmental protection: Promoting communication to raise the sense of responsibility of drug's gsuppliers and farmers directly using the plant protection drugs; Providing training courses to improve knowledge of people directly do cultivation; Adding loudspeakers and increasing radio frequency of propaganda programs to implement environmental protection works in general and using plant protection drugs in particular.
- Establish a specialized facility to collect and treat waste generated from using plant protection drugs
- Increasing fines for violations and for cases of repeated violations.

V. Conclusion

Based on the results obtained in the research process, it could be concluded that:

(1) The Cai Lay district has natural - social economic conditions in line with agricultural development, especially cultivation.

(2) The plant protection drugs which have been used in cultivation of the region quite diverse, however, there is aquite large number of farmers lacking knowledge in using plant protection drugs both dose and ways of use.

(3) The handling packaging of plant protection drugs after use is still sensible and not suitable for both technical and regulatory requirements.

(4) People's awareness on environmental protection in using plant protection drugs in the studied region is quite high and quite similar in some issues, although there are still some differences in awareness and action among the groups of people. The reasons related to high or low awareness (knowledge, attitude and action) of people include: accessibility to and awareness on the informations; professional qualifications and career characteristics; economic conditions as well as the level of exposure to work.

(5) The effectiveness of environmental management in general and management of using plant protection in the studied area in particular is not high due to a number of reasons such as knowledge of the target groups, monitoring and supervision, educational activities and propaganda of responsible agencies.

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