IMPACTS OF PESTICIDE USE ON FARMER HEALTH IN THE MEKONG DELTA OF VIETNAM

A MEDICAL AND ECONOMIC ASSESSMENT

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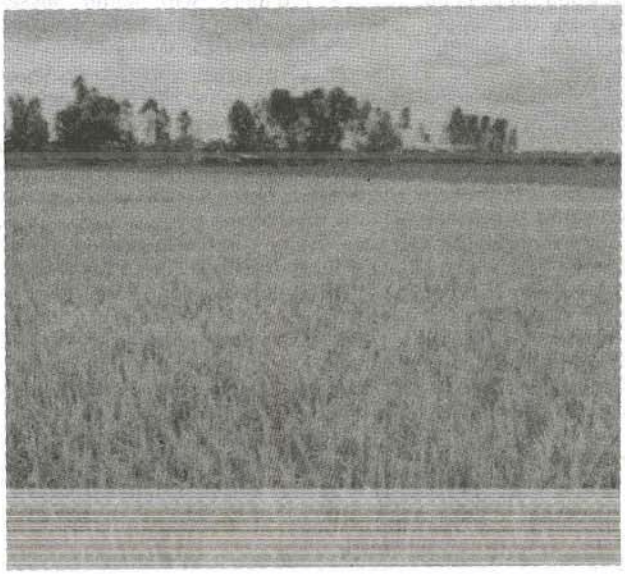
Health data collected from a farm-level survey are used to measure the impacts of pesticide use on farmer health in the Mekong Delta of Vietnam. Results reveal that pesticide use has a bad effect on farmer health and causes some diseases that could reduce farmers' productivity and that there are likely to be socio-economic and environmental benefits from an appropriate decrease in pesticide use in the Mekong Delta rice production.

I. INTRODUCTION

Pesticide is still an inevitable factor in rice production in Asian agricultural countries. The importance of pesticide is increasing although there are various options available for pesticides management such as the program of Integrated Pest Management (IPM) and pest-resistant varieties of rice. In fact, the impacts of pesticide use on farmer health is the community and the Government's deep concern but the research on this issue remains modest. This article is a part of the research program examining the effects of pesticide use on farmer health in the Mekong Delta - the country's biggest rice basket contributing more than 50% of the national rice output per year.

The article targets at identifying disease symptoms caused by the pesticide exposure and the health cost of farmers infected by these chemicals. In the article, the medical examination is based on pernicious symptoms of farmers just after they used pesticides on their rice fields in the winter-spring crop in 1997. The long disease symptom derived from infection of toxic chemicals needs time to monitor farmer health with a team of specialized doctors. Therefore, results will be transferred from a model of the Philippines and estimated suitably for farmers in the Mekong Delta.

We have conducted a random sample of 180 farmers in 6 villages of the Delta's four provinces including Tiền Giang, Đồng Tháp, An Giang and Cần Thơ based on different levels of intensive farming and applications of pesticides in each area. The farmers were directly interviewed about disease symptoms they had been infected just after using pesticides in the four-month winter-spring crop in 1997. The medical indicators of pesticide infection will be determined and related in terms of econometrics (logit regression functions) with such farmers' characteristics as: age, health (weight, height) and habits of drinking alcohol and smoking cigarettes. Health cost (the dose-response function) is also estimated with the same above characteristics. The pesticides commonly used in the 1997 winter-spring crop include 28 insecticides, 17 herbicides and 30 fungicides. These pesticides include Methyl Parathion, Methamidophos, Fenithrothon and Diazinon containing Organochlorine Endosulfan and Organophosphate; Fenobucarb, Benfuracarb and Carbofuran containing cabamates; and Cypermethrin and Deltamethrin containing pyrethroids. The World Health Organization classifies insecticides into two categories: I (very toxic) and II (toxic), while the herbicides are divided into category III (little toxic) and IV (not toxic in common use)



II. MEDICAL ANALYSIS OF DISEASE SYMTOMS FROM PESTICIDE INFECTION

The medical analysis has provided indicators to evaluate health consequence of pesticide use in paddy production in the Mekong Delta. In these consequences, impacts of pesticide on eyes, nervous system and skin are very prevailing for farmers directly using pesticides on their fields. The following symptoms and the logit function are used to examine the impact of these symptoms on farmer health.

1. Impacts on eyes

The eyes are too easily harmed by poisoning chemicals used in agriculture. Eye inflammation for a long time

will cause eye opacity, especially for aged persons. This symptom may affect eye pupils, reduce eyesight and need surgery for clearer sight. Eye opacity thus curtails farmer productivity from uneasy symptom to seriously deficient eyesight.

The logit function reveals the increasing ratio of ophthalmia has relations with alcohol drinking habit and exposure to herbicides and fungicides. The exposure to insecticides (classified into I and II toxic) also has bad effects on eyes, this is indicated by positive TOCA1 variable although the logit function shows no statistical significance. The ratio of weight to height is negative like expectation in case of ophthalmia, in addition, the number of exposures to insecticides of category I and II (NA1) make a significant contribution to the increase in ophthalmia while the number of exposure to herbicides is not positive like the expectation theory and has no statistical significance.

2. Impacts on nervous system

The compound of Organophosphate and 2.4 D is known as those causing nervous disturbance (Morgan 1977). Headache and vertigo are common symptoms of farmers after they have sprayed pesticides. Moreover, they often have trouble sleeping just in the day of spraying pesticide. This will reduce their productivity in the next days.

The ratio of headache symptom significantly refers to farmers' habit of drinking alcohol, age, and health. The variable indicating the habit of smoking cigarette is positive like expectation although it has no statistical significance. The herbicides and fungicides (divided into III and IV toxic category - TOCA3) affect greatly on this symptom, insecticides (TOCA1) have also effects albeit without statistical significance. In fact, 3% increase in TOCA3 will lead to 0.00073% increase in farmer headache after spraying insecticides.

At the sample average relative to age and health, 22% of the farmers drinking no alcohol will have headache when using pesticides. In addition, the total amount of herbicides and fungicides from the sample average when doubling will cause 60% of headache symptoms to farmers.

3. Impacts on skin

The dermatitis symptoms due to pesticide exposure are diagnosed as itchiness and allergy. The percentage of infection is relative to the concentration of chemical and place exposed, especially hands and arms (Castandeda et. al, 1988). The herbicide 2.4 D and insecticide Organochlorines are common substances causing dermatitis (Morgan, 1977).

Table 1: DISEASE SYMPTOMS BECAUSE OF PESTICIDE EXPOSURE

Explanation variable	Ophthalmia	Headache	Dermatitis	Many symptoms
Slope	-1.74*	0.33	-0.37	-4.23**
Age	0.0033	0.025*	-0.012***	0.03**
Smoking habit		0.13		0.18
Drinking habit	0.73***	1.25 ***	0.30**	1.2***
Weight/height	- 0.056 **	-0.095	-0.036***	0.032
Amount of insecticides (TOCA1)	0.000033	0.00033	-0.000092	0.00035
Amount of herbicides and fungicides (TOCA3)	0.001 ***	0.00073 *	0.0011 ***	0.00084*
Times of spraying insecticides (NA1)	0.195 ***	0.12	0.15***	0.11
Times of spraying herbicides and fungicides (NA3)	-0.058	-0.185	0.086**	-0.044
Log-likelihood	-443.2	-101.53	-681.34	-101.57

*, **, *** have statistical significance at levels of 0.10, 0.05 and 0.01 respectively.
Source: Analysis from data of the 1997 survey

The logit function reveals the dermatitis ratio is significantly relative to the times of spraying pesticides, herbicides and fungicides. The amount of herbicides and fungicides as well as health condition also significantly affect the dermatitis. 35% of farmers using no herbicides and examined at the sample average have dermatitis when using pesticides. The probability of infection will rise 56% if the times of exposure to herbicides triple from the sample average.

III. EVALUATION OF HEALTH COST DUE TO PESTICIDE INFECTION

The farmers' spending on health care in the 1997 winter-spring crop after they were poisoned by pesticides includes costs of medicine and medical examination charge at village and districts hospitals; opportunity cost of lay-off; cost of food and cost of protection clothing when spraying pesticides.

Table 2: EVALUATION OF HEALTH COST OF FARMERS IN THE 1997 WINTER-SPRING CROP

Independent variable: Natural logarithm of health cost		
Independent variables (explanation)	Model 1	Model 2
Slope	0.65 (0.2)	2.7 (1.83)
Logarithm of age	1.41*** (0.41)	1.24*** (0.4)
Weight divided by height	-0.026 (0.027)	-0.02 (0.026)
Smoking habit (imaginary variable)	0.02 (0.27)	0.12 (0.27)
Drinking habit (imaginary variable)	0.72*** (0.25)	0.62*** (0.25)
Logarithm of the total amount of pesticides	0.385*** (0.138)	
Logarithm of the amount of insecticides		0.075** (0.04)
Logarithm of the amount of herbicides		0.144*** (0.039)
R^2	0.1537	0.1925
Regression value F	5.52***	6***
Estimated health cost (VND)	44,310	46,390
Final health cost	89,310	91,390

*, **, *** have statistical significance at levels of 1.10, 0.05 and 0.01 respectively.
The parentheses are standard error.
Source: Analysis from data of the 1997 survey

The health cost mentioned above will be referred to the amount of pesticides used on farmers' fields and their characteristics such as health condition (indicating variable: weight divided by height). The dose-response function with appropriate variables will be used to estimate farmers' health care due to pesticide infection in the 1997 winter-spring crop. The regression results indicated in Table 2 show the total amount of pesticides affects greatly farmer health. The health cost will increase 0.385% with 1% increase in the total amount of pesticides. In addition,