

The Value of Pesticides Impact on Onion Farming in Brebes Regency, Central Java-Indonesia

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Abstract. The objectives of this research are: (1) to analyze the characteristics of pesticide used in onion production in Brebes Regency; (2) to identify the impact of pesticide use in onion on farmers' health and their environment; (3) to estimate the economic impact of pesticide use in onion using the economic valuation approach and (4) to formulate an empowerment model to increase farmers' and related parties' awareness on their job safety and environment. This research was conducted in Brebes Regency, Central Java the biggest onion producing area in Indonesia. It employs primary data collected from interviews with selected respondents and key persons. 150 onion farmers were chosen using a multi-stage sampling method while the purposive sampling was used to select 16 key-person respondents. Farmers' pesticide use pattern was based on the types of pesticides used, the existing pesticides use policies and the dosage of pesticides used by farmers in the study area. The use of pesticides in Brebes Regency is relatively not environmentally friendly and highly risky due to exposure to high dosage of pesticides both in terms of the amount and types or combination of pesticides. The level of farmers' empowerment and awareness with regards to pesticide use was however found to be relatively low. Therefore an empowerment model and strategies for pesticide use among onion farmers and related stakeholders (ABGC) are needed.

Keywords: Strategy, Pesticides, Overdose, Green, Environment, Onion, Brebes, Indonesia

1. Introduction

In traditional farming system, farmers were using natural materials to eradicate pest, herb or fungi. But in modern farming system farmers have to use production factors intensively with higher level of technology. Of course, the use of chemical materials for pest-, herb-, diseases- control and fertilizer always poisonous to human and other creatures. However, green revolution to push the production in agriculture products stipulated the use of chemicals material and technology adoption in the practiced of farming system. Scientists are intensively research to find the best breeding in agriculture and animal. The widely used of chemicals in agriculture such as fertilizer, pesticide, herbicide, etc affected the environment quality as well as human being.

Onion (*Allium cepa* var. *ascalonicum*. L) has higher economic value compare to other vegetables variety, particularly in Java. Javanese people are always using onion in the most cooking cuisine. Central Java province contributes for about 48% of Indonesia's onion production as shown in Table1. Brebes Regency is the central production of onion in Central Java Province. It supplied about 75% of Central Java production or 25% of National production. In 2009, Brebes produced for 312,533.2 from the harvest area of 25,000 Ha. Onion shared for about 58% of GDP Brebes Regency (Statistical Bureau of Brebes Regency, 2010).

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Onion production in Indonesia in general, particularly in Brebes Regency is still currently using a relatively high amount of pesticides and chemicals. This is reflected in the declining soil fertility and environmental quality thus impacting on human health in the study area.

This study is expected to shed a lights in materializing the food security achievement of onion for Central Java Province with adaptation proposed model for environmentally friendly in using pesticides and other chemical in farming system.

Table 1: Onion Production in Indonesia by Province (in 2010)

No.	PROVINCE	PRODUCTION (TON)
1.	Jawa Tengah (Central Java)	506,357
2.	Jawa Timur (East Java)	203,739
3.	Jawa Barat (West Java)	116,396
4.	Nusa Tenggara Barat (West Nusa Tenggara)	104,324
5.	Sumatra Barat (West Sumatra)	25,058
6.	Sulawesi Selatan (South Sumatra)	23,276
7.	DI Yogyakarta	19,950
8.	Bali	10,981
9.	Sulawesi Tengah (Central Sulawesi)	10,301
10.	Sumatra Utara (North Sumatra)	9,413
11.	Nusa Tenggara Timur (East Nusa Tenggara)	3,879
12.	Nangroe Aceh Darussalam	3,615

Source: Statistics of Indonesia, 2010.

2. Materials and Methods

The Government of Indonesia regulation No. 6 Year 1995 (re: Crop Protection) declared that people have to use pesticide with (1) a suitable type; (2) a proper dosed for certain crop and organism, (3) a proper way to apply; (4) a proper target of crop; (5) a suitable time; (6) a suitable place. This is due to the impact of pesticide will go to several parties of: farmers, environment, consumers of agriculture products, and surrounding community.

Natural resource and environmental management requires a balance in ecology and economic motives. Hence, economic tend to be the driving factor for people to be rational in decision (Garrod et al., 1999). In developing countries where most people are still partial fall into economic fulfillment, showed that ecology became a secondary. This phenomena is also happened in Indonesia.

In this study, the impact of pesticide used was analyzed from the health and environmental aspects. The health impact was estimated using a proxy of medical cost, while the environmental impact from excessive pesticides used was proxied by the loss of productivity (estimated by replacement cost of soil loss) using the economic valuation techniques (www.eepsea.org). The empowerment strategy is prioritized within the environmental, health, technology and socio-cultural aspects. These selected strategies are determined by the Focus Group Discussion (FGD) and in-depth interviews (Waridin, 1999), and supported by quantitative evidence obtained from the Analytical Hierarchy Process (AHP). The quoted sample of 150 onion farmers were selected using multiple stage sampling (Sekaran, 2000). The competent key-persons were gathered for FGD to outline the strategy of empowerment for the stakeholders from the components of academician (A), Business (B), Government (G), and Community (C).

3. Results

The Agriculture Department of Brebes claimed that year 2010 was affected by climate changed. This extreme climate is really pulled down the production of onion. At the sometime, disturbance and disease are attacking onion crops. This caused the use of pesticide and other chemical are increasing. On the other hand, perhaps farmers may not aware that they have to change their farming practiced accordingly in line with climate changed situation. In normal condition, the production of onion was about 12 ton per Ha. But during a survey, farmers just harvest in average about 7.5 ton per Ha. The highest production is in Wanasari sub-district for about 8.2 ton per Ha and the lowest production is in Larangan sub-district (6.6 ton per Ha).

The respondents used 38 commercial brands of pesticides, which consist of 23 types of insecticides, 12 types of fungicides and 3 types of herbicides. The productivity of onion during the study period was low at only 7.48 ton / Ha. The research also found that most health problems suffered by farmers were headache (67 cases), itchy skin (45 cases), nausea (41 cases), and eye irritation (40 cases). These problems occurred due to lack of awareness among farmers for not using a self-protecting device (APD). From the economic valuation methods, the medical costs to treat the pesticides effects were estimated at Rp 53,425 per farmer.

The environmental impact has caused productivity loss due to soil damage in agriculture and the soil replacement cost was estimated at Rp 8,875,000 per ha. The B/C ratio for onion production using the conventional method (with pesticides/chemicals) is estimated at 1.01 while the ratio is 2.37 when organic farming is practiced. More pesticide used then more losses of productivity in onion farming observed.

About 50 % of farmers had have mixed more than 5 types of pesticide for their onion farming in Brebes. This is considered as high dose pesticide used in this country since farmers are neglecting the usage indication for the respected type of pesticide. They just doing trials and error in mixing the pesticide without rely on the dose. This study found that 78% of farmers have categorized using pesticide in highly over-dosed.

3.1. Impact to the Environment

Impact to the environment was estimated using economic valuation method for soil loss and its rehabilitation costs. The breakdown of the costs is shown in Table 2.

Table 2: Costs of Soil Rehabilitation (per Ha)*

No	Description	Quantity	Price (Rp.)	Costs (Rp.)
1.	Fertilizing with organic material (compos): 4 times	20 ton	100,000	2,000,000
2.	Labor (4 times of soil digging)	36 HKp	4 x 40,000	5,760,000
3.	Biodiversity losses (estimated for 2 % for production cost *)	0.02	53,000,000*)	1,060,000
Total				8,820,000

*) Based on discussion with competent panel from assorted agencies in Brebes. Adimihardja (2008) advised that it takes about 5 years to let the soil naturally recovery.

3.2. Impact to Human Health

There 108 respondents (72 %) of 150 farmers have ever sicked due to pesticide. While the rest of respondents perhaps had have resistant or good in adaptation to handle pesticide or they do not care with their health (Susilowati, 2009). Medical cost is used to proxy the impact of pesticide to human health (Mariono, 2002) and the detail estimation is shown in Table 3.

3.3. Sensitivity Analysis: Benefits and Costs Analysis for Onion using Conventional vs Environmentally Friendly Farming (using Organic)

In order to provide a comparison, this study calculated the option of farming using conventional and green concepts. The direct use value and indirect use values and option values were estimated using economic valuation method. Table 4 showed the detail calculation.

Table 3: Medical Costs Spent by Farmers (per month)

No.	Description	Responden, n=108	
		Frequency	%
1.	Type of effect:		
	Eye irritation/ decrease in eye power	40	37.04
	Sort of throat/ Cough	25	23.15
	Nausea/ vomit/diarea/back pain	41	37.96
	Heart/ blood pressure	1	0.93
	Uneasy	13	12.04
	Headache/ less concentrate	67	62.04
	Dermatitis/ allergy	45	41.67
2.	Illness within a month:		
	- 1 type of illness	24	22.22
	- 2 type of illness	48	44.44
	- 3 type of illness	32	29.63
	- 4 type of illness	4	3.7
3.	Cost to see doctor/ paramedic per head (Rp.)		
	- < 49.,999	44	40.74
	- 50,000 – 99,999	24	22.22
	- 100,000 – 149,999	25	23.15
	- 150,000 – 199,999	15	13.89

Source: primary data, processed in 2010.

Table 4: Comparison the Benefits and Costs of Onion Farming

No.	Description	Conventional (Rp.)	Green Concept ^{*)} (Rp.)
1.	Benefits:		
	A. Direct Value	70,000,000	90,000,000
	B. Indirect Value		
	1. Good environment for working	-	53,425
	2. Increase soil fertility	-	8,875,000
	C. Option Value		
	Biodiversity	-	15,000,000
	Sub-total	70,000,000	113,928.,25
2.	Costs:		
	A. Direct Value	52,835,000	47,950,000
	B. Indirect Value		
	Decrease in soil fertility	1,235,000	-
	C. Option Value:		
	Biodiversity	15,000,000	-
	Sub-total	69,070,000	47,950,000
	B/C Ratio	1.01	2.37

*) Estimation is based on discussion with competent panel from assorted agencies in Brebes.

3.4. Strategy of Empowerment

The use of pesticides in Brebes Regency is relatively not environmentally friendly and highly risky due to exposure to high dosage of pesticides both in terms of the amount and types or combination of pesticides.

The study found that the level of farmers' empowerment and awareness with regards to pesticide use was however relatively low. In addition, the powerment level of onion farmers was measured from environmental, health, technology, and social-culture aspects. In overall, onion farmers in the study area have not used pesticide in a proper quantity and quality of pesticide as suggested by the competent agencies. Most of them are apply pesticide and other chemical material in highly over-dosed. One of their main reason is because farmers do not want to take a risk of their onion will attacked by pest or herb disturbance. They don't think the impact of those poisons to the environment and human, particularly in long term period.

From the Analytical Hierarchy Process (AHP) showed that the priority for empowerment strategy suggests for: (1) farmer should change his/her mind set of using pesticide or chemical material in farming system (score is 0.2); (2) the farmer union should be strengthen and need capacity building (score is 0.16); (3) improve in awareness toward the environment (score: 0.12). The overall inconsistency ratio of AHP is reliable with score of 0.04.

4. Conclusions

The empowerment strategy is prioritized within the environmental, health, technology and socio-cultural aspects. These selected strategies are determined by the FDG and in-depth interviews, and supported by quantitative evidence obtained from the Analytical Hierarchy Process (AHP).

Pesticide use model and strategy for onion production in Brebes can only be achieved when there is awareness among all stakeholders (ABGC) to fulfill the commitment to make onion production more sustainable and pro-environment in the long run. Therefore an empowerment model and strategies for pesticide use among onion farmers and stakeholders (ABGC) are urgently needed.

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