

Agricultural Students' Opinion about Some Issues on Sustainable Agriculture

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ABSTRACT

Agricultural students should be the motivators to promote society awareness on sustainable food security. Sustainable agriculture is one of the most important factors to ensure sustainable food security. This research is intended to collect preliminary data about agricultural students' opinion about some issues on sustainable agriculture.

The research was conducted from August 2002 to June 2003 on agricultural university students from Bogor Agricultural University, Djuanda University (the Faculty of Agriculture) and Sahid University (the Faculty of Agricultural Technology). The number of questionnaire returned was 103.

Agricultural university students' knowledge about indigenous auxiliary vegetables is poor. Most of the students (86%) recognized less than 50 % of the 33 plants being asked. Most of the students considered that grass is useful, weed is useless, and wild plants are both useful and useless depends on the situation. The facts are detrimental for the conservation of Indonesian biodiversity.

About environment and human safety, most students considered that organic farming was safe. Meanwhile, green revolution method was considered dangerous, (mostly because of the chemicals), and transgenic farming was mostly considered safe and dangerous depends on the situation.

About the yield, most students considered that green revolution method would produce the highest yield, and organic farming would produce the lowest compared to transgenic farming. The quality of organic farming products is considered superior, followed by transgenic farming and green revolution method respectively.

About preference, 76% students choose organic farming if they become a decision-maker. It seems that safety and quality consideration are more important to them rather than yield.

From the reasons that they described and the high proportion of 'do not know' and 'no answer' group, it seems that the students' knowledge about farming method, especially transgenic farming is limited. It would be troublesome to conserve biodiversity and promote sustainable agriculture if the students' knowledge is lacking. The students do need obtain balanced scientific information and to be encouraged to study from the society and the nature.

Keywords: sustainable agriculture, students, opinion

I. INTRODUCTION

Due to the inappropriate agricultural policy, many of the world biodiversity are approaching extinction. The Nature Conservancy Council (1984) in Dalzell (1994) reported that between 1945 to 1984, 95% of the UK's wildflower-rich-meadows destroyed due to intensive agriculture practice. A disturbance on a sector in a food chain would be followed by disturbance on the next sector. Department of the Environment UK reported that since 1930, ten species of plants extinct, and 1685 species of insects and 51 species of birds are endangered (Redman, 1992 in Dalzell, 1994). Many insects and birds are important for controlling agricultural pest, maintaining soil fertility, and helping pollination.

Indonesia, a country that has 17 % of the total species in the world, does experience similar devastation. The International Union for the Conservation of Nature (IUCN) reported that in 1996, the number of Indonesian flora being threatened was 184 species. The number is increasing throughout the year (Kehati, 2002).

Low understanding and poor respect to traditional knowledge do induce further disruption. FAO (2002) reported that only 120 out of 30,000 edible plant species are cultivated today. Many plants included the edible ones, which are misleadingly considered as useless, are killed by excessive use of herbicides, while many others are failed to survive in disrupted environment.

Indonesia as the second richest country in biodiversity should take suitable actions to prevent further devastation. Agricultural university students that usually situated as a referee by the society should possess awareness and adequate knowledge about agricultural and environmental issues. This research is aimed to conduct preliminary study about agricultural university awareness on some agricultural and environmental issues.

II. METHODOLOGY

Two hundred questionnaire were distributed to Bogor Agricultural University, Djuanda University (the Faculty of Agriculture) and Sahid University (the Faculty of Agricultural Technology) students to study their knowledge about auxiliary vegetables, and their opinion about wild plants and farming methods.

III. RESULT AND DISCUSSION

A. Respondents

From 200 questioners distributed, there were 103 returned until June 4, 2003. Forty-four of them are IPB students, 29 are Djuanda University students from the faculty of agriculture and 30 of them are Sahid University students from the Faculty of Agricultural Technology. Seventy-one percent of the respondents are younger than 30 years old, 4% between 30 to 41 years old, and 25% did not answer.

The respondent's growth place are dominated by Jakarta (36%), followed by West Java (36%), and Central Java (7%). The rest of the respondents (21%) were from East Java, Aceh, North Sumatera, Bengkulu, Lampung, West Sumatera, South Sumatera, North Sulawesi, South Sulawesi, and Maluku.

B. Students and Auxiliary Vegetables

Auxiliary plants are important part on sustainable agriculture. They functions as green manure, ground cover that promotes the growth of beneficial organism and maintain the soil humidity and temperature, shade and nurse trees, mulch, fallow crops, live fence, windbreak and shelter belt, erosion-controlling plant, land reclamation, live support and stakes, fuel wood and water clearing agent. Some of them are functions as vegetable as well. Such as it is, they are called auxiliary vegetables.

There were 33 auxiliary vegetables asked at the questioner. They are:

- | | |
|------------------------------------------------------|---------------------------------------------------------------|
| 1. <i>Alternanthera sessilis</i> | 18. <i>Oxalis corniculata</i> |
| 2. <i>Amaranthus spinosus</i> | 19. <i>Passiflora foetida</i> L. |
| 3. <i>Anotis hirsuta</i> (L.f.) Boerl | 20. <i>Portulaca oleracea</i> |
| 4. <i>Centella asiatica</i> (L.)urb. | 21. <i>Raphanus sativus</i> L. var. <i>Oleiformis</i> Persoon |
| 5. <i>Cosmos caudatus</i> Kunth | 22. <i>Saccharum edule</i> |
| 6. <i>Crotolaria pallida</i> Aiton | 23. <i>Samanea saman</i> (Jacq.) Merrill |
| 7. <i>Cyperus rotundus</i> L. | 24. <i>Schleichera oleosa</i> (Lour) Oken |
| 8. <i>Erythrina fusca</i> Loureiro | 25. <i>Senna hirsuta</i> (L.) Irwin & Barneby |
| 9. <i>Erythrina subumbrans</i> (Hassk. Merrill) | 26. <i>Senna siamea</i> (Lamk) Irwin & Barneby |
| 10. <i>Erythrina variegata</i> L. | 27. <i>Sonchus arvensis</i> L. |
| 11. <i>Hydrocotyle sibthorpioides</i> | 28. <i>Sonchus asper</i> |
| 12. <i>Kleinhovia hospita</i> L. | 29. <i>Sonchus oleraceus</i> |
| 13. <i>Leucaena leucocephala</i> (Lamk de Wit) | 30. <i>Symplocos odorantissima</i> (BL) Choisy |
| 14. <i>Marsilea crenata</i> | 31. <i>Taraxacum officinale</i> Wigg |
| 15. <i>Monochoria</i> K.B. Presl | 32. <i>Thespesia populnea</i> (L.) Soland ex. Correa |
| 16. <i>Moringa oleifera</i> Lamk | 33. <i>Trianthema portulacastrum</i> |
| 17. <i>Mucuna pruriens</i> (L.) DC. Cv. Group Utilis | |

Most of the students did not recognize the auxiliary vegetables being asked. Most of the students recognized less than 50 % of the asked vegetables (Figure 1). Two of them only knew one out of 33 vegetables (*Leucaena leucocephala* or lamtoro). Students from Tigabinanga (North Sumatera) has the most knowledge about the vegetables, followed by students from Ambon (Maluku), and Purbalingga (Central Java).

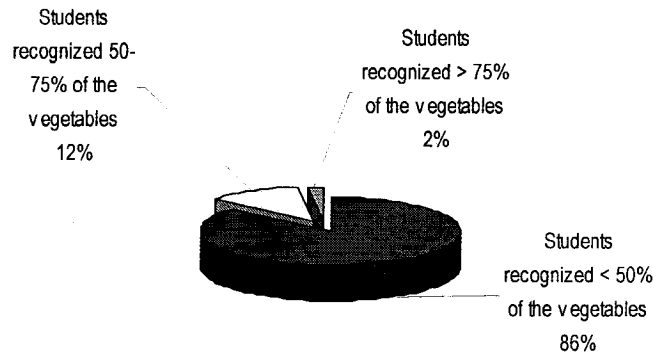


Figure 1. Distribution of the student's knowledge about 33 auxiliary vegetables being asked.

Note: n = 103, average = 31 %, SD = 17 %, top 84.85, lowest = 3%.

From the aforementioned vegetables, *Leucaena leucocephala* (Lamk de Wit) or *lamtoro* was the most familiar auxiliary vegetable (Figure 2). Although the respondents might confused it with *lamtoro gung*, a bigger cultivar of *lamtoro* that was popularized by the government about twenty years ago. The next familiar plant was *Cyperus rotundus* L. or *rumpuk teki*, but only one knew that this plant could be used as vegetable. Meanwhile, the most unfamiliar plant was *Kleinhovia hospita* L (or *timaha*, *timanga*, or *tangkele*). Only 3 percent of 103 respondents knew this plant, they are from North Sulawesi, Ambon and Central Java.

The fact that the students did not recognized indigenous vegetables anymore is detrimental for the conservation of Indonesian biodiversity and food security. Many students are more familiar with introduced vegetables introduced by the Dutch colonist centuries ago such as carrot, cabbage, and potato. The vegetables prefer low temperature, mostly in highlands. The cultivation area is keep decreasing because of tourism industry. Moreover, the fertility of the area is decreasing throughout the year because of erosion. To overcome the problem, many farmers use synthetic fertilizer and synthetic pesticides. The attitude is detrimental for sustainable agriculture and national economy.

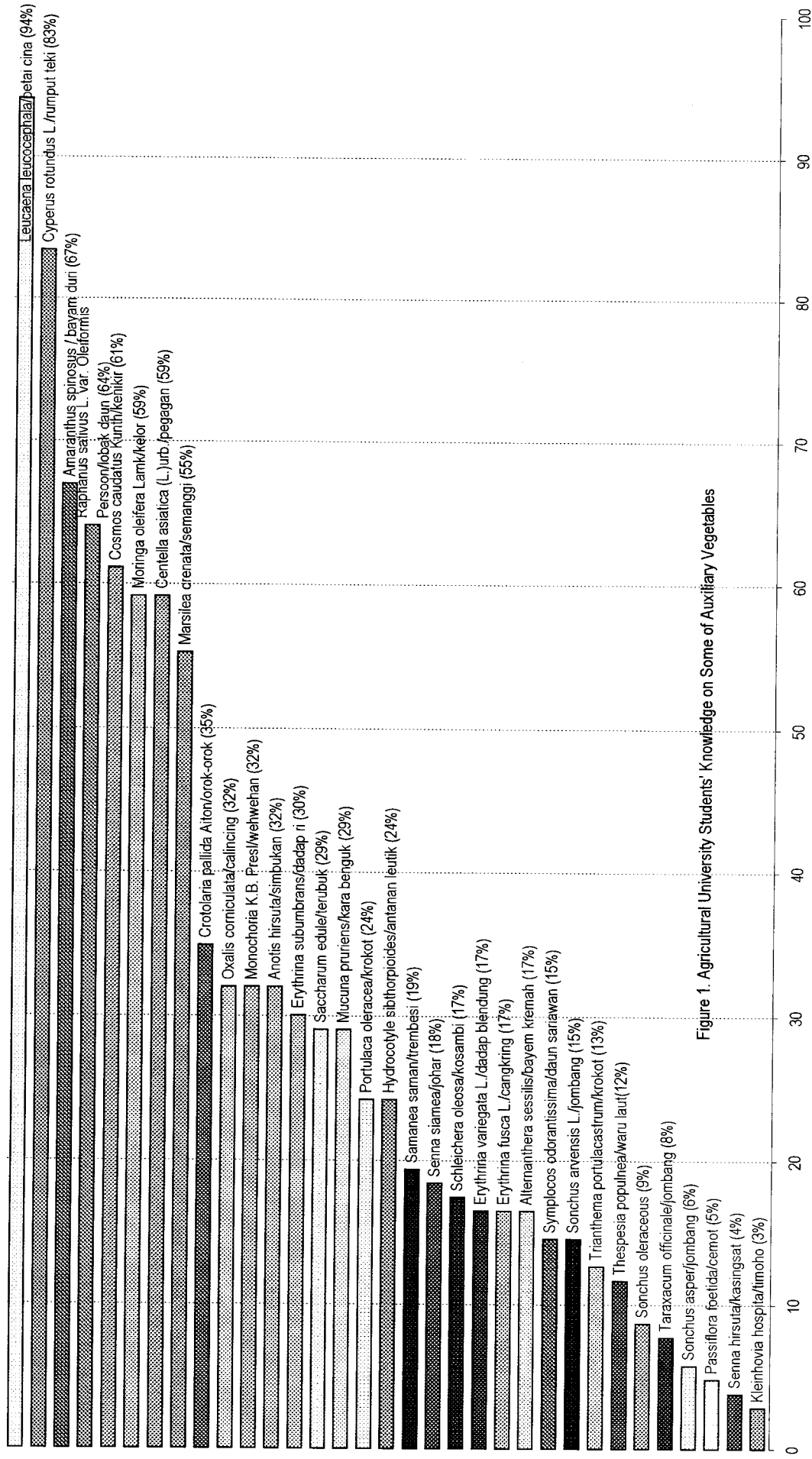


Figure 1. Agricultural University Students' Knowledge on Some of Auxiliary Vegetables

C. Students Knowledge and non Cultivated Plants

Non cultivated plants are important on balancing the ecosystem. Many of them plays important roles on sustainable agriculture such as supporting predators of agricultural pest, supporting insects which are beneficial for pollination, maintain soil humidity, etc. Many wild plants do contain chemicals that function as natural pesticides for plants or medicine for human. Unfortunately, many of this plant are approaching extinction because of excessive use of herbicides. In Indonesia, the market share of herbicides is 50% of the total market of pesticides (Uka, 2001).

Grass, weeds and wild plants are overlapping to each other. Most agricultural university students considered that grass is useful (Figure 3), while weeds are useless. Most students considered that wild plants could be both useful and useless depends on the situation. The summary of their reason is presented at Table 1.

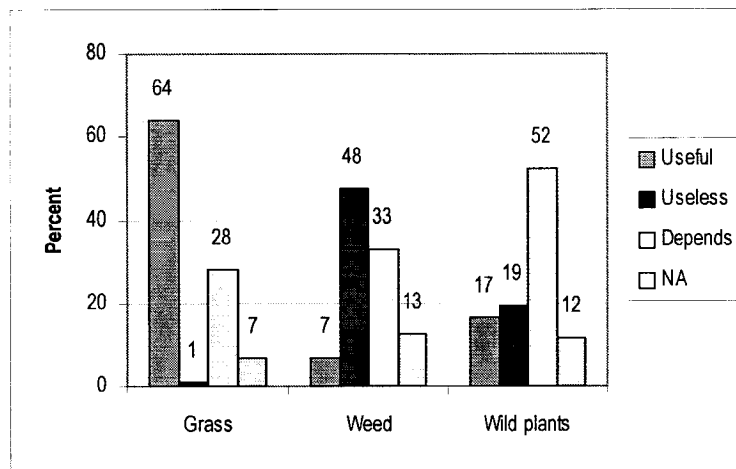


Figure 3. Distribution of students' opinion on grass, weeds and wild plants.

Agricultural issues i.e. the fertility of the soil and pest dominates the students' reason. Followed by esthetics, forages, and medicine. Biodiversity issue is rarely mentioned. The fact might be detrimental because the students tend to judge based on the instant benefit. Willingness to search for the hidden benefit and willingness to appreciate organism as a system are not yet prevalent. The condition needs to be improved.

Table 1. List of Reasons Underlying the Students' Opinion on Grass, Weeds and Wild Plants

Plants	List of opinion		
	Useful	Useless	Depends
Grass	<ul style="list-style-type: none"> ▪ for forages, fertilizer, ground cover, medicine, artwork. ▪ prevent the earth cracking and erosion ▪ maintain soil humidity, strengthened soil ▪ absorb water ▪ esthetical ▪ cooling the air 	<ul style="list-style-type: none"> ▪ it may grows in wrong places ▪ disturbing esthetics ▪ disturb the main crops ▪ kake the yard dirty. 	
Weeds	<ul style="list-style-type: none"> ▪ for forages, green manure, artwork, medicine, ground cover ▪ balancing the environment ▪ prevent erosion ▪ controlling pest 	<ul style="list-style-type: none"> ▪ disturbs other plants ▪ disturb the environment ▪ destroy soil fertility ▪ reduce the amount of oxygen in water ▪ disturb the ecology of water ▪ spreading diseases and inducing pest 	<ul style="list-style-type: none"> ▪ depends on the surrounding plants.
Wild Plants	<ul style="list-style-type: none"> ▪ prevent pollution ▪ absorbs rainwater ▪ for medicine, ornamental plant, forages, ground cover ▪ cool surrounding air ▪ maintain soil humidity ▪ balancing the ecosystem, one of our biodiversity. 	<ul style="list-style-type: none"> ▪ It is dirty ▪ invite pest ▪ can not be controlled ▪ reduce organic matters in soil 	<ul style="list-style-type: none"> ▪ further research is necessary to comprehend whether its is beneficial or detrimental ▪ Influenced by the species, population, and the community.

D. Students' Opinion on Farming Method & the Environmental Safety

Farming method is closely related with environmental issues. Green revolution has been criticized in many parts of the world. Many of the synthetic pesticides were easily spread by wind and water that they endangered species that lived far away from agricultural activities such as polar bear. Globally, they would harm the ecosystem.

DDT, aldrin, dieldrin and many other synthetic pesticides were discovered that they were stored in fatty tissue of animals, move up through the food chain and accumulate at higher concentration (Dalzell, 1994). Synthetic pesticides do cause resistance on varieties of pest and diseases. Georghiou (1986) in Dalzell (1994) reported that 650 species of fungi, insects and weeds are resistant to pesticides spray. UNEP (1992) reported that methyl bromide cause 10% of observed ozone loss that could be followed by other environmental damage. Meanwhile, transgenic farming is frequently associated with gene pollution that could endanger local species and induced pest resistance.

Based on the questionnaire, 79% agricultural university students considered that organic farming is safe for the environment (Figure 4). Mostly mentioned that organic farming is safe because it does not use synthetic chemicals. The other reasons are organic farming is biodegradable, and the agricultural yield could be adjusted with the nature capability to produce. A student that considered it dangerous mentioned that the crop could endanger human health. Students that said depends mentioned that if the technology is environmentally friendly, that it is fine to be applied.

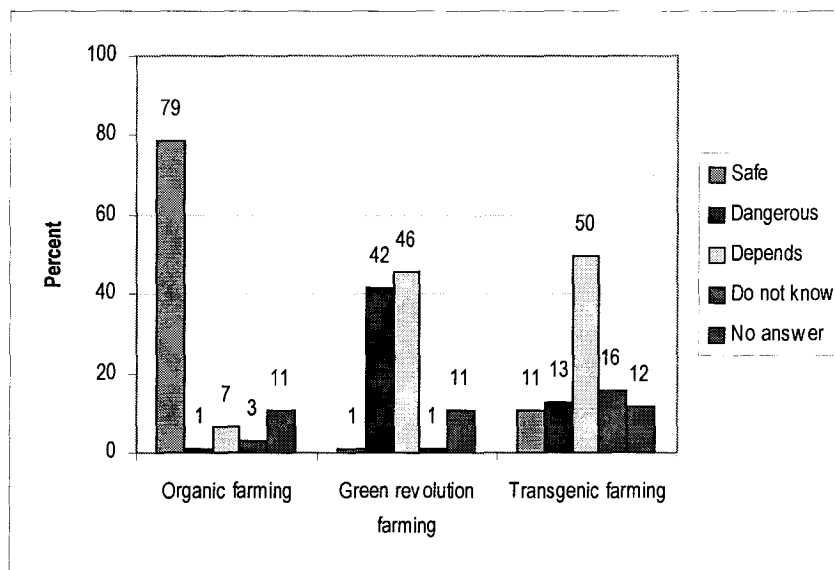


Figure 4. Agricultural university students' opinion about farming method and the environment.

The students' opinion on green revolution farming was generally neutral (46%). They said whether the effect on the environment is dangerous not would depends on the dosage and application. The group that considered it dangerous mentioned that it might destroy the ecosystem and natural balance, it kills pest, causing pest resistance, using toxic materials, causing pollution, destroys soil fertility. A student mentioned that as long as it does not broke the law/regulation, then it is safe.

Half of the respondents thought that whether transgenic farming is safe or dangerous depends on the amount, and practice on the filed. Students who considered it dangerous mentioned that it may cause DNA alteration, it may disturb future job of pest expert, it may cause indigenous plants extinct, it may cause pest resistance, and its side effect could be dangerous. The students, who considered it safe mentioned that the side effects of transgenic farming have been calculated, it is pest resistant, it could produce varieties of food, it may improve agricultural knowledge and as long as it is applied according to the regulation, then it would be safe.

Most students do not have any significant reason about this matter. Seven students mentioned that further research is necessary to evaluate transgenic farming. The proportion of students that mentioned that they do not know and the proportion of those who did not provide answer are quite high (28%). From the fact, we may conclude that their knowledge about transgenic farming is still limited.

E. Students' Opinion about Farming Method and Human Safety

Human health both the consumer and the practitioner of farming are influenced by the farming method being applied. The WHO reported that more than 3 million people are suffered from acute pesticides poisoning, 20,000 of them may die each year. One of the synthetic pesticides, DDT could cause tumor in the liver, adrenal glands, lung, or lymphatic tissue in laboratory animals such as rats, mice and hamsters. DDT and its breakdown product, DDE could stay in the environment for years and potentially accumulate in human's fatty tissue. DDT and its breakdown products could be found in human breast milk and they could reduce the mother's ability to lactate. There is also evidence that DDT and DDE can suppress the immune system (Cornell University BCERF, 2001).

Agricultural university students mostly considered that organic farming is safe (83%). Their reasons are organic farming is natural and fresh, it does not contain too much chemicals, it does not produce chemicals that could endanger human health, it helps to provide adequate food supply, and it is easy to manage. None of the students considered it dangerous (Figure 5). The students who answered depends did not mentioned any reason.

Almost half of the students (49%) considered that green revolution farming is dangerous because it contains chemicals, it is not sustainable, technology could produce dangerous effect, it may produce dangerous toxin, the chemicals residue tends to be high, it has pesticides residue, and it cause environmental damage. Students in 'depends' groups mentioned that whether it is safe or not is influenced by the application, and that further research is necessary to evaluate. The reasons of students in 'safe' groups are green revolution farming is easy to do and natural.

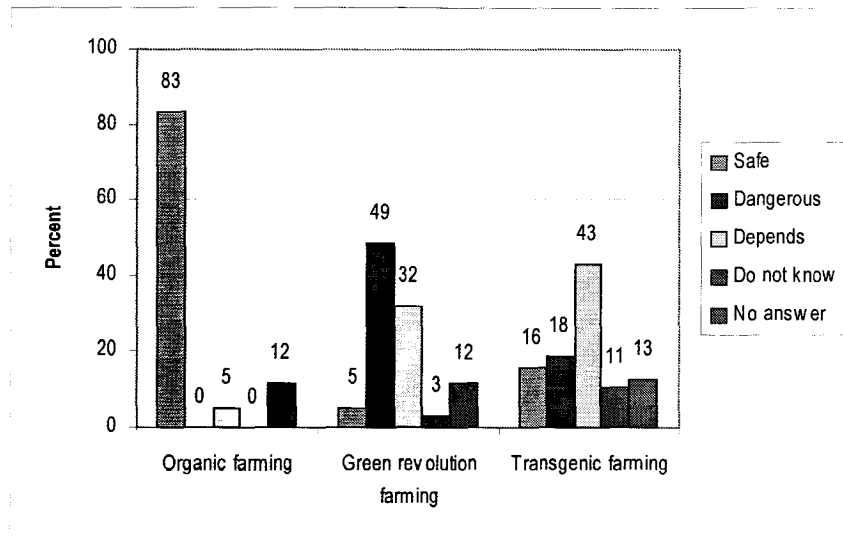


Figure 5. Agricultural university students' opinion about farming method and the human.

The number of students that considered that transgenic farming is safe is similar to the group that considered it dangerous. The reasons of the safe groups are transgenic crops has higher quality and more nutritious, it is profitable, it has less side effect, and the purpose of changing the plants DNA's is for human benefit. Ten out of 16 students in this group did not mention any reason.

The reasons of the students in the 'dangerous' groups are it would disturbing future job for pest expert, it may endanger human gene, it cause cancer, it accumulates in the body, it created by human, it imbalancing human life, and it is high cost. Meanwhile, the reasons of the students in 'depends' groups are: it would increase incomes but it may also destroy the environment, the effects has to be examined further, individual sensitivity are different, it depends on the application, it is still pro and contra, and it could solve nutritional problems but it cause cancer.

Chemical residue was dominating the reasons. Many students did not mention reliable reason about the safety of transgenic product. Indeed, the impact of transgenic products on human has not extensively evaluated. In 2001, Spiegelhalter, et al. revealed that DNA fragments is still detected on varieties of food products such as veggie burgers, tofu, and tomato paste.

F. Students' Opinion about Farming Method and Yield

Green revolution is frequently associated with efforts to increase yield. This farming method began at the Second World War. Because of the war, the food supply to United Kingdom that was mainly imported from the Empire was threatened. The England government decided to subsidize the cost of fertilizers. They also provided capital grants for farm improvement. Meanwhile, Germany was developing organophosphate and organochlorine-based chemicals for biological warfare. DDT (*pp'*-dichlorodiphenyltrichloroethane) was produced in large amount to control lice in the soldiers' clothing (Gear in Dalzell, 1994).

After the war, the use of synthetic chemicals on agriculture was enormously increased. Nitrogen fertilizer use was seven fold increased in the next 40 years (Gear in Dalzell, 1994). In Indonesia, there were about 600 pesticides brands registered at the national commission of pesticides. In year 2000, the sales value of pesticides produced by PT Monagro Kimia alone was over than 400 billion rupiahs. The total amount of total pesticides sales in Indonesia might be trillions (Uka, 2001).

At the beginning of green revolution, the agricultural yield did increase. Cereals production was doubled than before. However, in 1970 it was encountered that the impressive yield is failed to feed the whole populations and not even improve the national economy. In Europe, immense sums of money have to spend to pay for the excess of agricultural yield (Gear in Dalzell, 1994).

In Indonesia, the impact of green revolution is also detrimental. In Aug, 16, 2001 Kompas Daily published that cabbage harvest in Tarus, Timor Island, East Nusa Tenggara was attacked by pest, thus only half of them remain. The price dropped into Rp. 1,000/3 balls. The farmer complains that the pesticide called *tiodan* is no longer exist in the market, thus they are using other pesticides called *curacon*, *supersit*, *disnon* or the others but the pest continued regenerate, moreover the pest are getting more greedy on attacking the cabbage plant. They suspect that the pesticides dose has been reduced, thus they are no longer efficient to overcome the pest (Ans, 2001).

Agricultural university students considered that the yield of green revolution farming is higher than transgenic farming and organic farming (Figure 6). The only reason of students who considered that organic farming produced lots of yield is: it maintains the organic materials in soils. Seventeen students out of 19 did not give significant reasons.

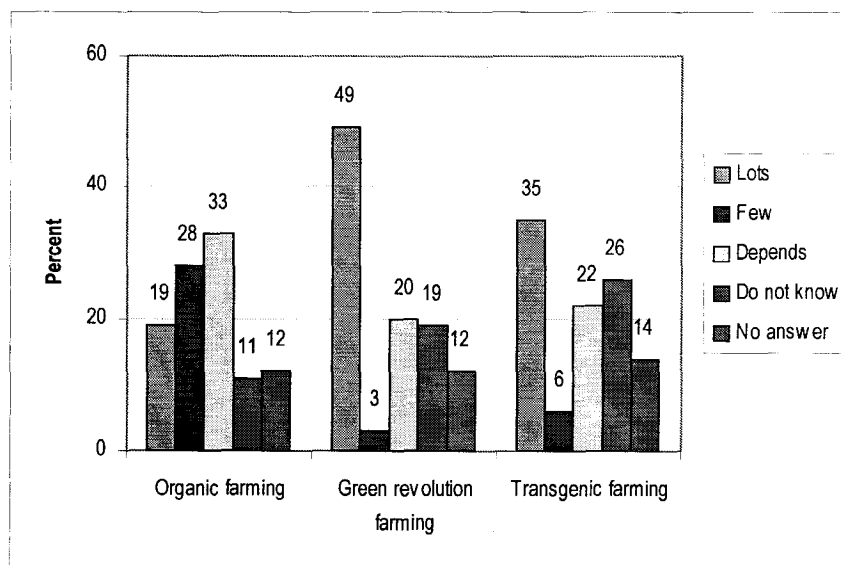


Figure 6. Agricultural university students' opinion about farming method and yield.

The reasons of the 'few' groups are: organic farming always attacked by pest, it depends on the nature condition, it needs specific handling and knowledge to develop it, the technology is simple, it does not use natural resources maximally, its is natural, the farmers rarely use pesticides to attack pest, the environment can not be controlled, and pollution would influence the yield of organic farming. Meanwhile, the reasons of the 'depends' groups are: it is influenced by adaptation process, nature condition, human resources, and the technology being applied.

Half of the agricultural university students (49%) considered that green revolution farming produce lots of yield. The reasons are: technology increase productivity the materials being used is easy to obtain and effective, it is widely applied, it can be manipulated, it is yield oriented, technology could control everything in the nature, and it is free from pest. The students who mentioned that the yield is few said that nature capability to support this kind of technology has decreasing, and the soil fertility has disturbed. The 'depends' group mentioned that the yield is plenty at the beginning than it would decreasing, it is influenced by the efficacy of the chemicals, many pest has becoming resistant, and it is influenced by the nature.

Thirty-five percent of the agricultural university students considered that transgenic farming could produce high yield because: they are forced to produce maximally, genetic engineering could maximize the yield, pest disturbance is minimal, the plant cells would easier to be proliferated, the good seed have been selected, it is suitable with natural condition, it is yield oriented, the plant has superior characteristics. The 'depends' group mentioned that it influenced by the type of the seed, and nature, not all plant could be manipulated to become a good plant and it still in controversy. The few

group mentioned that it is more difficult, need high cost, need adequate knowledge to avoid mistakes, need extra researches, rarely being applied.

Similar to transgenic farming, many students are not well informed about organic farming as well. There are more students who considered that green revolution method would produce higher yield compared to organic farming. In fact, the yield of organic farming is not always inferior compared to green revolution.

The crop yield of organic farming is typically higher compared to industrial farming in most state in Canada and the US and in most commodities (Table 2). However, they are still need time for adaptation at least for three to five years during the conversion from industrial to organic approaches (Dabbert and Madden, 1986; US Congress, 1983; Hanson et al, 1990; Lampkin, 1989; Smolik and Dobbs, 1991 in Anonymous, 1997). In Washington 1982, switching from industrial to organic farming reduce the wheat yield to 29% (Patten, 1982 in Anonymous, 1997), but in 1983, the reduction decrease to 4% (Pimental et al, 1983, in Anonymous, 1997).

Table 2. Crop yield data

Commodities Unit	Industrial	Organic	Location	Source
Wheat (tons/ha)	2.9	3.3	Ontario, Canada	Lampkin & Pader, 1994
	2.9	3.0	Ohio, the US	Lampkin & Pader, 1994
Soybean (tons/ha)	2.0	2.6	Pensylvania	Lampkin & Pader, 1994
Corn (tons/acre)	4.76	7.92	California	Temple et al, 1994b
	5.5	6.4	Ontario	Lampkin & Pader, 1994
Carrots (tons/acre)	15.0	15.8	Maine	Eggert, 1983

(Anonymous, Feb 1997)

G. Students' Opinion about Farming Method and Quality

Almost half of the students (48%) considered that organic farming would produce products with better quality (Figure 7). Their reasons are it is natural, there is no risk of dangerous material, it is fresh, there is no pesticide, and the plant grows naturally. The groups that considered it bad thought that it used chemicals and pollution has affected the quality of the products. The 'depends group' thought that it is influenced by the nature, and technology being applied.

The reasons of the students that considered that the quality of the green revolution farming is good were: technology would improve the quality, product oriented, and balance with natural changing. The reasons of the opposite group were: it is over exploited, thus they have side effects; and it has many dangerous chemicals. The reasons of the 'depend' groups was: it influenced by the technology.

About the quality of transgenic products, 34% of the students considered it good. Their reasons were: technology would improve the quality, laboratory tested, product oriented, pest resistance, contain vitamin A, modern products usually have good quality, the best genes are selected. Students that considered it bad did not give any reason, meanwhile, students that said depends mentioned that there are benefits as well as side effects, supported by the infrastructure, each individuals has different sensitivity, and it is influenced by information dissemination to the user.

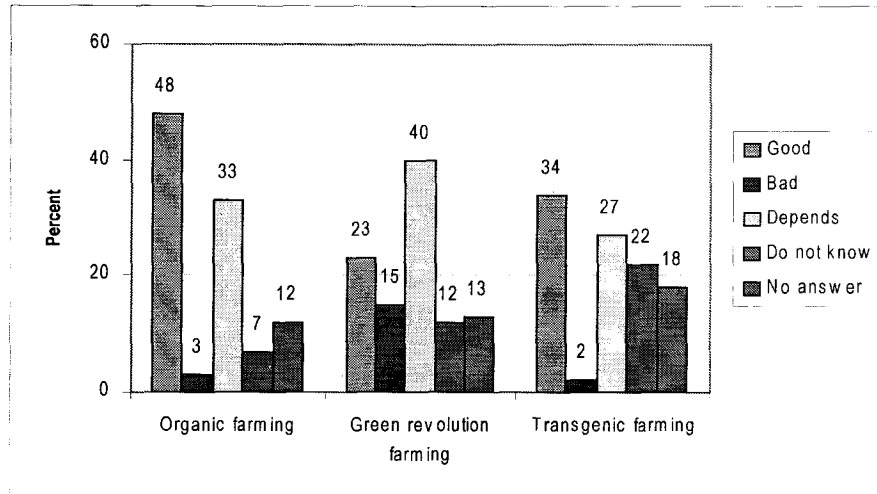


Figure 7. Agricultural university students' opinion about farming method and yield.

H. Farming Method Preferred

As potential 'future leaders,' it is interesting to observed agricultural university students opinion about which policy they would like to choose when they become a leader. Figure 8 revealed that organic farming is the most favorite choice. It seems that factors such as the safety to environment, human, and the quality of the products are more considered rather than quantity.

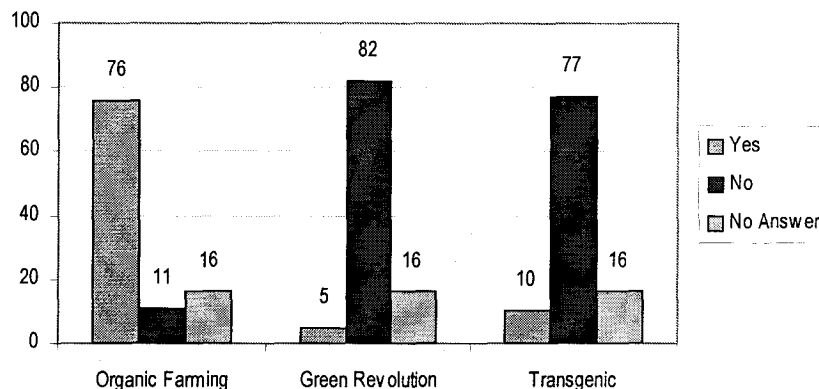


Figure 8. Agricultural university students' opinion about farming method that they would choose.

I. CONCLUSION

The knowledge of agricultural university students on practical issues in sustainable agriculture is limited as well as their ability to respond the questions. It would be troublesome to conserve biodiversity and promote sustainable agriculture if their knowledge is lacking.

However, their awareness on environmental issues is distinguishable. It shows by the facts that they are very concern about pollution. Besides, quality seems to be valued better rather than quantity when they were asked to make decisions. It is advisable that the students obtain balanced scientific information and encouraged studying from the society and the nature.

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