

## **CHAPTER VII**

### **SOCIAL IMPACT ASSESSMENT**

The social impact is an important part of the study many issues are concerned such as chemical use and food safety, labor use, and farmers' healthy. The chemical use is an essential issue in the present because the chemical-free products are more popular increasingly for decision making to buy by general consumer. So, this impact assessment is very necessary to expand boundary of development for the strawberry research and production. The labor employment study can explain the different groups of the farming activities in order to assess the labor use in each strawberry production.

#### **7.1 Impact on the Growers**

##### **7.1.1 Chemical use and food safety**

Chemicals have been used in the agricultural processes for a long time. The chemical use effects the farmers and environment and, as well as consumers. Similarly, the strawberry production has problem with the chemical use especially, insecticides. These chemicals may be residual in strawberry, if they are not managed well. Moreover, they are harmful to the farmers and the consumers. The pesticides used are very serious in the strawberry production because the farmers have increased the pesticide quantities extremely. The pesticides are used more increasingly but the production yields do not increase then they effect to the cost of production leading to decreased incomes. The controlling in pesticide use is a method to solve the residual problem.

The CSPUCS project has been established in order to decrease pesticide usage and residual in the strawberry. The products of the project are mentioned that they

could be resistant to pathogens as the virus-free runners. The result of the study has been found that on the average the numbers of insecticide uses in using VFS and NS are three and four times a month respectively. These numbers are pointed out that using VFS can reduce the use of pesticides. Moreover, the RPF and officers also strictly control chemical use for the farmers within the project.

The biotechnology processes, particularly genetic modification, is extremely important in devising new ways to increase food production, improve nutrient content, and provide better processing or storage characteristics. It follows that when new food or food components are developed using biotechnology, there are both national legal requirements and consumer expectations for effective systems and procedures to assess the safety of the food or food component for consumption. Traditional food safety assessment techniques, based on toxicological testing as used for food additive, for example, may not always apply to foods or food components produced by biotechnology. Food safety is defined as assurance that food will not cause harm to the consumer when it is prepared and/or eaten according to its intended use. Therefore, this study considers in food safety regarding with toxicity in the strawberry in order to analyze residual by using pesticide test kit method. The result of the study is identified the safety level as acceptable and unacceptable level. The meanings of each level from 0 to more than 5 which 0 mean no residual, 1-4 means that sample has residual but being in acceptable safety level and 5 or more 5 is unacceptable level or non-safety. The result of the study, which was checked by this method, is compared between the samples in VFS and NS.

Table 7.1 Residual levels by using pesticide test kit of strawberry samples in VFS and NS

Residual level By using pesticide test kit	Samples in VFS		Sample in NS	
	Freq.	Percent (%)	Freq.	Percent (%)
0	12	80.0	9	52.9
0.5	2	13.3	5	29.4
1	1	6.7	2	11.7
2	0	0	1	5.8
3-4	0	0	0	0
5 or more	0	0	0	0

Source: survey 1998

The result of the pesticide test of strawberry samples in NS is shown in Table 7.1 About 53% of the samples using NS have no residual. The remainders have residual being at an acceptable level. Approximately 80% of the samples in VFS are found residual free (Table 7.1). All samples have safety at acceptable level for consumption. The samples in VFS have higher safety than samples in NS because VFS has less pesticide use than NS.

### 7.1.2 Labor use

The farm activities of the strawberry production, there are land preparation, planting, mulching, watering, chemical application, harvesting and weeding. Generally, the assessment of labor use in the farming activities estimated from man-day. The definition of a man-day is the number of labor hours per day, which is 8 hours a day (Man-day = (Number of labors x number of days x number of hours) / 8 hours).

#### 7.1.2.1 Labor use in the strawberry production using VFS

Most VFS farmers employed 1-2 household labors for the farming activities in each household. Some households applied the exchanged labor use. The activities using exchanged labor were soil preparation, transplanting, mulching, and harvesting. However, exchanged labors were also used as about 28.6% of all of the VFS households.

About 12.5% of all of the VFS households used hired labors for the strawberry production. The hiring labor of the VFS was lower than the NS strawberry production because of the smaller production areas. By the average two workers can cover 0.5 rai so that they are not necessary to ask for exchange labors and labors.

From the estimation of man-day per rai of the VFS, the labor use in the harvesting activity employed the most labors. Moreover, this activity of VFS was more than the NS (Table 7.4). We can see that the labor used in watering activity of the NS was less than VFS obviously. The result can explain that most NS farmers applied the furrow irrigation. This irrigation is very convenient and less labor use for water supply management. The other activity was weeding activity, which has differentiation between 2 system substantially. The results of labor use in the NS and

VFS were 12.78 and 24.92 man-day/rai respectively. This result can explain that there were more the NS farmers using the chemicals for weed control.

Table 7.2 Labor use in strawberry production (VFS) (manday/rai)

Activity Items	Household labor	Exchanged labor	Hired labor	Total labor
Land preparation	13.36	4.66	2.74	20.76
Planting	10.90	2.77	1.05	14.72
Mulching	10.65	2.69	1.36	14.70
Watering	40.71	0.00	0.00	40.71
Fertilizer	10.61	0.00	0.00	10.61
Chemical application	7.60	0.00	0.00	7.6
Weeding	18.12	2.33	4.47	24.92
Harvesting	131.02	0.86	9.53	141.41
Total	242.97	13.31	19.15	275.43

Source: *Estimating the imputed labor cost*

#### 7.1.2.2 Labor use in the strawberry production using NS

On the average, the strawberry production areas of the NS have one or two adult workers, which are the household labors. The averages of the numbers of household labors were 2 peoples per household. There were 35% of all households having exchange of labors. For the averages of exchange labors in individual activities, they are explained in Table 7.3. The farming activities, which applied the exchanged labors, were preparation, transplanting and mulching, harvesting and weeding. The planting activity had the most number of exchanged labors. Moreover, some households had employment about 62% in strawberry production. The

activities, which were employment, are soil preparation, planting, mulching, watering, fertilizing, and spraying. The soil preparation and planting activities were the highest employment on the percentage as 61.7% of all households.

The man-day analysis used for the strawberry production is shown in Table 7.3. The result of the study points out that the NS farm activity of using the highest number of labors was harvesting activities. The labor use (including household, exchanged, and hiring labors) of the harvesting activity was 78.44 man-day per rai. About 2 man-day per rai, which was the least of the labor use, is the labor use of watering activity. Since, the furrow irrigation was used for water supply management in NS strawberry production. About 80% of most farmers used the furrow irrigation (see Chapter 5) moreover the watering activity used less numbers of the labor than the other irrigation system (socked irrigation). There were 3 farming activities, which the NS farmers did not employ the exchanged labors such as watering, fertilizer and sprayer activities.

Table 7.3 Labor use in strawberry production (NS) (manday/rai)

Activity Items	Household labor	Exchanged labor	Hired labor	Total labor
Land preparation	4.58	1.52	6.87	12.97
Planting	2.12	4.35	2.37	8.84
Mulching	4.74	2.69	1.79	9.22
Watering	1.89	0.00	0.33	2.22
Fertilizer	9.10	0.00	1.56	10.66
Chemical application	6.92	0.00	3.34	10.26
Weeding	4.80	6.21	1.97	12.98
Harvesting	37.27	0.61	40.56	78.44

Activity Items	Household labor	Exchanged labor	Hired labor	Total labor
<b>Total</b>	<b>71.42</b>	<b>15.38</b>	<b>58.79</b>	<b>145.59</b>

*Source: Estimating imputed labor cost*

The Table 7.4 pointed out that the result of total man-day per rai in the VFS was higher than the NS. We can say that the farming activities of the VFS were more intensive labor use, especially the activity of harvesting. The VFS harvesting was taken by the RP, therefore harvesting was more delicate than the NS.

Table 7.4 Comparison of total labor between the VFS and NS strawberry system estimated manday per rai in strawberry production (VFS)

Activity Items	VFS (manday/rai)	NS (manday/rai)
Land preparation	20.76	12.97
Planting	14.72	8.84
Mulching	14.70	9.22
Watering	40.71	2.22
Fertilizer	10.61	10.66
Chemical application	7.6	10.26
Harvesting	141.41	78.44
Weeding	24.92	12.98
<b>Total labor use</b>	<b>275.43</b>	<b>145.59</b>

*Source: Estimating imputed labor cost*

### 7.1.3 Farmers' health

The farmers' health was given as the long term of impact assessment. Chemicals are the essential factors for the agricultural production system in Thailand. Most farmers use chemical for pest management. Therefore, the farmers have understood that chemicals use is very important factor in order to achieve their production. Even the chemicals are useful for cultivation, however they are harmful to the farmers' health, especially the strawberry cultivation.

The strawberry production applied pesticide seriously, especially fungicides. The strawberries are very sensitive to pathogens. The 98% of the interviewed farmers used chemicals in the strawberry production. The comparison between the NS and VFS in chemical use are not different since farmers in both groups apply chemicals for their production.

The attitudes of people involving with strawberry development are the impact in medium term. The individual groups included with the strawberry development were the farmers, the consumers, processors and exporters. The attitude of the individual groups involving with the strawberry development is the adoption of changing technology. The adoption in changing cultivation technology seems to be hard in making decisions. The project tries to achieve the purpose, thus, subsidizes the farmers the cost of runners. In the first year 1997/98 of the promotion in transferring technology—promoting free-virus runners, there were many damaged plants caused from weakness of those runners and poor understanding of farmers on VF and promoting officers effected to damage of strawberry plants. These discouraged adoption of VF technology. The following year of the technological transferring was so hard to introduce the new technology.



### **7.3 The possibility of expanding runner production using VFS by farmers**

As strawberry production was promoted to farmers for replacing opium cultivation for over 2 decades, the upland areas are the suitable areas to grow the strawberries since they are the temperate fruit crops. This section explores possibility of expanding runner and strawberry production using VFS by farmers. The possibility of expanding depended on the adoption of the new technology. The first year of promotion had serious problems of damaged plants. Therefore, the adoption in technological change had influence to possibility of expanding runner production using the VFS. The VFS strawberry system was not convinced to the general farmers. The decision making was not easy to decide to use the virus free plants. However, the varieties developed and promoted were the varieties, which were higher prices normal varieties. Therefore, it was not the effect seriously to possibility of expanding the VFS runner production. However, expanding runner production should be carried out with technological transferring in order to increasing the understanding of the farmers.

### **7.4 Consumer preference**

This study also focuses in consumer aspects and the impact on the new varieties effecting to the consumers. The consumer preference was used in order to evaluate the consumer impact. The data collected from the consumers included sex, education level, and the consumer preferences in each characteristic of the strawberries. The varieties used in this study were Phraradchatan 16 (Tioga), Phraradchatan 50, and Phraradchatan 70 (Toyonoka). Phraradchatan 16 is referred as the original variety and Phraradchatan 50 and 70 are referred as the new varieties in Thailand. For the consumer preference interviewing, Likert scaling was used. They consist of 6 scales to measure the consumer preferences, i.e., highly like, moderately, and slightly like, moderately dislike, very dislike, and highly dislike. The

characteristics of strawberries are taste, color of skin, size, shape, fragrance, and crispiness were brought for testing the consumer preferences.

The data sampling of the study were 51 consumers interviewed and given samples of strawberries in order test their preference in each strawberry variety. 64.7% and 35.3% were male and female, respectively. The education level ranged between primary school to the graduated level.

The study can assess the impact of the new varieties to the consumer preference for improving the strawberry varieties. According explaining in above paragraph, the characteristics of the strawberries are taste, color of skin, size, shape, fragrance, and crispiness.

#### 7.4.1 The consumer preferences in the taste of strawberry

From this survey in the consumer preference for the taste of strawberry, it was been found that almost 58.8% of the consumers interviewed had the most preference in the taste of the P70 variety. The most preferences in taste of the P50 and P16 varieties are 15.7% and 7.8% respectively (Table 7.5).

Table 7.5 the consumer preferences in the taste of strawberry

Level of preference	Percentage of the preference (%)		
	Phraradchatan 16	Phraradchatan 50	Phraradchatan 70
Extremely like	7.8	15.7	58.8
Moderately like	23.8	25.5	25.5
Slightly like	11.8	9.8	3.9
Moderately dislike	35.3	23.5	0
Very dislike	7.8	7.8	9.8
Extremely dislike	13.7	17.6	2.0

Source: Survey 1998

#### 7.4.2 The consumer preferences in color of skin

The results of the consumer preference in color of skin are shown in Table 2. It is concluded that the most preference in color of skin of P16, P50 and P70 are 17.6%, 41.2% and 3.9% respectively (Table 7.6). The color of skin of the P70 is a lighter red color. It is not an attractive color for the buying decision of the consumers. Therefore, the consumer preference in its color of skin is the least in three varieties.

Table 7.6 The consumer preferences in color of skin

Level of preference	Percentage of the preference (%)		
	Phraradchatan 16	Phraradchatan 50	Phraradchatan 70
Extremely like	17.6	41.2	3.9
Moderately like	31.4	27.5	3.9
Slightly like	33.3	11.8	2.0
Moderately dislike	13.7	11.8	31.4
Very dislike	3.9	7.8	23.5
Extremely dislike	0	0	35.3

*Source: Survey 1998*

#### 7.4.3 The consumer preferences in the size of strawberry

The strawberries are sold in grades with grade A being the best in quality. Almost all producers apply size for grading therefore grade A is a big size. This study uses the grade A strawberry for controlling variability in size. Grade A of each variety of strawberries is different. P50 is the biggest size with P70 and P16 with rather the same in size. From the result of the study, the most preferences in P16 and P70 varieties are only 19.6% and 15.7% respectively (Table 7.7). The consumers have the most preference level in P50 variety as 37.3% (Table 7.7).

Table 7.7 The consumer preference of the size of strawberries

Level of preference	Percentage of the preference (%)		
	Phraradchatan 16	Phraradchatan 50	Phraradchatan 70
Extremely like	19.6	37.3	15.7
Moderately like	31.4	23.5	13.7
Slightly like	35.3	23.6	45.1
Moderately dislike	11.8	5.9	15.7
Very dislike	0	5.9	7.8
Extremely dislike	2.0	3.9	2.0

Source: Survey 1998

#### 7.4.4 The consumer preferences in the shape of strawberry

The strawberries have differences in shape depending on each variety. The varieties are brought for testing in this study as well. The shape of P70 is conic or globose conic shape. The shape of P50 is wedge or long wedge. The shape of P16 is globose conic shape. The results of the most consumer preferences of P16, P50 and P70 in shape are 17.6%, 16.7% and 15.7% respectively. Every variety has a level of the most preference closely, but shape of P16 seems to be most preferred by observed (considering to two levels of preference) and P70 is least preferred.

Table 7.8. The consumer preference of the shape of strawberries

Level of preference	Percentage of the preference (%)		
	Phraradchatan 16	Phraradchatan 50	Phraradchatan 70
Extremely like	17.6	17.6	15.7
Moderately like	39.2	27.5	21.6
Slightly like	33.3	13.8	23.6
Moderately dislike	5.9	19.6	23.5
Very dislike	2.0	13.7	7.8
Extremely dislike	2.0	7.8	7.8

Source: Survey 1998

#### 7.4.5 The consumer preferences in the fragrance of strawberry

The fragrance of strawberry is a characteristic to attract the consumers. From the result, it is found that almost 49% of the consumers interviewed prefer the fragrance of the P70 variety is the most preference level. The P50 and P16 varieties have the level of the most preference in fragrance as 17.6% and 7.8% respectively.

Table 7.9 The consumer preference of the fragrance of strawberries

Level of preference	Percentage of the preference (%)		
	Phraradchatan 16	Phraradchatan 50	Phraradchatan 70
Extremely like	7.8	17.6	49.0
Moderately like	7.8	25.5	21.6
Slightly like	31.4	15.7	5.9
Moderately dislike	9.8	2.0	9.8
Very dislike	7.8	7.8	2.0
Extremely dislike	25.5	11.8	2.0

Source: Survey 1998

#### 7.4.6 The consumer preferences in the crispiness of strawberry

Besides the characteristics mentioned in the above Table, the crispiness of the strawberry was also used for studying the consumer preference. The opinions of the interviewed consumers about the crispiness of the strawberry have several levels. The most preference level in the crispiness of the P16, P50 and P70 varieties are 3.6%, 25.5% and 31.4% respectively (Table 7.10). It is pointed out that the crispy characteristic of the strawberry varieties in Thailand is not an attractive buying decision for the consumers because the percentage of the most preference level of three varieties are quite low.

Table 7.10. The consumer preference of the strawberry crispiness

Level of preference	Percentage of the preference (%)		
	Phraradchatan 16	Phraradchatan 50	Phraradchatan 70
Extremely like	3.6	25.5	31.4
Moderately like	27.5	29.4	19.6
Slightly like	15.7	27.5	29.4
Moderately dislike	33.3	5.9	11.8
Very dislike	13.7	2.0	2.0
Extremely dislike	2.0	9.8	5.9
No comment	2.0	0	0

Source: Survey in 1998

The Likert scale of consumer in each characteristic is shown in Table 7.11. The scales represent 5 to 0 which are 5 = Extremely like, 4 = Moderately like, Slightly like = 3, Moderately dislike = 2, Very dislike = 1, Extremely dislike = 0. The scale of each characteristic was transformed to the consumer preference as shown in Table 7.12.

Table 7.11 Likert scale of the consumer preference to each characteristics of P16, P50, and P70 (score since 0-5)

Characteristics	P16	P50	P70
Color	3.38	3.75	1.25
Shape	3.52	2.81	2.79
Size	3.48	3.56	2.96
Crispiness	2.58	3.35	3.42
Taste	2.42	2.50	4.19
Fragrance	1.69	2.77	3.75

Source: From Table 7.5 – 7.10

The consumer preference of P16, P50 and P70 were in slightly and moderately like level in each variety but consumer preference in color of P70 was in very dislike lever. Since the color of P70 is red yellowish (light red) color which were different from the other varieties (red to dark red).

Table 7.11 consumer to each characteristics of P16, P50,

Characteristics	P16	P50	P70
Color	Slightly like	Moderately like	Very dislike
Shape	Moderately like	Slightly like	Slightly like
Size	Slightly like	Moderately like	Slightly like
Crispy	Slightly like	Slightly like	Slightly like
Taste	Moderately like	Slightly like	Moderately like
Fragrance	Moderately like	Moderately like	Moderately like

Source: From Table 7.11

#### 7.4.1 Buying decision and consumers' attitude

The study of the consumer aspect includes the strawberry characteristics for buying decision. The main hypotheses of the buying decision are color of skin, shape, and size. From the study it has been found that color of skin, shape and size are the reasons in the buying decision as 96.1%, 52.9% and 72.5% respectively (Table 7.12). The color of skin has the most influence to buying decision. The shape of strawberry is regarded for buying decision adequately.

Table 7.12 The percentage of buying decision with strawberry characteristics.

Characteristic	Obs.	Regarded		Non-regarded	
		Freq.	Percent	Freq.	Percent
Color of skin	51	49	96.1	2	3.9
Shape	51	27	52.9	24	47.1
Size	51	37	72.5	14	27.5

Source: Survey 1998

From this consumer survey, the favorite tastes of the consumers are sweet, sour and sweet with a sour taste as 37.3%, 5.9% and 54.9%. The percentage of sweet with a sour taste is the highest because generally the consumers have been under the impression that strawberry had a sour taste. Moreover, the consumers were inquired about the new varieties (Phraradchatan 50 and 70) and it has been found that 51% of the interviewed consumers already knew about the new varieties. Besides, 49% did not know about the new varieties.

After the consumers have tastes with the old strawberry variety as well as the new varieties, they require the strawberries for developing in sweetness, fragrance,



color of skin, shape, size and crispy as 54.9%, 74.5%, 76.5%, 54.9%, 56.9% and 49.0% respectively.

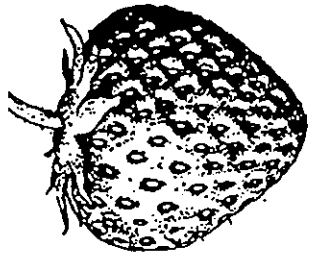
#### The favorite shapes for strawberry variety improvement

The strawberries have several shapes depending on variety and different climate. Ajarn Chupong (1988) wrote in a strawberry book that the strawberry is classified into 8 shapes as an oblate, globose, globose conic, conic, long conic, necked, long wedge and short wedge (Figure 7.2). From the survey, the most favorite strawberry shape is a conic as 43.1% (Table 7.13). An oblate and globose shapes are not chosen as the favorite shape.

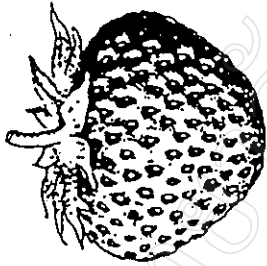
Table 7.13 The percentage of the favorite strawberry in individual shapes.

Characteristic	Obs.	Frequency	Percent
Oblate	51	0	0
Globose	51	0	0
Globose Conic	51	1	2.0
Conic	51	21	43.1
Long Conic	51	13	25.5
Necked	51	1	2.0
Long Wedge	51	12	23.5
Short Wedge	51	2	3.9

Source: Survey 1998.



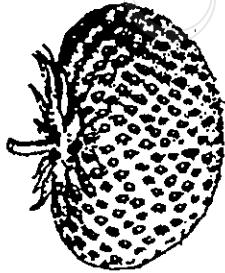
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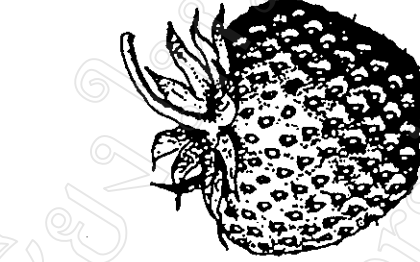
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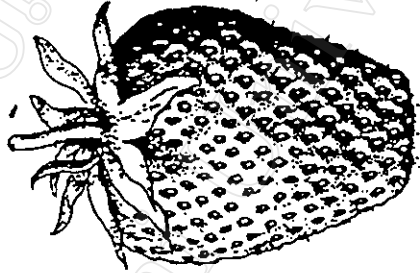
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SHORT WEDGE



LONG WEDGE



NECKED



LONG CONIC

DN-958

Shapes of strawberries.

USDA Charts

### The favorite color of skin for strawberry variety improvement

Interviewing the consumers about the color of skin and the results of the favorite colors for strawberry variety improvement are shown in Table 7.14. The consumers require dark red, red, and bright red color as 25.5%, 29.4% and 45.1% respectively.

Table 7.14 The percentage of each color of strawberry skin for buying decision.

Characteristic of color of skin	Obs.	Freq.	Percent (%)
Dark red color	51	13	25.5
Red color	51	15	29.4
Bright red color	51	23	45.1

Source: Survey 1998

### The favorite taste for strawberry variety improvement

There are several tastes of strawberries, such as, sweet, sour and sweet with a sour taste. This study found that what the favorite taste preferred by Thais is. Therefore, the result of this study about this issue is shown in Table 7.15. Almost 52.9% of the interviewed consumers prefer a sweet taste and only 15.7% and 5.9% of the consumers prefer a sour taste and sweet with a sour taste respectively. There were some consumers preferring the sweet taste of P50 and P70 as for 5.9% and 19.6% respectively.

Table 7.15 The favorite taste of the consumers for variety improvement

Tastes	Frequencies (people)	Percent (%)
Sweet	27	52.9
Sour	3	15.7
Sweet with a sour taste	8	5.9
Sweet as P50	3	5.9
Sweet as P70	10	19.6

*Source: Survey 1998*