



CHAPTER IV

RESEARCH RESULTS

This research was a cross-sectional analytical study conducted to describe pesticide-related symptoms (dependent variables) and pesticide knowledge, pesticide attitude, pesticide practice and sociodemographic characteristics (independent variables), and to investigate relationships between independent and dependent variables, in agriculturists in Tambon Krabinoi Amphur Mueang Krabi Province. Results are presents in 3 parts as follows:

Section 4.1: Descriptive information on the following characteristics:

General information [independent variables]: age, gender, education, work characteristic, duration of work, type of plantation, duration of chemical practice, smoking history, drinking alcohol.

Pesticide use in occupation [independent variables]: pesticide knowledge, pesticide attitude and pesticide practice.

Symptoms [dependent variable].

Section 4.2: Relationships between pesticide knowledge, pesticide attitude and pesticide practice (in this assessment, pesticide practice is treated as a dependent variable).

Section 4.3: Relationships between symptoms and independent variables listed above.

Section 4.4: Comparing pesticide-related knowledge and attitude in agriculturalists who do and do not use pesticides

4.1 Descriptive information

4.1.1 General information (independent variables)

Subject characteristics are summarized in table 3. The proportion of male subjects (55.7%) was slightly higher than that of female subjects and most of agriculturists (85.5%) were older than 34 years of age. The average age was 47.19 years old. Most subjects (54.6%) had education level at pratom grade 4. Most of them (66.4%) did not smoke at present. Most of agriculturists that smoked cigarettes at present (68.8%) smoked not above 10 cigarettes per day, on average. Most (66.4%) drink any kind of alcoholic beverage less than one time per month (including never). Most of agriculturists (91.6%) cultivate crops by themselves, and most (69.8%) growing Para Rubber. Most (57.6%) had done agriculture less than 15 years. Most of agriculturists who use pesticide (60.2%) had used pesticide less than 5 years, and most (57.8%) use pesticide 1 – 3 times a year. Most (66.4%) dissolved pesticide in water not above 50 c.c. per rai on average, and most (73.4%) usually spray pesticide before 8.00 am. Most recent pesticide use 31 – 60 days ago for 43.8% of subjects. Most of them (94.3%) used chemical fertilizer, and most (80.5%) used herbicide in theirs garden. Most (59.9%) used mosquito coils.

Table 3: Number and percentage of subjects for general characteristics (n = 262).

General information	Number	Percentage
Age group (year)		
≤ 34	38	14.5
35 – 44	83	31.7
45 – 54	67	25.6
≥ 55	74	28.2
X =47.19, SD. =12.208 , Minimum =20 , Maximum =76		
Gender		
Male	146	55.7
Female	116	44.3
Education		
No formal education	6	2.3
Pratom Grade 4	137	52.3
Pratom Grade 5 or 6	72	27.5
Matayom 1-3 or Matayom Seuksa 1-3	34	13.0
Matayom 4-6 or Matayom Seuksa 4-5	7	2.7
Certificate/Diploma	3	1.1
Bachelor Degree and above	3	1.1

Table 3: (continued) Number and percentage of subjects for general characteristics

(n = 262).

General information	Number	Percentage
Smoking history		
Smoke at present	88	33.6
Have ever smoked but do not smoked at present	24	9.2
Not smoke	150	57.3
Smoked ≤ 10 cigarettes per day, on average	77	68.8
Smoked 11-20 cigarettes per day, on average	27	24.1
Smoked ≥ 21 cigarettes per day, on average	8	7.1
X =5.0, SD. =7.635, Minimum =0, Maximum =40		
Drinking alcohol		
Less than one time per month (including never)	174	66.4
1-3 times per month	56	21.4
About one time per week	15	5.7
2-4 times per month	8	3.1
Almost every day or every day	9	3.4
Did not drink at all on days, on average	156	59.5
1 or 2 drinks on days, on average	93	35.5
3 – 4 drinks on days, on average	8	3.1
5 drinks or more on days, on average	5	1.9

Table 3: (continued) Number and percentage of subjects for general characteristics

(n = 262).

General information	Number	Percentage
Present working characteristic		
Cultivate crops by yourself	240	91.6
Hire other person(s) to cultivate crops	72	27.5
Employee in agricultural sector	39	14.9
Employee, not in agricultural sector	47	17.9
Growing (type of agricultural product)		
Paddy field	1	0.4
Farm	22	8.4
Plantation	109	41.6
Oil Palm	84	32.1
Para Rubber	183	69.8
None	4	1.5
Done agriculture (years)		
1 – 15	151	57.6
≥ 16	111	42.4

X = 15.60, SD. = 9.780, Minimum = 1, Maximum = 50

Table 3: (continued) Number and percentage of subjects for general characteristics

(n = 262).

General information	Number	Percentage
Contact with pesticides		
Do not use pesticide (lowest exposure)	134	51.1
Do not spray or mix but go into pesticide using area	60	22.9
Only sprayer or mixer	27	10.3
Both mix and spray pesticide	41	15.6
Using pesticide (years)		
1 - 5	77	60.2
6 - 10	41	32.0
≥ 11	10	7.8
X=1.27, SD. =0.497, Minimum = 1, Maximum = 22		
use pesticide (times per year)		
1-3 times	74	57.8
4-6 times	34	26.6
more than 6 times	20	15.6
Spray pesticide each time, on average (cc. per rai)		
1 - 50	85	66.4
≥ 51	43	33.6
X=33.87, SD.=49.126, Minimum=20, Maximum=500		

Table 3: (continued) Number and percentage of subjects for general characteristics

(n = 262).

General information	Number	Percentage
usually spray pesticide		
Before 8 am.	94	73.4
After 8 pm.	34	26.6
The latest time used or contacted pesticide (days ago)		
1 - 30	47	36.7
31 – 60	56	43.8
≥ 61	25	19.5
X =25.24, SD.=34.372, Minimum=5, Maximum=210		
Use chemical fertilizer		
yes	247	94.3
no	15	5.7
Use mosquito coils		
yes	157	59.9
no	105	40.1
Use household pesticide spray		
yes	103	39.3
no	159	60.7
Use herbicide		
yes	211	80.5
no	51	19.5

4.1.2 Pesticide use in occupation.

Pesticide knowledge, pesticide attitude and pesticide practice

Table 4 summarizes agriculturists' knowledge regarding pesticides. It was shown that 66.4 percentages of knowledge was in good level (10 – 12 points). The average point was 9.72 points.

Table 4: Number and percentage of knowledge in pesticide practice of agriculturists (n = 262).

Knowledge (point)	Number	Percentage
Have to improve (≤ 6 points)	15	5.7
Average (7 – 9 points)	73	27.9
Good (≥ 10 points)	174	66.4

X =9.72, SD.=1.816, Minimum =3 , Maximum =12

Regarding to attitude in pesticide practice of agriculturists, most (69.1%) were in average level of attitude (37 – 47 points). The average point was 44.18 points. These are summarized in table 5.

Table 5: Number and percentage of attitude in pesticide practice of agriculturists

(60 points) (n = 262).

Attitude (points)	Number	Percentage
Have to improve (≤ 36 points)	11	4.2
Average (37 – 47 points)	181	69.1
Good (≥ 48 points)	70	26.7

X =44.18 , SD. =4.676 , Minimum =30, Maximum =53

Table 6 summarizes in the part of practice in pesticide use of agriculturists. Most (78.9%) were in good level of practice (more than 104 points). The average point was 109.44 point from 130 points.

Table 6: Number and percentage of practice in pesticide use of agriculturists

(130 points) (n = 128) (missing = 134).

Practice (point)	Number	Percentage
Have to improve (≤ 78)	-	0
Average (79 – 103)	27	21.1
Good (≥ 104)	101	78.9

X =109.44, SD. =6.887, Minimum =86, Maximum =125

A total of 16 symptoms were considered as dependent variables. Responses regarding individual symptoms are given in table 7. The symptom experienced most commonly was rash (45.3%). The symptoms that subjects had

during using were been soaked with sweat (27.3%). Major symptoms experienced shortly after using pesticide were rash (43.0%). The major symptoms that they had persisting after using were being soaked with sweat (10.9%).

Table 7: Number and percentage of symptoms while and/or after spraying pesticide
(n = 128).

Symptoms	Number	Percentage
Headache	38	29.7
During using	2	1.6*
Shortly after using	27	21.1
persisting after using	11	8.6
Weakness / lack of energy	27	21.1
During using	-	0*
Shortly after using	19	14.8
persisting after using	8	6.3
Trembling	2	1.6*
During using	-	0*
Shortly after using	2	1.6*
persisting after using	-	0*
Twitching muscles	6	4.7*
During using	-	0
Shortly after using	6	4.7*
persisting after using	-	0*

Table 7: (continued) Number and percentage of symptoms while and/or after spraying pesticide (n = 262).

Symptoms	Number	Percentage
Been soaked with sweat	48	37.5
During using	35	27.3
Shortly after using	6	4.7*
persisting after using	14	10.9
Stomach ache	3	2.3*
During using	-	0*
Shortly after using	2	1.6*
persisting after using	1	0.8*
Diarrhea	4	3.1*
During using	-	0*
Shortly after using	4	3.1*
Persisting after using	-	0*
Feel nauseous or vomiting	2	1.6*
During using	2	1.6*
Shortly after using	-	0*
Persisting after using	-	0*
Blurred or dim vision	5	3.9*
During using	-	0*
Shortly after using	2	1.6*
Persisting after using	3	2.3*

Table 7: (continued) Number and percentage of symptoms while and/or after spraying pesticide (n = 262).

Symptoms	Number	Percentage
Difficulty breathing	5	3.9*
During using	-	0*
Shortly after using	4	3.1*
Persisting after using	2	1.6*
Itchy eyes / scratchy eyes / eye irritation	29	22.7
During using	7	5.5*
Shortly after using	24	18.8
Persisting after using	1	0.8*
Rash	58	45.3
During using	-	0*
Shortly after using	55	43.0
Persisting after using	3	2.3*
Numbness in arms or legs	3	2.3*
During using	-	0*
Shortly after using	1	0.8*
Persisting after using	2	1.6*
Saliva / runny nose / tears comes down	9	7.0
During using	1	0.8*
Shortly after using	8	6.3
Persisting after using	-	0*

Table 7: (continued) Number and percentage of symptoms while and/or after spraying pesticide (n = 262).

Symptoms	Number	Percentage
Numbness of tongue	4	3.1*
During using	-	0*
Shortly after using	4	3.1*
Persisting after using	-	0*
Wheezing	4	3.1*
During using	1	0.8*
Shortly after using	2	1.6*
Persisting after using	1	0.8*

* Sample size too small to analyze with confidence.

There were 10 symptoms that only small numbers of subjects experienced.

These were categorized into 3 groups by organ system as follows:

Digestive symptoms: stomach ache, diarrhea and feel nauseous or vomiting

Respiratory symptoms: difficulty breathing and wheezing

Neuromuscular symptoms: twitching muscles, blurred or dim vision, trembling, numbness in arms or legs and numbness of tongue

4.2 Relationships between pesticide knowledge, pesticide attitude and pesticide practice.

When using Chi-square test knowledge in pesticide usage had no significant relationship with pesticide attitude of agriculturists ($p = 0.182$), as shown in table 8.

Table 8 : Relationship between pesticide knowledge and pesticide attitude(n=262).

Attitude level	Knowledge level			
	Have to improve or		Good	
	Average			
	Average			
	Average		Good	
	Average		Good	
	Average		Good	
	Average		Good	
Have to improve to Average	69	78.4%	123	70.7%
Good	19	21.6%	51	29.3%
P = 0.182				

Table 9 shows that attitude in pesticide practice of agriculturists had significant relationship with practice in pesticide use ($p = 0.004$). Subjects with better attitude also had better practice (positive relationship).

Table 9 : Relationship between pesticide attitude and pesticide practice.

Attitude level	Practice level			
	Average		Good	
	Average			
	Average			
	Average		Good	
	Average		Good	
	Average		Good	
	Average		Good	
Have to improve or Average	27	100%	78	77.2%
Good	0	0%	23	22.8%
P = 0.004*				

* Fisher's Exact Test

Knowledge in pesticide practice had no significant relationship with practice in pesticide use of agriculturists ($p = 0.246$), as shown in table 10.

Table 10 : Relationship between pesticide knowledge and pesticide practice.

Practice level	Knowledge level			
	Have to improve or Average		Good	
		(%)		(%)
Have to improve or Average	10	27.8%	17	18.5%
Good	26	72.2%	75	81.5%
P = 0.246				

4.3 Relationships between independent and dependent variables.

4.3.1 Relationship between general information and symptoms.

This section presents relationships between symptom frequencies and independent variables in the 128 subjects who did not use pesticides but went into areas where pesticides were used (low exposure, 60 subjects), who mixed or sprayed pesticides but did not do both (medium exposure, 27 subjects), and those who both mixed and sprayed pesticides (high exposure, 41 subjects). Table 11 shows that highest symptom rates were usually found in age 45 – 54 years, although age was not significantly associated with symptom rates.

Table 11: Relationship between age and symptoms.

Symptoms	Age								P-value
	≤34		35 - 44		45 - 54		≥55		
	(n=15)	(n=44)	(n=37)	(n=32)					
	N	%	N	%	N	%	N	%	
Headache	1	6.7	12	27.3	16	43.2	9	28.1	0.065
Weakness / lack of energy	0	0	9	20.5	9	24.3	9	28.1	0.158
Been soaked with sweat	6	40.0	17	38.6	14	37.8	11	34.4	0.978
Itchy eyes / scratchy eyes / eye irritation	3	20.0	12	27.3	10	27.0	5	15.6	0.612
Rash	9	60.0	19	43.2	19	51.4	11	34.4	0.324

Regarding to relationship between gender and pesticide-related symptoms, males had a significantly higher frequency of being soaked with sweat than females ($p < 0.001$). Other symptoms were not significantly associated with gender. (table 12).

Table 12: Relationship between gender and symptoms.

Symptoms	Gender				P-value
	Male (n=81)		Female (n=47)		
	N	%	N	%	
Headache	24	29.6	14	29.8	0.985
Weakness / lack of energy	16	19.8	11	23.4	0.625
Digestive Symptoms	7	8.6	1	2.1	0.256*
Respiratory Symptoms	6	7.4	1	2.1	0.422*
Neuromuscular Symptoms	9	11.1	5	10.6	0.934
Been soaked with sweat	40	49.4	8	17.0	< 0.001
Itchy eyes / scratchy eyes / eye irritation	23	28.4	7	14.9	0.082
Rash	39	48.1	19	40.4	0.398
Saliva / runny nose / tears comes down	7	8.6	2	4.3	0.484*

* Fisher's Exact Test.

As shown in table 13, gender had no significant relationship with knowledge in pesticide practice of agriculturists when using Chi-square test ($p = 0.106$), although there was a tendency for knowledge to be somewhat higher in males.

Table 13: Relationship between gender and knowledge in pesticide practice.

Knowledge	Gender				P-value
	Male (n=146)		Female (n=116)		
	N	%	N	%	
Have to improve	7	4.8	8	6.9	0.106
Average	34	23.3	39	33.6	
Good	105	71.9	69	59.5	

Gender had no significant relationship with attitude in pesticide practice of agriculturists when using Chi-square test ($p = 0.240$), as shown in table 14.

Table 14: Relationship between gender and attitude in pesticide practice.

Attitude	Gender				P-value
	Male (n=146)		Female (n=116)		
	N	%	N	%	
Have to improve	6	4.1	5	4.3	0.240
Average	95	65.1	86	74.1	
Good	45	30.8	25	21.5	

As shown in table 15, gender was not significantly associated with pesticide use practice, although practice tended to be better in females than in males.

Table 15: Relationship between gender and practice in pesticide use.

Practice	Gender				P-value
	Male (n=81)		Female (n=47)		
	N	%	N	%	
Have to improve	0	0	0	0	0.190
Average	20	24.7	7	14.9	
Good	61	75.3	40	85.1	

Relationship between education level and knowledge in pesticide practice, found that education level had significant relationship with knowledge in pesticide practice of agriculturists when using Chi-square test ($p = 0.013$), as shown in table 16. Higher education was associated with higher knowledge (positive association).

Table 16: Relationship between education level and knowledge in pesticide use.

Knowledge	Education level						P-value
	Non education		Pratom 5-6 (n=72)		Matayom 1-3 Matayom 4-6 diploma Bachelor degree and above (n=47)		
	N	%	N	%	N	%	
Have to improve	10	7.0	2	2.8	3	6.4	0.013
Average	51	35.7	15	20.8	7	14.9	
Good	82	57.3	55	76.4	37	78.7	

There was a tendency for lower education to be associated with better attitude about pesticides (negative association), although this association was not significant by chi-square test ($p = 0.082$), as shown in table 17.

Table 17: Relationship between education level and attitude in pesticide use.

Attitude Level	Education level						P-value
	Non education To		Pratom 5-6 (n=72)		Matayom 1-3 Matayom 4-6 diploma Bachelor degree and above (n=47)		
	N	%	N	%	N	%	
Have to improve	5	3.5	3	4.2	3	6.4	0.082
Average	91	63.6	58	80.5	12	25.5	
Good	47	32.9	11	15.3	32	68.1	

Education level had no significant relationship with practice in pesticide use of agriculturists when using Chi-square test ($p = 0.605$), as shown in table 18.

Table 18: Relationship between education level and practice in pesticide use.

Practice Level	Education level						P-value
	Non education		Pratom		Matayom 1-3		
	To Pratom 4 (n=66)		5-6 (n=42)		Matayom 4-6 diploma Bachelor degree and above (n=20)		
	N	%	N	%	N	%	
Have to improve	0	0	0	0	0	0	0.605
Average	12	18.2	11	26.2	4	20.0	
Good	54	81.8	31	73.8	16	80.0	

Regarding to relationship between education level and pesticide-related symptoms, education level had no significant relationship with symptoms, as shown in table 19. In this table and the following tables regarding symptom rates, symptoms for which cell sizes were too small to be analyzed confidently are not included.

Table 19 : Relationship between education level and symptoms.

Symptoms	Education level						P-value
	Non education To Pratom 4 (n=66)		Pratom 5-6 (n=42)		Matayom 1-3 Matayom 4-6 diploma Bachelor degree and above (n=20)		
	N	%	N	%	N	%	
Headache	20	30.3	14	33.3	4	20.0	0.555
Weakness / lack of energy	15	22.7	8	19.0	4	20.0	0.893
Neuromuscular Symptoms	9	13.6	2	4.8	3	15.0	0.290
Been soaked with sweat	23	34.8	20	47.6	5	25.0	0.186
Itchy eyes / scratchy eyes / eye irritation	12	18.2	14	33.3	4	20.0	0.179
Rash	26	39.4	24	57.1	8	40.0	0.171

Table 20 shows that work characteristic had some significant relationships with pesticide-related symptoms. In the term of agriculturists who cultivated crops by themselves had significant relationship with symptoms including rash ($p = 0.006$). Prevalence of rash was higher in those who cultivated crops by themselves (58.0%) than in those who did not (11.1%). Agriculturists that hired other person had significant relationship with symptoms including itchy eyes/scratchy eyes/eye irritation ($p = 0.012$). Those who hired other persons had higher prevalence of eye symptoms (91.7%) than did those who did not (70.7%). Agriculturists that been an employee in agricultural sector had significant relationship with symptoms including been soaked with sweat ($p = 0.009$), itchy eyes/scratchy eyes/eye irritation ($p = 0.004$). For both types of symptoms, prevalence was lower in those who had been employees in the agricultural sector than in those who had not. Agriculturists that been an employee but not in agricultural sector had significant relationship with symptoms including Digestive symptoms ($p = 0.017$), and itchy eyes/scratchy eyes/eye irritation ($p = 0.014$). Prevalence of digestive symptoms was higher, and prevalence of eye symptoms was lower, in those who had been non-agricultural employees than in those who had not. In summary, relationships of work characteristics with symptoms were complex, and it could not be concluded that higher symptom rates were consistently associated with higher pesticide exposure.

Table 20 : Relationship between work characteristic and symptoms.

Symptoms	Work characteristic							
	Cultivate crops by themselves (n=119)		Hire other person (n=36)		Employee in agricultural sector (n=27)		Employee not in agricultural sector (n=30)	
	N	P-value	N	P-value	N	P-value	N	P-value
Headache	36	0.611	9	0.468	9	0.641	9	0.966
Weakness / lack of energy	27	0.203*	8	0.845	6	0.871	8	0.393
Digestive Symptoms	-	-	-	-	-	-	5	0.017*
Respiratory Symptoms	-	-	-	-	-	-	-	-
Neuromuscular Symptoms	-	-	3	0.756*	2	0.733*	6	0.093*
Been soaked with sweat	44	0.655	11	0.310	16	0.009	14	0.236
Itchy eyes / scratchy eyes / eye irritation	28	0.929	3	0.012	12	0.004	12	0.014
Rash	50	0.006	14	0.361	16	0.101	17	0.153
Saliva / runny nose / tears comes down	-	-	1	0.443*	-	-	-	-

* Fisher's Exact Test

Table 21 shows that the relationship between amount year that done agriculture with pesticide related symptoms, the amount year that done agriculture had significant relationship with headache ($p = 0.033$) and weakness/lack of energy ($p = 0.016$). Generally, higher symptom rates were associated with longer duration of work in agriculture.

Table 21: Relationship between duration of work and symptoms.

Symptoms	Done agriculture (year)				P-value
	1 - 15		≥ 16		
	(n=69)	(n=59)	(n=59)	(n=59)	
	N	%	N	%	
Headache	15	21.7	23	39.0	0.033
Weakness / lack of energy	9	13.0	18	30.5	0.016
Digestive Symptoms	5	7.2	3	5.1	0.725*
Respiratory Symptoms	3	4.3	4	6.8	0.703*
Neuromuscular Symptoms	5	7.2	9	15.3	0.148
Been soaked with sweat	25	36.2	23	39.0	0.749
Itchy eyes / scratchy eyes / eye irritation	18	16.1	12	20.3	0.444
Rash	29	42.0	29	49.2	0.420
Saliva / runny nose / tears comes down	6	8.7	3	5.1	0.505*

* Fisher's Exact Test.

Table 22 shows that type of cultivation had significant relationship between pesticide-related symptoms. In the term of plantation had significant

relationship with symptoms including headache ($p = 0.010$) and rash ($p = 0.034$). There was no consistent association of paddy field, oil palm, farm, para rubber and no type of plantation with symptoms. Symptom rates were generally lower in the plantation group than in other subjects.

Table 22 : Relationship between type of plantation and symptoms.

Symptoms	Type of cultivation											
	Paddy field (n=1)		Farm (n=22)		Plantation (n=79)		Oil palm (n=34)		Para rubber (n=84)		None (n=4)	
	N	P-value	N	P-value	N	P-value	N	P-value	N	P-value	N	P-value
Headache	-	-	6	0.785	17	0.010	11	0.691	26	0.665	-	-
Weakness / lack of energy	-	-	7	0.248*	15	0.458	8	0.685	19	0.559	-	-
Digestive Symptoms	-	-	-	-	6	0.710*	-	-	7	0.262*	-	-
Respiratory Symptoms	-	-	-	-	6	0.250*	-	-	6	0.421*	-	-
Neuromuscular Symptoms	-	-	21	0.461*	10	0.428	3	0.759*	11	0.378*	-	-
Been soaked with sweat	-	-	10	0.397	25	0.082	12	0.757	36	0.084	-	-

Table 22: (continued) Relationship between type of plantation and symptoms.

Symptoms	Type of cultivation											
	Paddy field (n=1)		Farm (n=22)		Plantation (n=79)		Oil palm (n=34)		Para rubber (n=84)		None (n=4)	
	N	P-value	N	P-value	N	P-value	N	P-value	N	P-value	N	P-value
Itchy eyes / scratchy eyes / eye irritation	-	-	6	0.641	15	0.131	6	0.352	22	0.310	-	-
Rash	-	-	9	0.648	30	0.034	15	0.870	43	0.065	3	0.328*
Saliva / runny nose / tears comes down	-	-	-	-	5	0.731*	3	0.699*	6	1.000*	-	-

Table 23 shows that pesticides exposure level including agriculturists who do not use pesticides, go into pesticide area but not spray-mix, who mix or spray only one and who had done both of spray and mix type had significant relationship between pesticide-related symptoms including weakness/lack of energy ($p = 0.002$), weakness/lack of energy shortly after using pesticides ($p = 0.050$), been soaked with sweat ($p = 0.001$), itchy eyes/scratchy eyes/eye irritation ($p = 0.004$), itchy eyes/scratchy eyes/eye irritation shortly after using pesticides ($p = 0.002$), rash ($p = 0.006$), rash shortly after using pesticides ($p = 0.002$), saliva/runny nose/tears comes down ($p = 0.005$) and saliva/runny nose/tears comes down shortly after using ($p = 0.013$). For 7 of 9 symptom types, symptom rates were higher in persons who both mixed and sprayed pesticides than in others.

Table 23: Relationship between pesticides exposure level and symptoms.

Symptoms	Pesticides exposure level								P-value
	Do not use pesticide (n=134)		Go into pesticide area not spray-mix (n=60)		Only Sprayer or Mixer (n=27)		Both Sprayer and Mixer (n=41)		
	N	%	N	%	N	%	N	%	
Headache	0	0	16	26.7	6	22.2	16	39.0	0.260
Shortly after using	0	0	9	15.0	5	18.5	13	31.7	0.121
Weakness / lack of energy	0	0	11	18.3	12	44.4	4	9.8	0.002
Shortly after using	0	0	7	11.7	8	29.6	4	9.8	0.050
Been soaked with sweat	0	0	13	21.7	12	44.4	23	56.1	0.001
Itchy eyes / scratchy eyes / eye irritation	0	0	8	13.3	5	18.5	17	41.5	0.004
Shortly after using	0	0	6	10.0	3	11.1	15	36.6	0.002
Rash	0	0	21	35.0	10	37.0	27	65.9	0.006
Shortly after using	0	0	19	31.7	10	37.0	27	65.9	0.002

Table 23: (continued) Relationship between pesticides exposure level and symptoms.

Symptoms	Pesticides exposure level				P-value
	Only Sprayer or Mixer or Go into pesticide area not spray-mix (n=87)		Both Sprayer and Mixer (n=41)		
	N	%	N	%	
	Weakness / lack of energy persisting after using	8	9.2	0	
Been soaked with sweat persisting after using	11	12.6	3	7.3	0.546*
Neurological symptoms	11	12.6	3	7.3	0.546*
Saliva / runny nose / tears comes down	2	2.3	7	17.1	0.005*
Saliva / runny nose / tears comes down shortly after using	2	2.3	6	14.6	0.013*

* Fisher's Exact Test

Table 24 shows that highest percentage of good level in knowledge of pesticide usage was agriculturists who spraying and mixing pesticides. Pesticides exposure level including agriculturists who do not use pesticides, sprayer, mixer and agriculturists that go into pesticide area but not spray and/or mix pesticides had no relationship with knowledge of pesticide usage ($p = 0.518$).

Table 24: Relationship between pesticides exposure level and knowledge in pesticide use.

Knowledge level	Pesticides exposure level							
	Do not use pesticide (n=134)		Go into pesticide area not spray-mix (n=60)		Only Sprayer or Mixer (n=27)		Both Sprayer and Mixer (n=41)	
	N	%	N	%	N	%	N	%
Have to improve	11	8.2	2	3.3	1	3.7	1	2.4
Average	41	30.6	16	26.7	7	25.9	9	22.0
Good	82	61.2	42	70.0	19	70.4	31	75.6
P-value	0.518							

Most subjects in pesticides exposure level that including agriculturists who do not use pesticides, sprayer, mixer and agriculturists that go into pesticide area but not spray and/or mix pesticides were in average level of attitude in pesticide use. Pesticides exposure level had significant relationship with attitude in pesticide usage ($p = 0.010$) as shown in table 25. Persons who did not use pesticides had better attitude than those who used pesticides.

Table 25: Relationship between pesticides exposure level and attitude in pesticide use.

Attitude level	Pesticides exposure level							
	Do not use pesticide (n=134)		Go into pesticide area not spray-mix (n=60)		Only Sprayer or Mixer (n=27)		Both Sprayer and Mixer (n=41)	
	N	%	N	%	N	%	N	%
Have to improve	4	3.0	3	5.0	0	0	4	9.8
Average	83	61.9	45	75.0	25	92.6	28	68.3
Good	47	35.1	12	20.0	2	7.4	9	22.0
P-value	0.010							

Table 26 shows that most of subjects had points in good level of practice in pesticide use. Pesticides exposure level including agriculturists who do not use pesticides, sprayer, mixer and agriculturists that go into pesticide area but not spray and/or mix pesticides had no relationship with practice in pesticide use ($p = 0.356$).

Table 26: Relationship between pesticides exposure level and practice in pesticide use.

Practice level	Pesticides exposure level							
	Do not use pesticide		Go into pesticide area not spray-mix		Only Sprayer or Mixer		Both Sprayer and Mixer	
	(n=134)		(n=60)		(n=27)		(n=41)	
	N	%	N	%	N	%	N	%
Have to improve	0	0	0	0	0	0	0	0
Average	0	0	14	23.3	3	11.1	10	24.4
Good	0	0	46	76.7	24	88.9	31	75.6
P-value	0.356							

Table 27 shows that symptom prevalence was generally directly associated with the number of years using pesticides. Subjects who had long using pesticides had more symptoms than using pesticides a few years, and the amount year that using pesticides had significant relationship with symptoms including headache ($p = 0.004$) and weakness/lack of energy ($p = 0.001$).

Table 27 : Relationship between duration of chemical practice and symptoms.

Symptoms	Using pesticide (year)						P- value
	≤ 5 (n=77)		6 - 10 (n=41)		≥ 11 (n=10)		
	N	%	N	%	N	%	
Headache	15	19.5	17	41.5	6	60.0	0.004
Weakness / lack of energy	8	10.4	15	36.6	4	40.0	0.001
Been soaked with sweat	28	36.4	13	31.7	7	70.0	0.077
Itchy eyes / scratchy eyes / eye irritation	14	18.2	12	29.3	4	40.0	0.175
Rash	30	39.0	21	51.2	7	70.0	0.117

Table 28 shows that percentage of symptoms was high when frequency of using pesticide a year was high, and times using pesticide a year had significant relationship with symptoms including headache ($p = 0.007$), been soaked with sweat ($p=0.001$), itchy eyes/scratchy eyes/eye irritation ($p < 0.001$) and rash ($p = 0.009$).

Table 28: Relationship between duration of chemical practice and symptoms.

Symptoms	Use pesticide a year (times)						P-value
	1 – 3		4 – 6		≥ 16		
	(n=74)		(n=34)		(n=20)		
	N	%	N	%	N	%	
Headache	14	18.9	16	47.1	8	40.0	0.007
Weakness / lack of energy	13	17.6	9	26.5	5	25.0	0.515
Been soaked with sweat	22	29.7	11	32.4	15	75.0	0.001
Itchy eyes / scratchy eyes / eye irritation	7	9.5	13	38.2	10	50.0	<0.001
Rash	27	36.5	16	47.1	15	75.0	0.009

Table 29 shows that the amount of pesticide sprayed per rai had no significant relationship with symptoms.

Table 29 : Relationship between amount of pesticide sprayed and symptoms.

Symptoms	Spray pesticide each time, on average(cc./rai)				P- value
	1-50		>50		
	(n=85)		(n=43)		
	N	%	N	%	
Headache	28	32.9	10	23.3	0.257
Weakness / lack of energy	21	24.7	6	14.0	0.159
Neuromuscular Symptoms	11	12.9	3	7.0	0.381*
Been soaked with sweat	33	38.8	15	34.9	0.664
Rash	43	50.6	15	34.9	0.092
Saliva / runny nose / tears comes down	7	8.2	2	4.7	0.717*

* Fisher's Exact Test

Time that subjects usually sprayed pesticides had no significant relationship with symptoms as shown in table 30.

Table 30 : Relationship between duration of chemical practice and symptoms.

Symptoms	Usually spray pesticide				P-value
	Before 08.00		After 08.00		
	am		am		
	(n=94)		(n=34)		
	N	%	N	%	
Headache	27	28.7	11	32.4	0.691
Weakness / lack of energy	20	21.3	7	20.6	0.933
Neuromuscular Symptoms	10	89.4	4	11.8	1.000*
Been soaked with sweat	36	38.3	12	35.3	0.757
Itchy eyes / scratchy eyes / eye irritation	25	26.6	5	14.7	0.161
Rash	47	50.0	11	32.4	0.076
Saliva / runny nose / tears comes down	8	8.5	1	2.9	0.443*

* Fisher's Exact Test

The highest percentages of most symptoms were observed in subjects who had most recently used pesticides 1-30 days ago. The most recent time of use was significantly associated with headache ($p = 0.039$), itchy eyes/ scratchy eyes/ eye irritation ($p = 0.030$), and rash ($p = 0.018$), as shown in table 31.

Table 31: Relationship between duration of chemical practice and symptoms.

Symptoms	Latest time used/contacted pesticide (days ago)						P- value
	1 - 30		31 - 60		≥ 61		
	(n=47)		(n=56)		(n=25)		
	N	%	N	%	N	%	
Headache	20	42.6	11	19.6	7	28.0	0.039
Weakness / lack of energy	13	27.7	11	19.6	3	12.0	0.282
Neuromuscular Symptoms	4	8.5	7	12.5	3	12.0	0.797
Been soaked with sweat	21	44.7	17	30.4	10	40.0	0.314
Itchy eyes / scratchy eyes / eye irritation	17	36.2	8	14.3	5	20.0	0.030
Rash	29	61.7	20	35.7	9	36.0	0.018

There was no consistent association of symptom rates with frequency of drinking alcohol. However, the rate of being soaked with sweat was significantly higher in subjects with higher drinking frequency ($p = 0.001$), as shown in table 32.

Table 32 : Relationship between frequency of drinking alcohol and symptoms.

Symptoms	Drink alcoholic per month						P-value
	Less than		1-3		More than		
	1/month		/month		3/month		
	(n=72)		(n=36)		(n=20)		
	N	%	N	%	N	%	
Headache	22	30.6	13	36.1	3	15.0	0.246
Weakness / lack of energy	20	27.8	4	11.1	3	15.0	0.104
Been soaked with sweat	17	23.6	21	58.3	10	50.0	0.001
Itchy eyes / scratchy eyes / eye irritation	15	20.8	9	25.0	6	30.0	0.670
Rash	32	44.4	20	55.6	6	30.0	0.179

Regarding to relationship between smoking history and pesticide-related symptom, smoking cigarettes had no significant relationship with symptoms, as shown in table 33.

Table 33: Relationship between smoked cigarettes and symptoms.

Symptoms	Smoked cigarettes at present		P-value
	(n=56)		
	N	%	
Headache	16	28.6	1.000*
Weakness / lack of energy	10	17.9	1.000*
Digestive Symptoms	4	7.1	0.159*
Respiratory Symptoms	5	7.9	0.567*
Neuromuscular Symptoms	6	10.7	0.260*
Been soaked with sweat	26	46.4	0.719*
Itchy eyes / scratchy eyes / eye irritation	18	32.1	0.418*
Rash	30	53.6	0.468*
Saliva / runny nose / tears comes down	7	12.5	1.000*

* Fisher's Exact Test

Regarding to relationship between used mosquito coils and pesticide-related symptom, used mosquito coils had significant relationship with symptoms including rash ($p = 0.011$), as shown in table 34. Rash prevalence was higher in those who used mosquito coils than in those who did not.

Table 34: Relationship between used mosquito coils and symptoms.

Symptoms	Used mosquito coils		P-value
	(n = 82)		
	N	%	
Headache	21	25.6	0.178
Weakness / lack of energy	17	20.7	0.893
Digestive Symptoms	5	6.1	1.000*
Respiratory Symptoms	2	2.4	0.097*
Neuromuscular Symptoms	8	9.8	0.567
Been soaked with sweat	31	37.8	0.924
Itchy eyes / scratchy eyes / eye irritation	18	22.0	0.596
Rash	44	53.7	0.011
Saliva / runny nose / tears comes down	7	8.5	0.488*

* Fisher's Exact Test

Regarding to relationship between used household pesticide spray and pesticide-related symptom, used household pesticide spray had no significant relationship with symptoms, as shown in table 35.

Table 35: Relationship between used household pesticide spray and symptoms.

Symptoms	used household pesticide spray		P-value
	(n = 42)		
	N	%	
Headache	12	28.6	0.847
Weakness / lack of energy	13	31.0	0.056
Digestive Symptoms	5	11.9	0.113*
Respiratory Symptoms	3	7.1	0.683*
Neuromuscular Symptoms	8	19.0	0.067
Been soaked with sweat	11	26.2	0.065
Itchy eyes / scratchy eyes / eye irritation	11	26.2	0.607
Rash	18	42.9	0.697
Saliva / runny nose / tears comes down	3	7.1	1.000*

* Fisher's Exact Test

4.3.2 Relationship between knowledge in pesticide practice and symptoms.

Table 36 shows that have to improve level to average level in knowledge of pesticide practice was associated with higher symptoms than good level

in knowledge, knowledge level had significant relationship with symptoms including neuromuscular symptoms ($p = 0.003$). Somewhat surprisingly, neuromuscular symptom prevalence was higher in subjects with high knowledge than in those with lower knowledge.

Table 36: Relationship between knowledge in pesticide practice and symptoms.

Symptoms	Knowledge level				P-value
	Have to improve		Good		
	to Average		(n=92)		
	(n=36)				
	N	%	N	%	
Headache	13	36.1	25	27.2	0.320
Weakness / lack of energy	11	30.6	16	17.4	0.101
Digestive Symptoms	4	11.1	4	4.3	0.220*
Respiratory Symptoms	3	8.3	4	4.3	0.401*
Neuromuscular Symptoms	9	25.0	5	5.4	0.003*
Been soaked with sweat	12	33.3	36	39.1	0.542
Itchy eyes / scratchy eyes / eye irritation	8	22.2	22	23.9	0.839
Rash	15	41.7	43	46.7	0.604
Saliva / runny nose / tears comes down	5	13.9	4	4.3	0.116*

* Fisher's Exact Test

4.3.3 Relationship between attitude in pesticide practice and symptoms.

Regarding to relationship between attitude in pesticide practice and pesticide-related symptom, attitude in pesticide practice had no significant relationship with symptoms as shown in table 37.

Table 37: Relationship between attitude in pesticide practice and symptoms.

Symptoms	Attitude level				P-value
	Have to improve to Average (n=105)		Good (n=23)		
	N	%	N	%	
	Headache	29	27.6	9	
Weakness / lack of energy	24	22.9	3	13.0	0.403*
Digestive Symptoms	6	5.7	2	8.7	0.634*
Respiratory Symptoms	5	4.8	2	8.7	0.608*
Neuromuscular Symptoms	12	11.4	2	8.7	1.000*
Been soaked with sweat	41	39.0	7	30.4	0.440
Itchy eyes / scratchy eyes / eye irritation	24	22.9	6	26.1	0.741
Rash	49	46.7	9	39.1	0.511
Saliva / runny nose / tears comes down	8	7.6	1	4.3	1.000*

* Fisher's Exact Test

4.3.4 Relationship between practice in pesticide use and symptoms.

Regarding to relationship between practice in pesticide use and pesticide-related symptom, practice in pesticide use had significant relationship with symptoms including Itchy eyes / scratchy eyes / eye irritation ($p = 0.017$), as shown in table 38. Generally, symptom rates were higher in subjects with poorer practice.

Table 38: Relationship between practice in pesticide use and symptoms.

Symptoms	Practice level				P-value
	Have to		Good		
	Improve				
	to Average	(n=0)	(n=101)		
	N	%	N	%	
Headache	8	29.6	30	29.7	0.994
Weakness / lack of energy	8	29.6	19	18.8	0.221
Digestive Symptoms	2	7.4	6	5.9	0.675*
Respiratory Symptoms	0	0	7	6.9	0.344*
Neuromuscular Symptoms	5	18.5	9	8.9	0.171*
Been soaked with sweat	13	48.1	35	34.7	0.198
Itchy eyes / scratchy eyes / eye irritation	11	40.7	19	18.8	0.017
Rash	14	51.9	44	43.6	0.442
Saliva / runny nose / tears comes down	4	14.8	5	5.0	0.093*

* Fisher's Exact Test

4.4 Comparing pesticide-related knowledge and attitude in agriculturalists who do and do not use pesticides.

Regarding to relationship between pesticide usage agriculturalists with agriculturalists not used in pesticide knowledge, pesticide usage agriculturalists and agriculturalists not used had a marginally significant relationship with pesticide knowledge ($p = 0.067$), as shown in table 39. Knowledge was better in subjects who used pesticides than in those who did not.

Table 39 : Relationship between pesticide use and pesticide-related knowledge.

Knowledge level	Agriculturists				P-value
	Not used pesticide (n=134)		Used pesticide (n=128)		
	N	%	N	%	
Have to improve to	52	38.8	36	28.1	0.067
Average					
Good	82	61.2	92	71.9	

Regarding to relationship between pesticide usage agriculturists with agriculturists not used in pesticide attitude, pesticide usage agriculturists and agriculturists not used had significant relationship with pesticide attitude ($p = 0.002$), as shown in table 40. In contrast to knowledge, attitude was better in subjects who did not use pesticides than in those who used them.

Table 40: Relationships between pesticide usage agriculturists with agriculturists not used in pesticide attitude.

Attitude level	Agriculturists				P-value
	Not used pesticide (n=134)		Used pesticide (n=128)		
	N	%	N	%	
Have to improve to	87	64.9	105	82.0	0.002
Average					
Good	47	35.1	23	18.0	