RESULTS

Sampling Stem Fly *Melanagromyza sojae* (Zehntner) on Soybean

Sampling adult populations

The mean number of adult *M. sojae* (Zhnt.) per 25 plants throughout the sampling period of 3 to 12 weeks after planting is summarized in Table 2. The peak of seasonal abundance was reached on the eighth week after planting (Figure 3). There were statistically significant differences between the mean density of adult stem flies counted in the designed cropping systems as determined by the F-test ($P<0.01$). These differences in stem fly numbers were consistent for the ten sampling dates. The highest density of *M. sojae* was 18.03±6.9 stem flies per 25 plants which was counted in soybean monocultures kept weed-free throughout the season. The lowest density of *M. sojae* was 4.00±0.9 stem flies per 25 plants which was counted in soybean/corn polycultures weedy throughout the season.

Table 2. Mean densities of soybean stem fly, Melanagromyza sojae (Zhnt.) adults counted on 25 plants in various soybean cropping systems at the Multiple Cropping Center Experimental Farm, Chiang Mai (1989).

Cropping System	Sampling date (weeks after planting)										
	3	4	5	6	7	8	9	10	11	12	Mean±S.E.
	Number of adult stem flies per 25 plants										
Soybean Monocultures:											
Weedy throughout the season	8.00	8.50	5.50	6.50	5.50	6.50	6.25	0.25	2.75	0	5.28 ± 0.9 c
Weed-free for only two weeks after planting	6.00	10.00	8.75	9.00	10.00	21.75	11.75	2.25	0	0.25	7.98 ± 2.0 bc
Weed-free for only four weeks after planting	3.00	12.00	6.50	13.25	22.75	50.75	27.00	8.00	1.50	0.75	14.55 ± 4.8 ab
Weed-free throughout the season	2.75	6.50	9.50	9.00	22.75	69.00	44.75	14.00	1.25	0.75	18.03 ± 6.9 a
Soybean/sweet corn Polycultures:											
Weed-free throughout the season	4.50	8.00	10.25	3.75	13.50	52.25	19.50	8.25	1.00	0.75	12.13 ± 4.8 b
Weed-free for only two weeks after planting	4.23	9.25	10.50	6.25	14.50	14.75	7.50	2.25	0.25	0	6.95 ± 1.7 bc
Weed-free for only four weeks after planting	4.00	11.00	7.50	8.00	12.75	33.75	14.00	1.00	0	0	9.20 ± 3.1 bc
Weedy throughout the season	5.75	4.50	7.00	3.75	7.25	7.00	3.25	1.25	0.25	0	4.00 ± 0.9 c

S.E. = The standard error associated with the means.

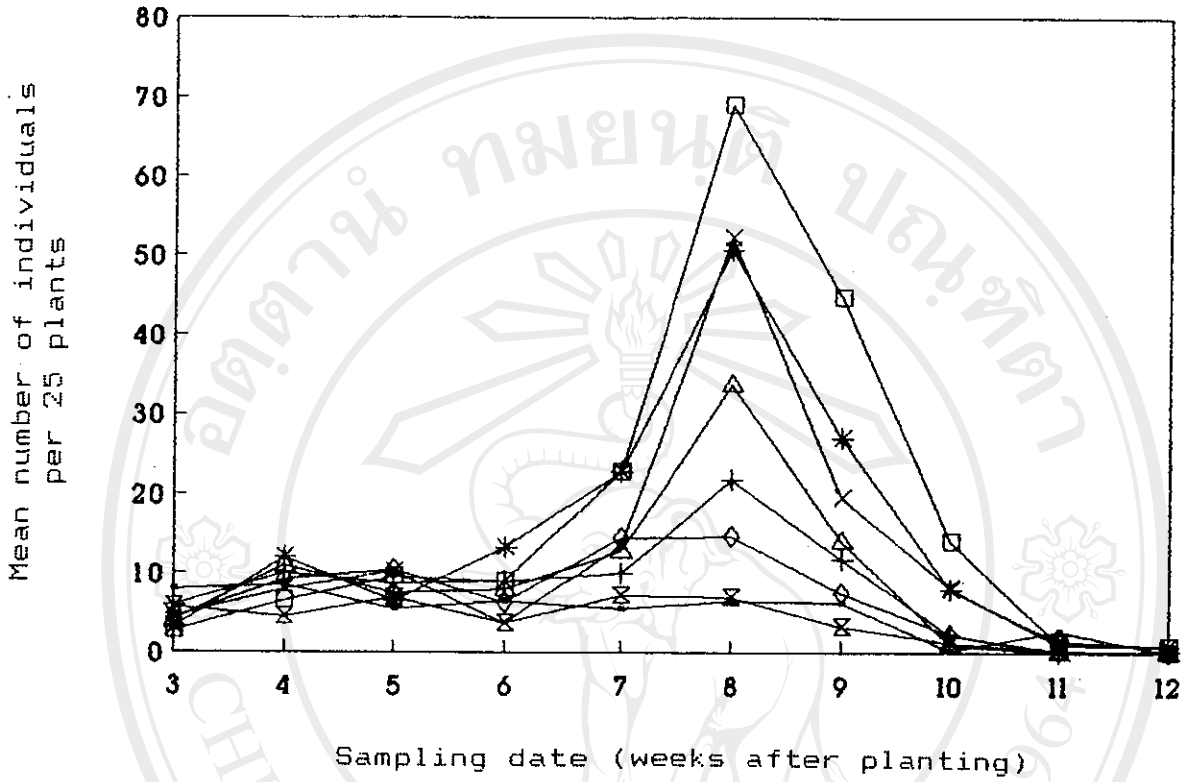

Figure 3. The seasonal abundance of adult soybean stem fly, Melanagromyza sojae (Zhnt.) in soybean monocultures: (▪) weedy throughout the season, (+) weed-free for only two weeks after planting, (✱) weed-free for only four weeks after planting, (□) weed-free throughout the season, and soybean/corn polycultures: (×) weed-free throughout the season, (◇) weed-free for only two weeks after planting, (△) weed-free for only four weeks after planting, and (⧖) weedy throughout the season at the Multiple Cropping Center Experimental Farm, Chiang Mai (1989).

There was an observed pattern of stem fly density increasing with time. The least density was observed during the third and fourth weeks after planting for all cropping systems and the highest peak occurred during the eighth week after planting after which stem fly densities declined until soybean harvest.

Sampling larvae and pupae populations

The mean number of stemfly larvae and pupae counted per 10 plants summarized in Table 3 indicated that there were statistically significant differences between the mean densities in both soybean monocultures and soybean/corn polycultures ($P<0.01$). The highest number of immature stem flies was 4.75 ± 1.4 larvae and pupae per 10 plants which was observed in monocultures and polycultures kept weed-free for only four weeks after planting. The lowest number of immature stem flies was 2.00 ± 0.5 larvae and pupae per 10 plants which was observed in monocultures kept weedy throughout the season. Throughout the sampling period, an increasing pattern of immature population trends were observed in all the designed systems (Figure 4). The stem fly

Table 3. Mean densities of soybean stemfly, Melanagromyza sojae (Zhnt.) larvae and pupae in various soybean cropping systems at the Multiple Cropping Center Experimental Farm, Chiang Mai (1989).

Cropping System	Number of larvae and pupae/10 plants					
	3	4	5	6	7	Mean±S.E.
Soybean Monocultures:						
Weedy throughout the season	0.50	2.00	1.50	2.25	3.75	2.00±0.5 c
Weed-free for only two weeks after planting	0.75	2.25	5.00	5.50	5.00	3.70±0.9 ab
Weed-free for only four weeks after planting	1.00	2.25	5.75	6.50	8.25	4.75±1.4 a
Weed-free throughout the season	1.50	1.75	2.00	5.75	8.50	3.90±1.4 ab
Soybean/sweet corn Polycultures:						
Weed-free throughout the season	1.25	2.50	4.75	5.75	5.00	3.85±0.8 ab
Weed-free for only two weeks after planting	1.00	4.75	3.75	7.00	5.50	4.40±1.0 a
Weed-free for only four weeks after planting	2.75	1.75	7.50	5.00	6.75	4.75±1.1 a
Weedy throughout the season	1.00	2.75	6.25	2.25	4.25	3.30±0.9 b

S.E = The standard error associated with the means.

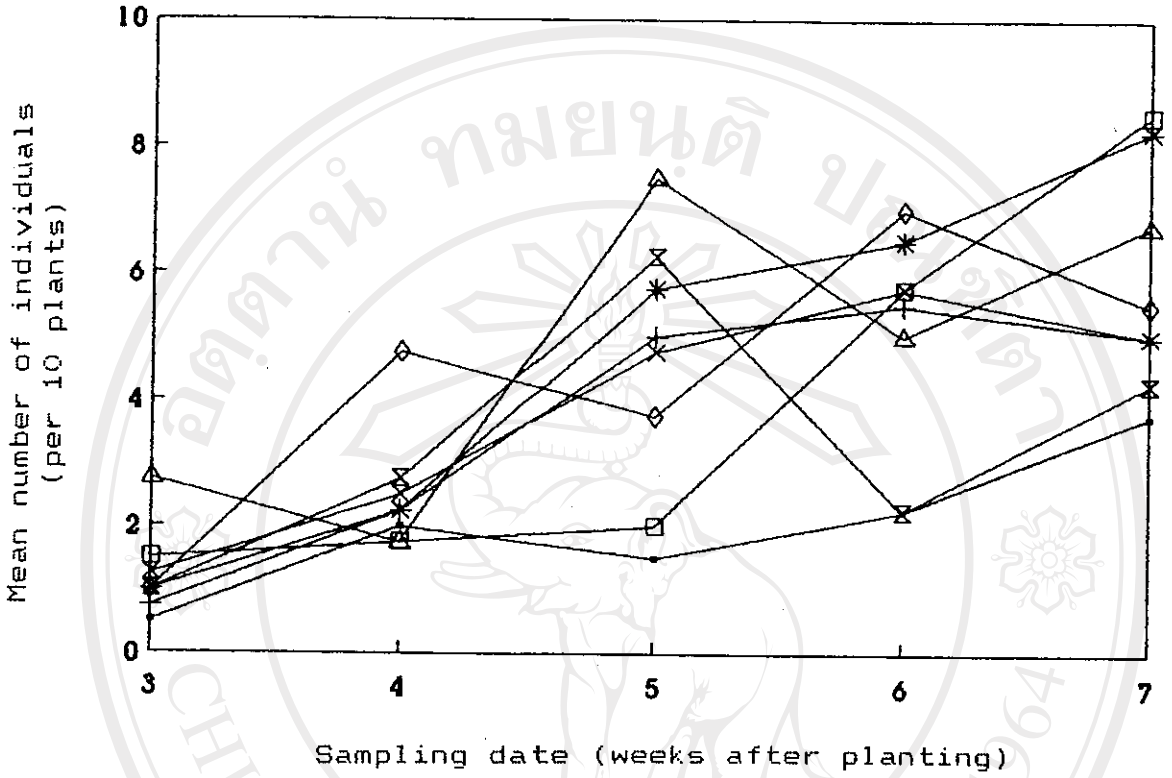

Figure 4. Mean densities of soybean stem fly, Melanagromyza sojae (Zehnt.) larvae and pupae in soybean monocultures: (•) weedy throughout the season, (+) weed-free for only two weeks after planting, (✳) weed-free for only four weeks after planting, (□) weed-free throughout the season, and soybean/corn polycultures: (×) weed-free throughout the season, (◇) weed-free for only two weeks after planting, (△) weed-free for only four weeks after planting, and (⧖) weedy throughout the season at the Multiple Cropping Center Experimental Farm, Chiang Mai (1989).

population in soybean monocultures kept weedy throughout the season increased from 0.50 on the third week to 2.00 larvae and pupae on the fourth week but decreased to 1.50 on the fifth week which increased again from 2.25 on the sixth week to 3.75 on the seventh week. Population in monocultures weed-free for only two weeks after planting was 5.00 on the fifth week which increased to 5.50 on the sixth week but decreased to 5.00 on the seventh week. The number of larvae and pupae increased continuously for monocultures weed-free for only four weeks after planting and weed-free throughout the season from 1.00 to 8.25 and 1.5 to 8.5 larvae and pupae per 10 plants from the third to the seventh week, respectively. The trend in population for polycultures kept weed-free for only two weeks after planting and weed-free throughout the season was increasing from 1.25 to 5.75 and 1.00 to to 7.00 larvae and pupae until the sixth week, respectively. However, the trend in population decreased on the seventh week from 5.75 to 5.00 and 7.00 to 5.50 larvae and pupae, respectively. Larvae and pupae counts in polycultures which were kept weed-free for only four weeks after planting and weedy throughout the season decreased on the sixth week from 7.50 to 5.00 and 6.25 to 2.25 larvae and pupae, respectively. The population was

observed to increase again from 5 to 6.75 and 2.25 to 4.25 larvae and pupae on the seventh week, respectively.

Data gathered from soybean plants dissected in the laboratory indicated that there were significant differences in percent infestation of plants between cropping systems ($P<0.01$). Highest percentage infestation was 48.00 ± 8.8 percent which was observed in monocultures kept weed-free for only four weeks after planting (Table 4). Lowest percentage of 21.50 ± 4.40 percent infestation was observed in soybean monocultures kept weedy throughout the season. Percent infestation in soybean monocultures kept weed-free throughout the season increased from 17.5 percent on the third week after planting to 57.5 percent on the seventh week while percent infestation in soybean/corn polycultures kept weed-free throughout the season increased only from 15.0 percent to 40.0 percent. During the seventh week after planting, a decreasing trend in percent infestations from 55 to 45 percent and from 60 to 57.5 percent was observed in soybean monocultures kept weed-free for only two and four weeks after planting, and in soybean/corn polycultures kept weed-free throughout the season and weed-free for only four weeks after planting which declined significantly from 55.0 to 40.0 percent and from

Table 4. Mean percent infestations by Melanagromyza sojae (Zhnt.) in various soybean cropping systems at the Multiple Cropping Center Experimental Farm, Chiang Mai (1989).

Cropping System	Sampling date (weeks after planting)					
	3	4	5	6	7	Mean±S.E.
	Percent infestation per 10 plants					
Soybean Monocultures:						
Weedy throughout the season	10.0	35.0	15.0	20.0	27.5	21.5±4.4 c
Weed-free for only two weeks after planting	10.0	35.0	42.5	55.0	45.0	37.5±7.6 ab
Weed-free for only four weeks after planting	15.0	42.5	62.5	60.0	57.5	48.0±8.8 a
Weed-free throughout the season	17.5	35.0	20.0	50.0	57.5	36.0±7.9 b
Soybean/Sweet corn Polycultures:						
Weed-free throughout the season	15.0	25.0	57.5	55.0	40.0	38.5±8.3 ab
Weed-free for only two weeks after planting	10.0	47.5	37.5	55.0	37.5	37.5±7.6 ab
Weed-free for only four weeks after planting	27.5	27.5	52.5	47.5	52.5	41.5±5.8 ab
Weedy throughout the season	12.5	35.0	55.0	27.5	32.5	32.5±6.8 b

S.E. = The standard error associated with the means.

55.0 to 37.5 percent, respectively (Figure 5).

The highest percentage of parasitization of 59.52 percent occurred on the sixth week after planting in soybean monocultures kept weed-free for only two weeks after planting. Parasitism in soybean/corn polycultures reached the highest percentage of 56.25 percent in cropping systems kept weed-free for only four weeks after planting (Table 5 and Figure 6). There were no statistically significant differences between percent parasitism in the treatments as determined by the Duncan's Multiple Range Test ($P>0.05$). Combined results of these observations are tabulated and shown in Table 6. The effects of cropping systems and sampling dates on the number of larvae, adults, rates of parasitization, and percent infestation are presented graphically in Figures 7 to 26.

There was a direct relationship between the number of larvae and percent infestation in all cropping systems (Figures 7 to 10). However, except in monocultures kept weed-free for only two weeks after planting (Figure 12), the number of larvae and rate of parasitization in all the cropping systems did not seem to show any relationship (Figures 11 to 14). The number of adults and larvae, except in polycultures weedy throughout the

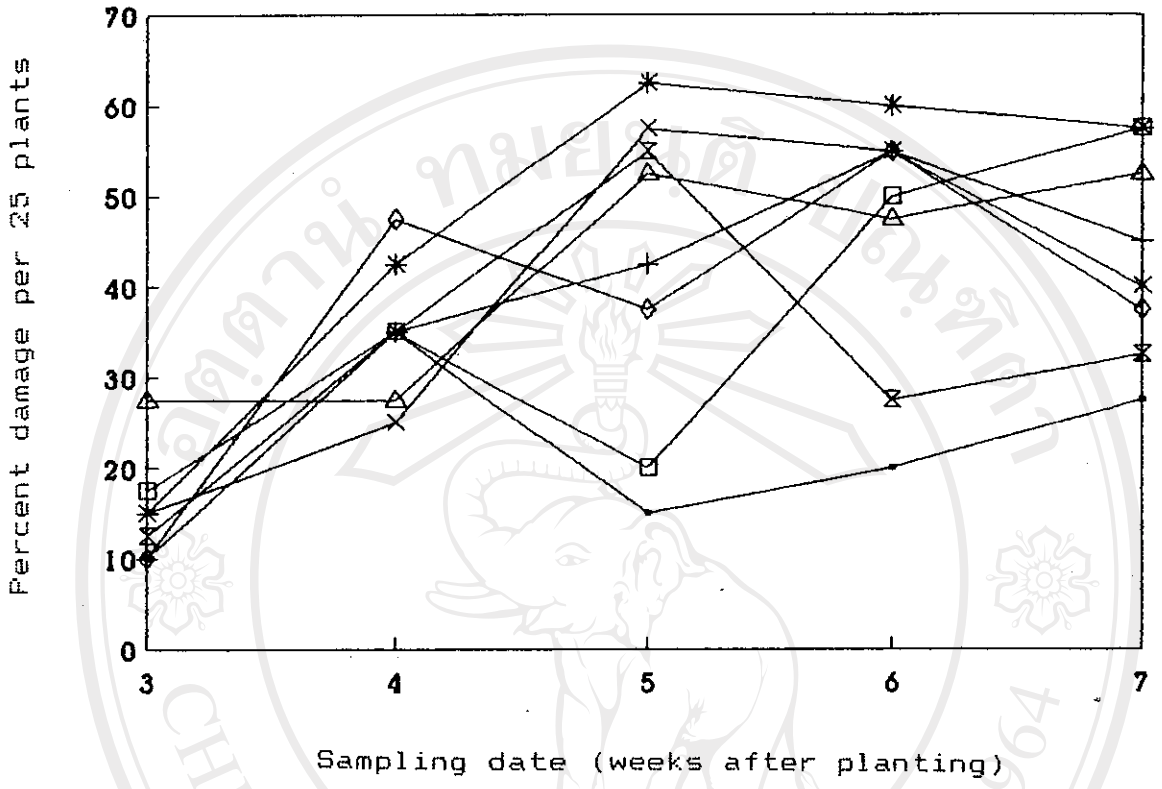

Figure 5. Mean percent infestation by soybean stem fly, Melanagromyza sojae (Zhnt.) in soybean monocultures: (•) weedy throughout the season, (+) weed-free for only two weeks after planting, (✳) weed-free for only four weeks after planting, (□) weed-free throughout season, and soybean/corn polycultures: (X) weed-free throughout the season, (◇) weed-free for only two weeks after planting, (△) weed-free for only four weeks after planting, and (⧖) weedy throughout the season at the Multiple Cropping Center Experimental Farm, Chiang Mai (1989).

Table 5. Mean rates of parasitization of Melanagromyza sojae (Zhnt.) by the naturally occurring parasitoid, Eurytoma sp. in various soybean cropping systems at the Multiple Cropping Center Experimental Farm, Chiang Mai (1989).

Cropping System	Sampling date (weeks after planting)					
	3	4	5	6	7	Mean±S.E.
	Percent of larvae attacked per 10 plants					
Soybean Monocultures:						ns
Weedy throughout the season	0	10.00	45.83	16.67	48.75	24.50±9.8
Weed-free for only two						ns
weeks after planting	12.50	12.50	27.50	59.52	41.67	30.74±8.9
Weed-free for only four						ns
weeks after planting	16.67	31.25	51.79	29.45	49.29	35.69±7.4
Weed-free throughout						ns
the season	25.00	0	37.50	20.00	40.00	24.52±7.2
Soybean/sweet corn Polycultures:						
Weed-free throughout						ns
the season	12.50	25.00	12.50	46.95	40.28	27.49±7.0
Weed-free for only two						ns
weeks after planting	0	18.75	51.25	35.72	51.67	31.48±9.9
Weed-free for only four						ns
weeks after planting	25.00	20.83	17.26	56.25	53.14	34.56±16.3
Weedy						ns
throughout the season	0	0	31.55	37.50	31.67	20.15±8.3

S.E. = The standard error associated with the means.
ns = Not significant as deterained by the F-test.

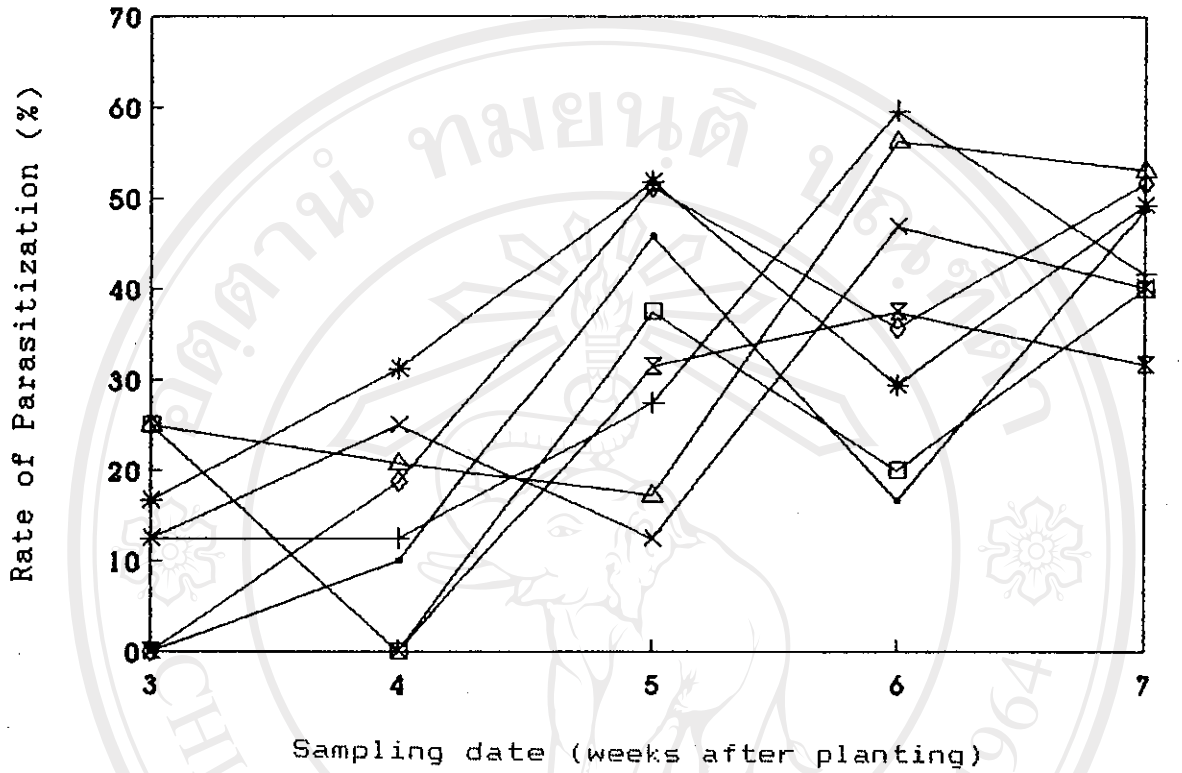

Figure 6. Percentage of soybean stem fly, Melanagromyza sojae (Zhnt.) larvae attacked by the naturally occurring parasitoid, Eurytoma sp. in soybean monocultures: (•) weedy throughout the season, (+) weed-free for only two weeks after planting, (✳) weed-free for only four weeks after planting, (□) weed-free throughout the season, and soybean/corn polycultures: (X) weed-free throughout the season, (◇) weed-free for only two weeks after planting, (△) weed-free for only four weeks after planting, and (⧖) weedy throughout the season at the Multiple Cropping Center Experimental Farm, Chiang Mai (1989).

Table 6. Mean soybean stem fly, Melanagromyza sojae (Zhnt.) densities, percent infestations, and rates of parasitization by naturally occurring parasitoid, Eurytoma sp. in various soybean cropping systems at the Multiple Cropping Center Experimental Farm, Chiang Mai (1989). 1/

Cropping System	Number of Adult Fly (±S.E.) 2,4/	Number of Larva+Pupa (±S.E.) 3,4/	Rate of Parasitization (%)(± S.E) 4/	Percent Infestation (±S.E.) 4/
Soybean Monocultures:				
Weedy throughout the season	5.28±0.9 c	2.00±0.5 c	24.25±9.8	21.5±4.4 c
Weed-free for only two weeks after planting	7.98±2.0 bc	3.70±0.9 ab	30.74±8.9	37.5±7.6 ab
Weed-free for only four weeks after planting	14.55±4.8 ab	4.75±1.4 a	35.69±7.4	48.0±8.8 a
Weed-free throughout the season	18.03±6.9 a	3.90±1.4 ab	24.52±7.2	36.0±7.9 b
Soybean/sweet corn Polycultures:				
Weed-free throughout the season	12.13±4.8 b	3.85±0.8 ab	27.49±7.0	38.5±8.3 ab
Weed-free for only two weeks after planting	6.95±1.7 bc	4.40±1.0 a	31.48±9.9	37.5±7.6 ab
Weed-free for only four weeks after planting	9.20±3.1 bc	4.75±1.1 a	34.56±16.3	41.5±5.8 ab
Weedy throughout the season	4.00±0.9 c	3.30±0.9 b	20.15±8.3	32.5±6.8 b

1 All means are averages of 10 sampling dates for stem fly adults and 5 sampling dates for stem fly larvae, percent infestation and rate of parasitization.
2 Counts taken from 25 sample plants.
3 Counts taken from 10 sample plants.
4 Data were analyzed by analysis of variance and Duncan's Multiple Range Test; treatment means within a row followed by the same letter are not significantly different (P>0.05).
S.E = The standard error associated with the means.

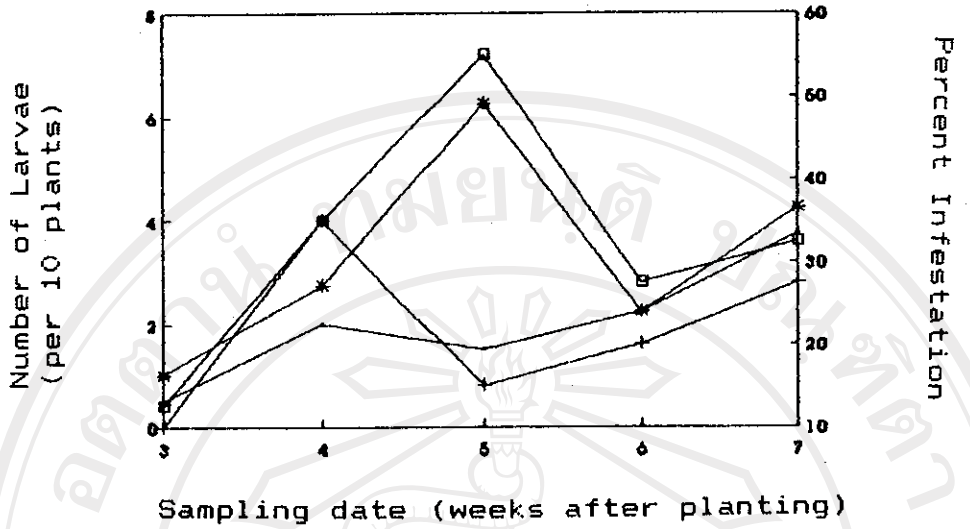

Figure 7. Relationship between soybean stem fly, Melanagromyza sojae (Zhnt.) larvae (L) and percent infestation (I) in soybean monocultures (L = .—.—., I = +—+—+) and soybean/corn polycultures (L = *—*—*, I = □—□—□) weedy throughout the season at the Multiple Cropping Center Experimental Farm, Chiang Mai(1989).

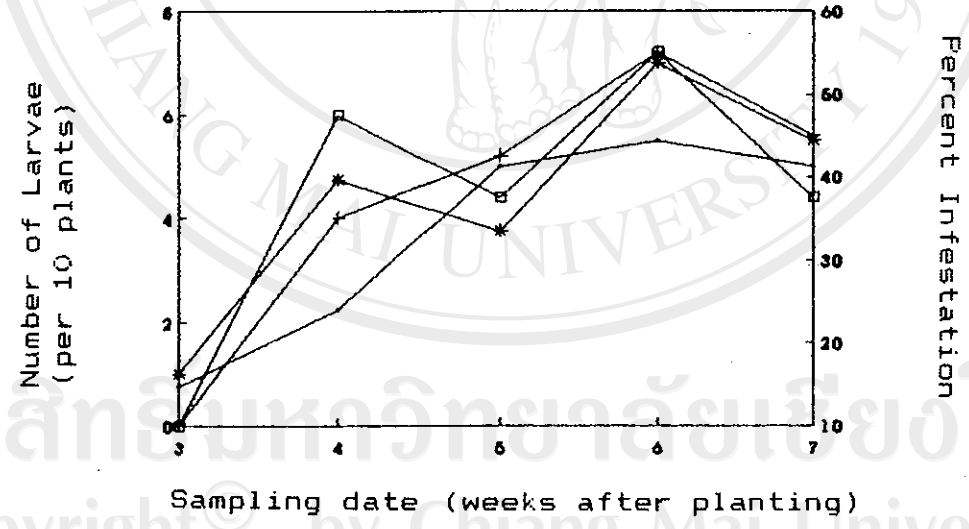

Figure 8. Relationship between soybean stem fly, Melanagromyza sojae (Zhnt.) larvae (L) and percent infestation (I) in soybean monocultures (L = .—.—., I = +—+—+) and soybean/corn polycultures (L = *—*—*, I = □—□—□) weed-free for only two weeks after planting at the Multiple Cropping Center Experimental Farm, Chiang Mai(1989).

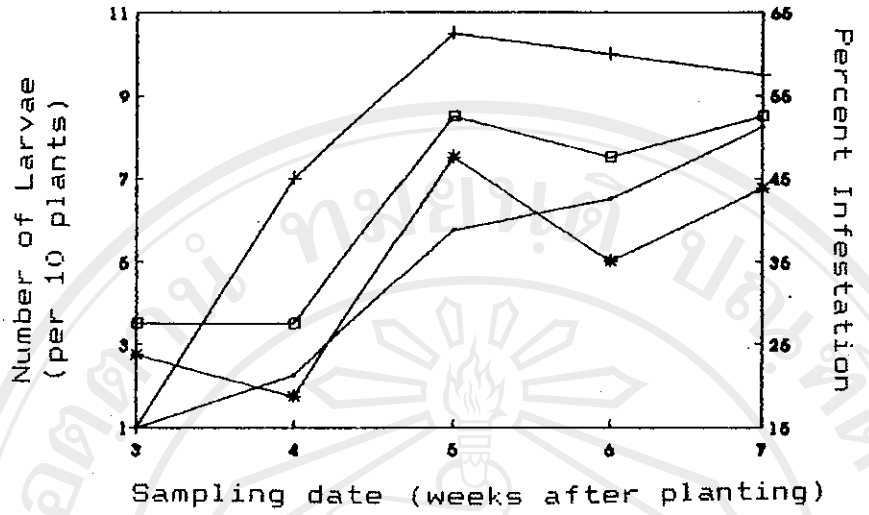

Figure 9. Relationship between soybean stem fly, Melanagromyza sojae (Zhnt.) larvae (L) and percent infestation (I) in soybean monocultures (L = .—.—., I = +—+—+) and soybean/corn polycultures (L = *—*—*, I = □—□—□) weed-free for only four weeks after planting at the Multiple Cropping Center Experimental Farm, Chiang Mai (1989).

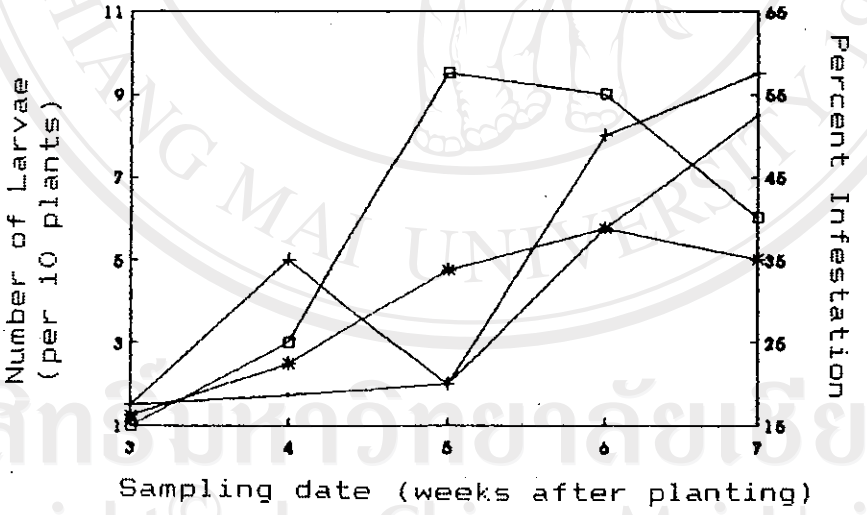

Figure 10. Relationship between soybean stem fly, Melanagromyza sojae (Zhnt.) larvae (L) and percent infestation (I) in soybean monocultures (L = .—.—., I = +—+—+) and soybean/corn polycultures (L = *—*—*, I = □—□—□) weed-free throughout the season at the Multiple Cropping Center Experimental Farm, Chiang Mai (1989).

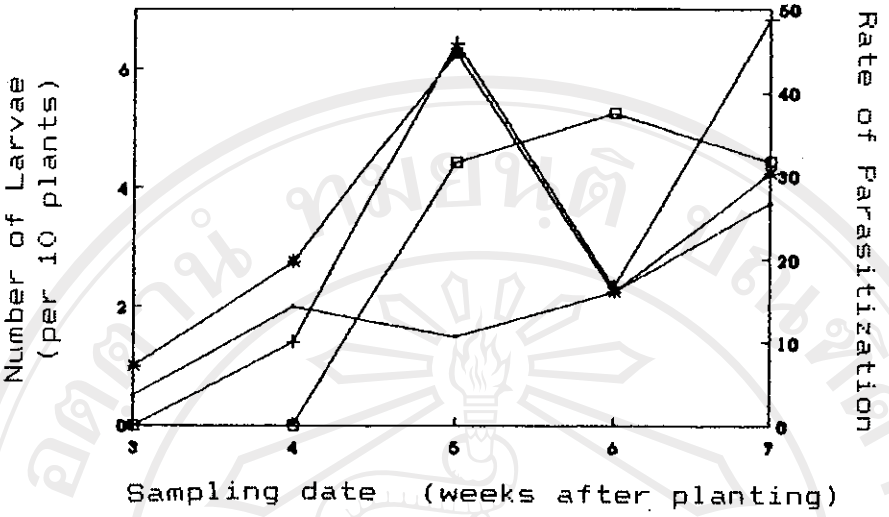

Figure 11. Relationship between soybean stem fly, Melanagromyza sojae (Zhnt.) larvae (L) and rate of parasitization (P) in soybean monocultures (L = .—.—., P = +—+—+) and soybean/corn polycultures (L = *—*—*, P = □—□—□) weedy throughout the season at the Multiple Cropping Center Experimental Farm, Chiang Mai (1989).

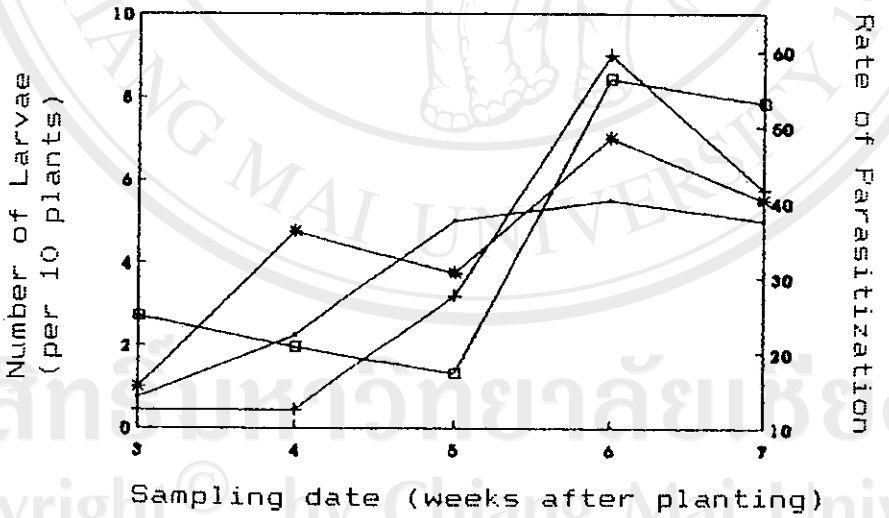

Figure 12. Relationship between soybean stem fly, Melanagromyza sojae (Zhnt.) larvae (L) and rate of parasitization (P) in soybean monocultures (L = .—.—., P = +—+—+) and soybean/corn polycultures (L = *—*—*, P = □—□—□) weed-free for only two weeks after planting at the Multiple Cropping Center Experimental Farm, Chiang Mai (1989).

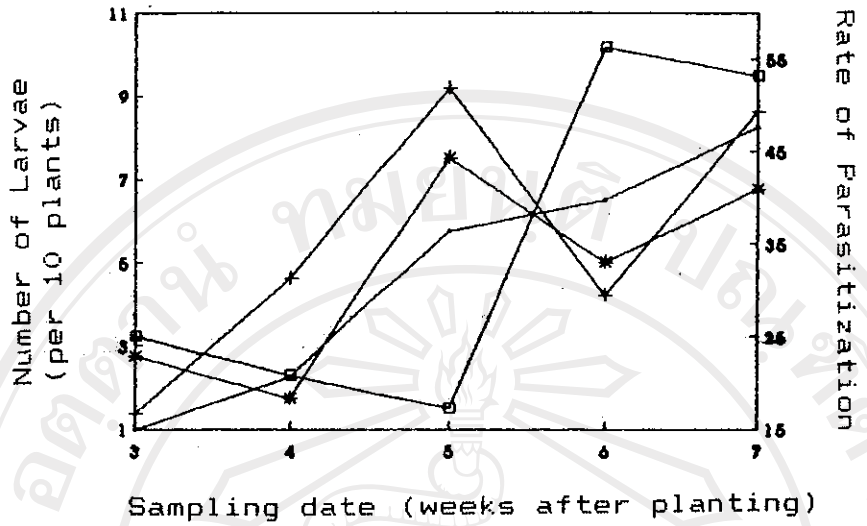

Figure 13. Relationship between soybean stem fly, Melanagromyza sojae (Zhnt.) larvae (L) and rate of parasitization (P) in soybean monocultures (L = .—.—., P = +—+—+) and soybean/corn polycultures (L = *—*—*, P = □—□—□) weed-free for only four weeks after planting at the Multiple Cropping Center Experimental Farm, Chiang Mai (1989).

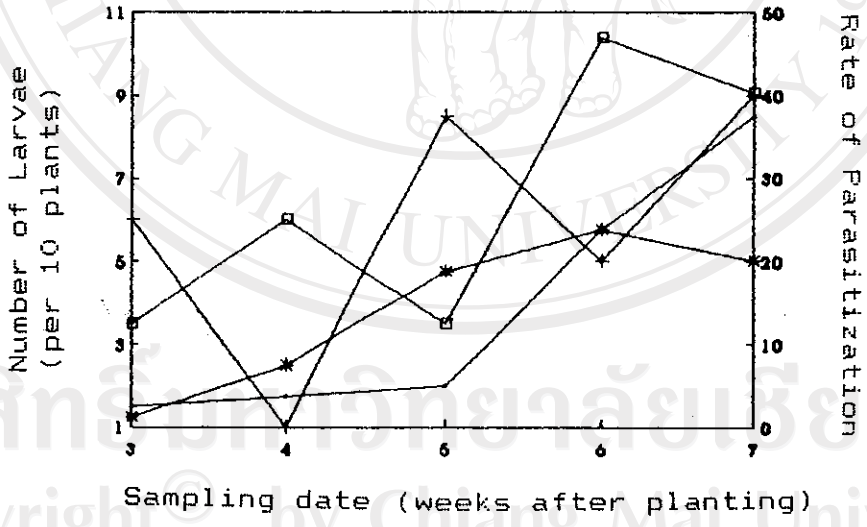

Figure 14. Relationship between soybean stem fly, Melanagromyza sojae (Zhnt.) larvae (L) and rate of parasitization (P) in soybean monocultures (L = .—.—., P = +—+—+) and soybean/corn polycultures (L = *—*—*, P = □—□—□) weed-free throughout the season at the Multiple Cropping Center Experimental Farm, Chiang Mai (1989).

season (Figure 15), also did not seem to show any relationship (Figures 15 to 18). Likewise, Figures 19 to 22 also showed that there was no relationship between the number of adults and percent infestation except in polycultures weedy throughout the season (Figure 19) and weed-free for only four weeks after planting (Figure 21). Only polycultures weed-free for only two weeks after planting (Figure 24) and monocultures weed-free throughout the season (Figure 26) seem to show a direct relationship between the number of adults and percent parasitization (Figures 23 to 26).

Predator Population Density Assessment

Large fluctuation in numbers of coccinellids, spiders, pentatomid predators, and syrphids occurred in the plots during the growing season. It was observed that predators became more abundant later in the season reaching its peak starting on the ninth until the eleventh week after planting after which populations seemingly declined until crop harvest. This trend coincided with the highest peak of adult M. sojae

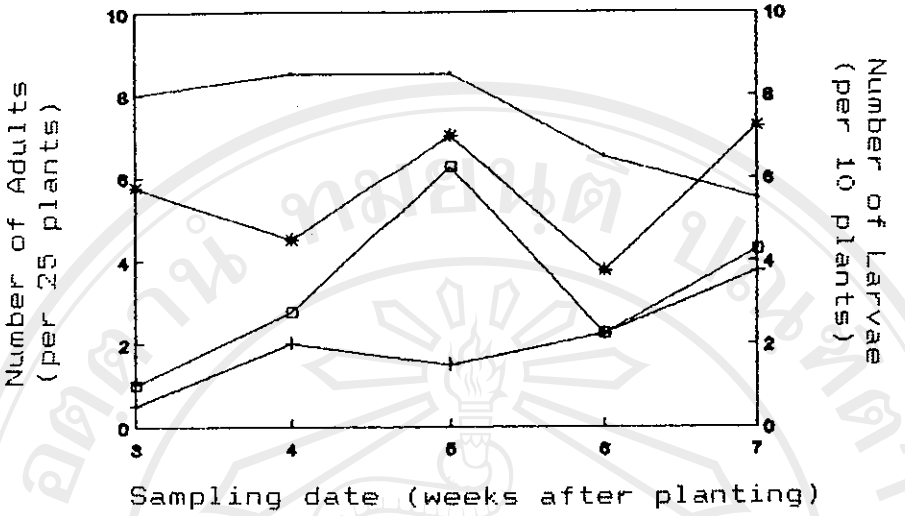

Figure 15. Relationship between soybean stem fly, Melanagromyza sojae (Zhnt.) larvae (L) and adults (A) in soybean monocultures (L = .—.—., A = +—+—+) and soybean/corn polycultures (L = *—*—*, A = □—□—□) weedy throughout the season at the Multiple Cropping Center Experimental Farm, Chiang Mai (1989).

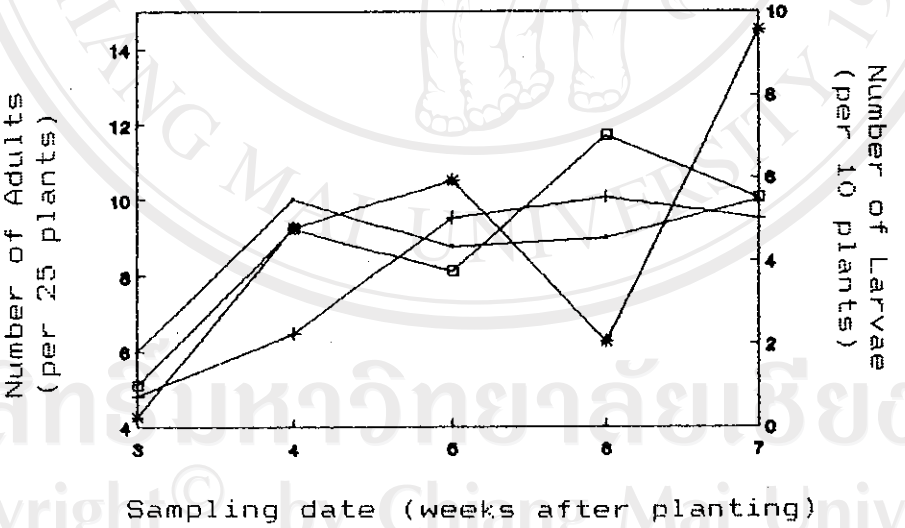

Figure 16. Relationship between soybean stem fly, Melanagromyza sojae (Zhnt.) larvae (L) and adults (A) in soybean monocultures (L = .—.—., A = +—+—+) and soybean/corn polycultures (L = *—*—*, A = □—□—□) weed-free for only two weeks after planting at the Multiple Cropping Center Experimental Farm, Chiang Mai (1989).

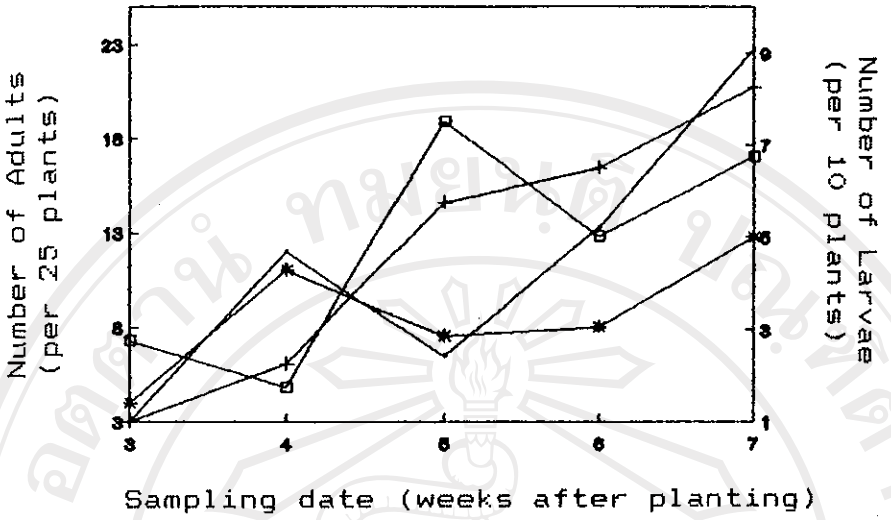

Figure 17. Relationship between soybean stem fly, Melanagromyza sojae (Zhnt.) larvae (L) and adults (A) in soybean monocultures (L = .—.—., A = +—+—+) and soybean/corn polycultures (L = *—*—*, A = □—□—□) weed-free for only four weeks after planting at the Multiple Cropping Center Experimental Farm, Chiang Mai (1989).

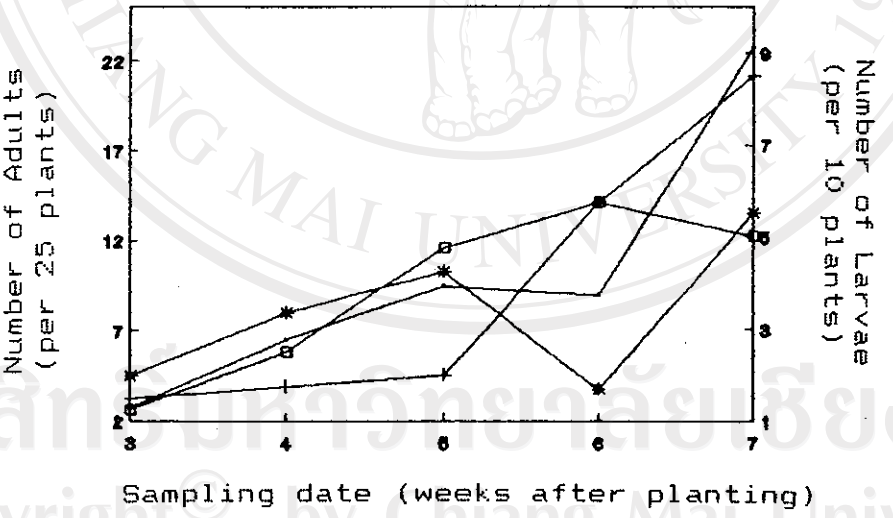

Figure 18. Relationship between soybean stem fly, Melanagromyza sojae (Zhnt.) larvae (L) and adults (A) in soybean monocultures (L = .—.—., A = +—+—+) and soybean/corn polycultures (L = *—*—*, A = □—□—□) weed-free throughout at the Multiple Cropping Center Experimental Farm, Chiang Mai (1989).

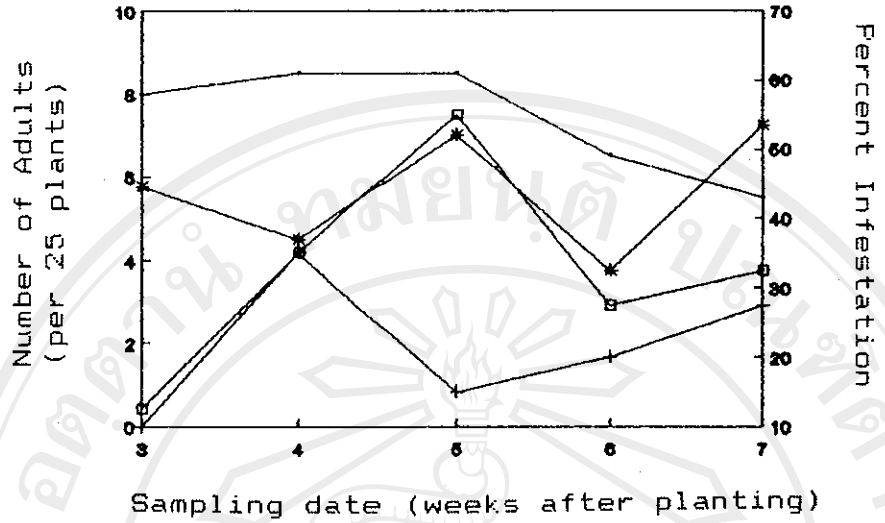

Figure 19. Relationship between soybean stem fly, Melanagromyza sojae (Zhnt.) adults (A) and percent infestation (I) in soybean monocultures (A = .—.—., I = +—+—+) and soybean/corn polycultures (A = *—*—*, I = □—□—□) weedy throughout the season at the Multiple Cropping Center Experimental Farm, Chiang Mai (1989).

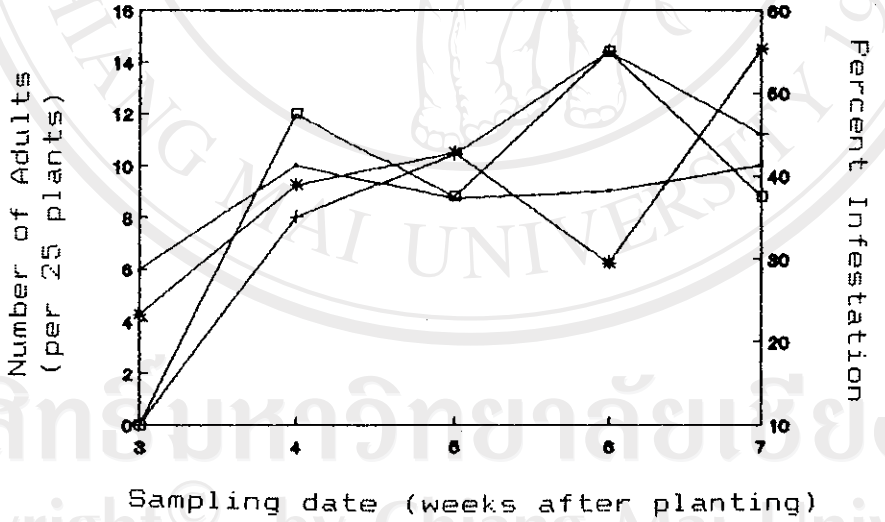

Figure 20. Relationship between soybean stem fly, Melanagromyza sojae (Zhnt.) adults (A) and percent infestation (I) in soybean monocultures (A = .—.—., I = +—+—+) and soybean/corn polycultures (A = *—*—*, I = □—□—□) weed-free for only two weeks after planting at the Multiple Cropping Center Experimental Farm, Chiang Mai (1989).

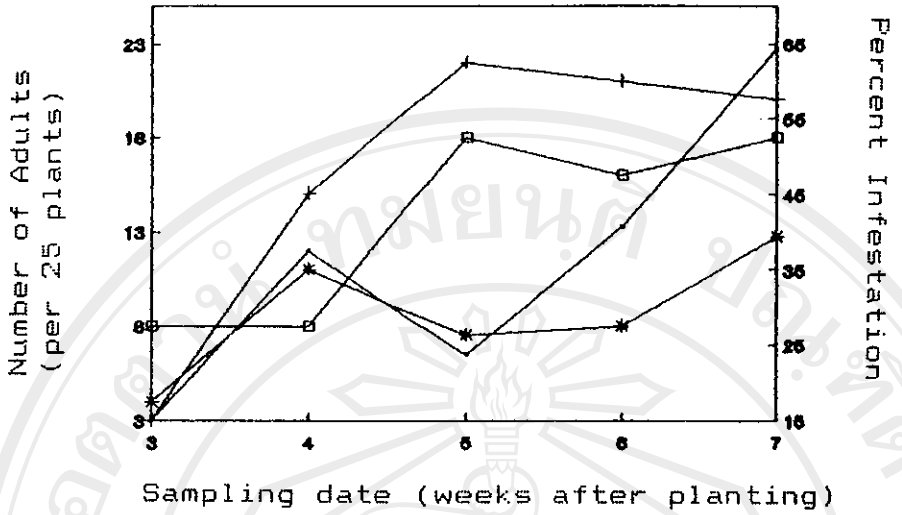

Figure 21. Relationship between soybean stem fly, Melanagromyza sojae (Zhnt.) adults (A) and percent infestation (I) in soybean monocultures (A = .—.—., I = +—+—+) and soybean/corn polycultures (A = *—*—*, I = □—□—□) weed-free for only four weeks after planting at the Multiple Cropping Center Experimental Farm, Chiang Mai (1989).

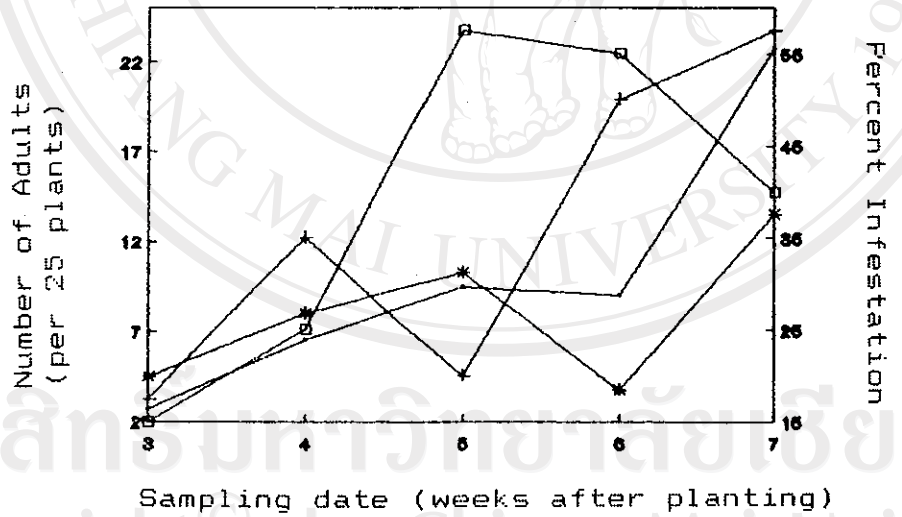

Figure 22. Relationship between soybean stem fly, Melanagromyza sojae (Zhnt.) adults (A) and percent infestation (I) in soybean monocultures (A = .—.—., I = +—+—+) and soybean/corn polycultures (A = *—*—*, I = □—□—□) weed-free throughout the season at the Multiple Cropping Center Experimental Farm, Chiang Mai (1989).

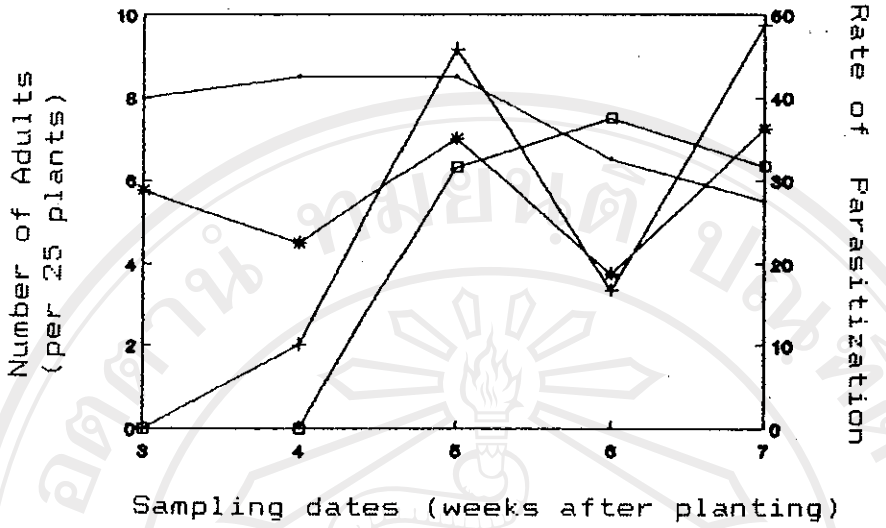

Figure 23. Relationship between soybean stem fly, Melanagromyza sojae (Zhnt.) adults (A) and rate of parasitization (P) in soybean monocultures (A = .—.—., P = +—+—+) and soybean/corn polycultures (A = *—*—*, P = □—□—□) weedy throughout the season at the Multiple Cropping Center Experimental Farm, Chiang Mai (1989).

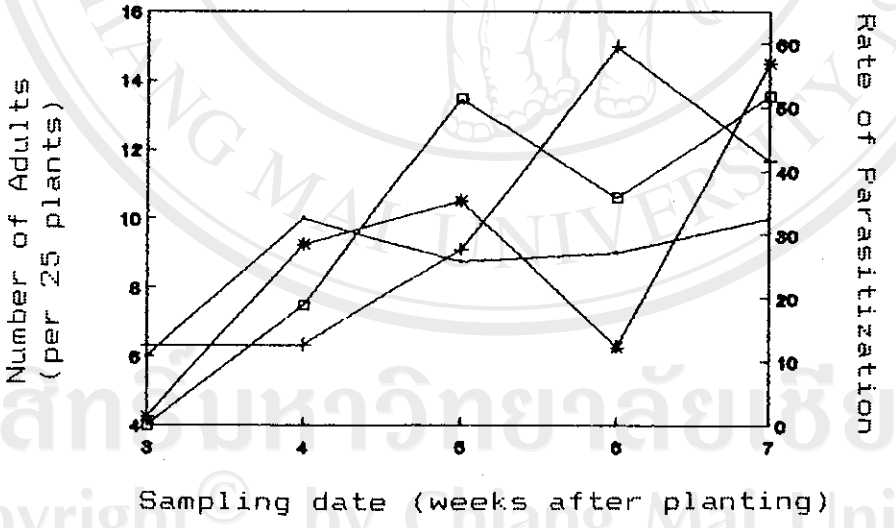

Figure 24. Relationship between soybean stem fly, Melanagromyza sojae (Zhnt.) adults (A) and rate of parasitization (P) in soybean monocultures (A = .—.—., P = +—+—+) and soybean/corn polycultures (A = *—*—*, P = □—□—□) weed-free for only two weeks after planting at the Multiple Cropping Center Experimental Farm, Chiang Mai (1989).

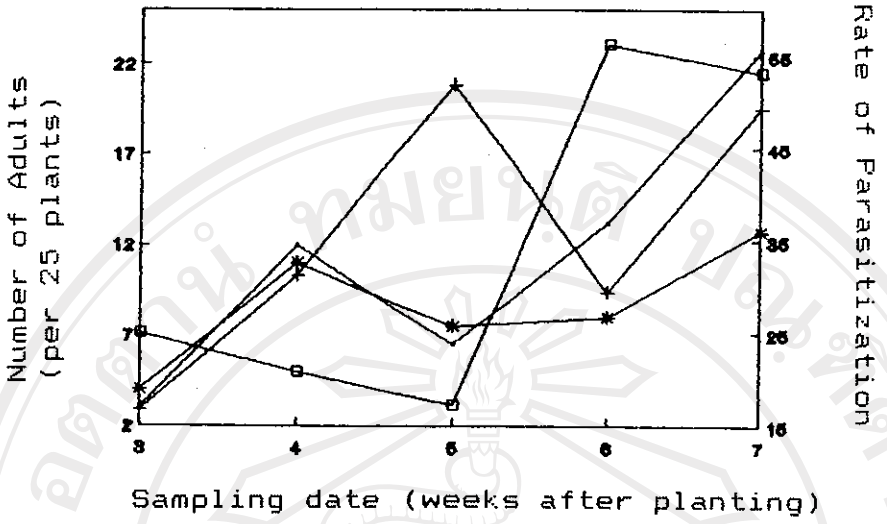

Figure 25. Relationship between soybean stem fly, Melanagromyza sojae (Zhnt.) adults (A) and rate of parasitization (P) in soybean monocultures (A = .—.—., P = +—+—+) and soybean/corn polycultures (A = *—*—*, P = □—□—□) weed-free for only four weeks after planting at the Multiple Cropping Center Experimental Farm, Chiang Mai (1989).

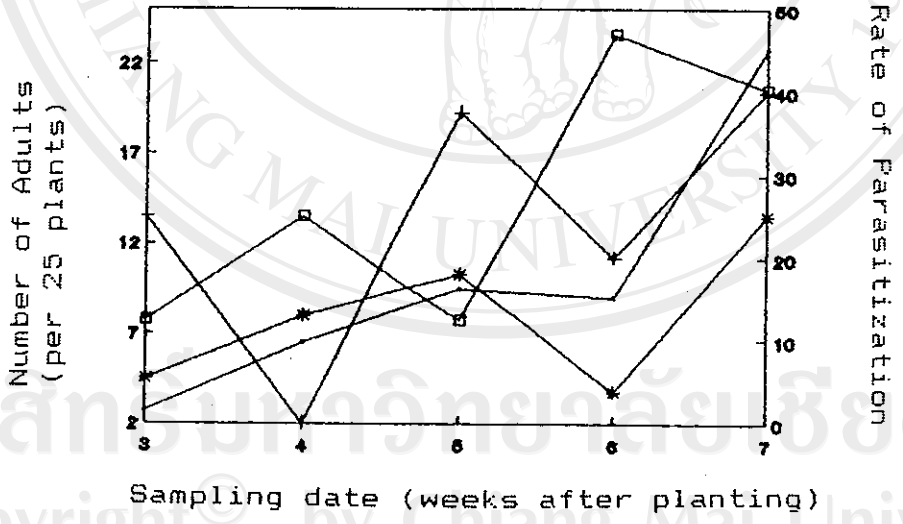

Figure 26. Relationship between soybean stem fly, Melanagromyza sojae (Zhnt.) adult (A) and rate of parasitization (P) in soybean monocultures (A = .—.—., P = +—+—+) and soybean/corn polycultures (A = *—*—*, P = □—□—□) weed-free throughout the season at the Multiple Cropping Center Experimental Farm, Chiang Mai (1989).

densities which occurred on the eighth week and at the same time during the reproductive stages of corn and soybean.

The most predominant predators during the seventh week after planting were spiders and coccinellid beetles (Table 7). Highest spider density of 0.5 per 25 plants occurred in soybean monocultures weedy throughout the season. No spiders were counted in monocultures weed-free throughout the season and in all soybean/corn polycultures except for polycultures weed-free throughout the season which had 0.25 spiders per 25 plants. Soybean/corn monocultures weed-free throughout the season with 0.75 coccinellid beetles per 25 plants had higher beetle densities as compared to soybean monocultures weed-free throughout the season which had no coccinellid beetles. Soybean monocultures weedy throughout the season, weed-free for only two and four weeks after planting with 0.50, 0.25, and 1.00 coccinellid beetles per 25 plants had more coccinellid beetles than soybean/corn polycultures weedy throughout the season and weed-free for only two weeks after planting where no coccinellid beetles were found, and weed-free for only four weeks after planting where only 0.5 beetles per 25 plants were counted. The number of Podisus sp. in

Table 7. Abundance of predators in various soybean cropping systems (7 weeks after planting) at the Multiple Cropping Center Experimental Farm, Chiang Mai (1989).

Cropping System	Mean number of predators per 25 plants (± S.E.)						
	Spider	Coccinellid Beetle	*Geocoris* sp.	*Podisus* sp.	*Stiretrus* sp.	Syrphid Fly	Total
Soybean Monocultures:							
Weedy throughout the season	0.50±0.50	0.50±0.50	0	0	0	0	1.00
Weed-free for only two weeks after planting	0.25±0.25	0.25±0.25	0	0.25±0.25	0	0	0.75
Weed-free for only four weeks after planting	0.25±0.25	1.00±0.71	0	0.50±0.29	0	0	1.75
Weed-free throughout the season	0	0	0	0.25±0.25	0	0	0.25
Soybean-sweet corn Polycultures:							
Weed-free throughout the season	0.25±0.25	0.75±0.25	0	0	0	0	1.00
Weed-free for only two weeks after planting	0	0	0	0	0	0	0
Weed-free for only four weeks after planting	0	0.50±0.50	0	0.25±0.25	0	0	0.75
Weedy throughout the season	0	0	0	0	0	0	0

S.E. The standard error associated with the means.

monocultures weed-free for only two and four weeks after planting and weed-free throughout the season of 0.25, 0.50, and 0.25 Podisus sp. per 25 plants were also greater than in soybean/corn polycultures where no Podisus sp. were counted in polycultures weed-free for only two weeks after planting and weed-free throughout the season and only 0.25 in weed-free for only four weeks after planting. Geocoris sp., Stiretrus sp., syrphid flies were not observed during this time.

Marked increases in predator numbers were observed on the eighth week after planting (Table 8). Spider populations were variable. Monocultures weedy throughout the season with 2.70 spiders per 25 plants had higher spider counts than soybean/corn polycultures weedy throughout the season with 1.50 spiders per 25 plants. Soybean/corn polycultures weed-free for only two weeks after planting with 1.75 spiders per 25 plants had higher spider counts than monocultures weed-free for only two weeks after planting with 1.0 spiders per 25 plants. Monocultures weed-free for only four weeks after planting and weed-free throughout the season with 1.25 and 2.75 spiders per 25 plants were higher than 0.50 and 0.75 spiders per 25 plants counted in polycultures weed-free for only four weeks after planting and weed-free

Table 8. Abundance of predators in various soybean cropping systems (8 weeks after planting) at the Multiple Cropping Center Experimental Farm, Chiang Mai (1989).

Cropping System	Mean number of predators per 25 plants (± S.E.)						
	Spider	Coccinellid Beetle	*Geocoris* sp.	*Podisus* sp.	*Stiretrus* sp.	Syrphid Fly	Total
Soybean Monocultures:							
Weedy throughout the season	2.70±1.55	0.25±0.25	0	1.50±0.50	0	1.25±0.25	5.7
Weedfree for only two weeks after planting	1.00±0.50	0.25±0.25	0	1.50±0.65	0	1.25±0.63	4.0
Weed-free for only four weeks after planting	1.25±0.95	0.25±0.25	0	1.25±0.75	0	1.50±0.65	4.25
Weed-free throughout the season	2.75±1.11	0.25±0.25	0	2.75±1.44	0	1.00±1.00	6.75
Soybean-sweet corn Polycultures:							
Weed-free throughout the season	0.75±0.75	0.25±0.25	0	1.25±0.95	0	1.50±1.19	3.75
Weed-free for only two weeks after planting	1.75±0.63	3.50±1.66	0	1.00±0.71	0	1.00±0.41	7.25
Weed-free for only four weeks after planting	0.50±0.29	0.50±0.50	0	0.50±0.50	0	0.50±0.29	2.0
Weedy throughout the season	1.50±0.65	0.25±0.25	0	1.00±0.71	0	0.75±0.48	3.75

S.E. = The standard error associated with the means.

throughout the season, respectively. Coccinellid beetles were more prominent in polycultures. Polycultures weed-free for only two weeks after planting with 3.50 coccinellid beetles per 25 plants were higher than 0.25 coccinellid beetles per 25 plants counted in soybean monocultures weed-free for only two weeks after planting. Polycultures weed-free for only four weeks after planting with 0.50 coccinellid beetles per 25 plants had higher counts than monocultures weed-free for only four weeks after planting with 0.25 coccinellid beetles per 25 plants. Geocoris sp. and Stiretrus sp. were still not observed on the eighth week after planting. Podisus sp. seemed to be more abundant in soybean monocultures than soybean/corn polycultures. Soybean monocultures weedy throughout the season, weed-free for only two and four weeks after planting, and weed-free throughout the season had 1.50, 1.50, 1.25, and 2.75 Podisus sp. per 25 plants which were higher than in soybean corn polycultures weedy, weed-free for only two and four weeks after planting and weed free throughout the season with 1.0, 0.50, 1.0, and 1.25 Podisus sp. per 25 plants, respectively. Syrphid flies also seemed to be more abundant in all monoculture cropping systems. Monocultures weedy throughout the season and weed-free

for only four weeks after planting with 1.25 and 1.50 syrphid flies per 25 plants were higher than in soybean/corn polycultures weedy throughout the season and weed-free for only four weeks after planting with 0.75 and 0.50 syrphid flies per 25 plants, respectively.

Spiders, Podisus sp., and syrphid fly were found in all the soybean cropping systems during the ninth week after planting (Table 9). Spider counts in monocultures and polycultures weedy throughout the season were 1.50 spiders per 25 plants. Polycultures weed-free for only two weeks after planting with 1.75 spiders per 25 plants had higher spider counts than monocultures weed-free for only two weeks after planting with only 1.00 spider per 25 plants. Monocultures weed-free for only four weeks after planting and weed-free throughout the season with 1.25 and 2.75 spiders per 25 plants had higher spider counts compared to polycultures weed-free for only four weeks after planting and weed-free throughout the season with 0.50 and 0.75 spiders per 25 plants, respectively. Coccinellid beetles were not found in both monoculture and polyculture cropping systems weedy throughout the season. Polycultures weed-free throughout the season had 1.0 coccinellid beetle per 25 plants whereas there was none in monocultures weed-free throughout the season. The

Table 9. Abundance of predators in various soybean cropping systems (9 weeks after planting) at the Multiple Cropping Center Experimental Farm, Chiang Mai (1989).

Cropping System	Mean number of predators per 25 plants (± S.E.)						
	Spider	Coccinellid Beetle	*Geocoris* sp.	*Podisus* sp.	*Stiretrus* sp.	Syrphid Fly	Total
Soybean Monocultures:							
Weedy throughout the season	1.50±0.29	0	0	0.50±0.29	0.50±0.50	1.00±0.41	3.50
Weed-free for only two weeks after planting	1.00±0.58	0.50±0.29	0	1.50±0.87	0	1.25±0.48	4.25
Weed-free for only four weeks after planting	1.25±0.87	1.00±0.71	0	4.50±0.87	0	1.25±0.25	8.00
Weed-free throughout the season	2.75±1.60	0	0	2.00±0.58	0.25±0.25	1.25±0.48	6.25
Soybean-sweet corn Polycultures:							
Weed-free throughout the season	0.75±0.75	1.00±1.00	0	0.25±0.25	0.25±0.25	0.50±0.29	2.75
Weed-free for only two weeks after planting	1.75±1.55	0.50±0.29	0	1.00±0.71	0	1.25±0.63	4.50
Weed-free for only four weeks after planting	0.50±1.31	0	0	1.00±0.71	1.25±0.63	0.25±0.25	3.00
Weedy throughout the season	1.50±0.85	0	0	0.75±0.48	7.50±4.79	0.75±0.25	10.50

S.E. = The standard error associated with the means.

same number of 0.5 coccinellid beetles per 25 plants were counted in both monocultures and polycultures weed-free for only two weeks after planting. No Geocoris sp. was found in all the cropping systems. Podisus sp. counts in monocultures weed-free for only two and four weeks after planting and weed-free throughout the season with 1.50, 4.50, and 2.00 Podisus sp. per 25 plants were higher than counts taken from soybean polycultures weed-free for only two and four weeks after planting and weed-free throughout the season with 1.0, 1.0, and 0.75 Podisus sp. per 25 plants, respectively. Stiretrus sp. attained its highest peak of 7.5 Stiretrus sp. per 25 plants in soybean/corn polycultures weedy throughout the season as compared to monocultures weed-free for only two and four weeks after planting and polycultures weed-free for only two weeks after planting where no Stiretrus sp. was found. Syrphid fly counts of 1.0, 1.25, 1.25 flies per 25 plants in monocultures weedy throughout the season, weed-free for only four weeks after planting and weed-free throughout the season were greater than counts of 0.75, 0.25, and 0.50 syrphid flies per 25 plants obtained from polycultures weedy throughout the season, weed-free for only four weeks after planting and weed-free throughout the season, respectively.

Spider counts of 3.75, 2.50, and 4.25 per 25 plants in monocultures weedy throughout the season, weed-free for only two weeks after planting, and weed-free throughout the season were greater than counts of 1.25, 2.0, and 1.75 spiders per 25 plants obtained from polycultures weedy throughout the season, weed-free for only two weeks after planting and weed-free throughout the season, respectively (Table 10). Polycultures weed-free for only four weeks after planting with 3.0 spiders per 25 plants had greater spider density than monocultures weed-free for only four weeks after planting with 2.0 spiders per 25 plants. Coccinellid beetles became less abundant during the tenth week after planting. This was only observed in polycultures weed-free and weedy throughout the season, and monocultures weedy throughout the season with a total of 0.25 beetles per 25 plants for each of these cropping systems. Geocoris sp. of 0.25 per 25 plants were only counted in polycultures weedy throughout the season whereas Stiretrus sp. was only counted in cropping systems weed-free throughout the season in monocultures. Highest Stiretrus sp. density of 3 per 25 plants was counted in polycultures weed-free for only four weeks after planting, and the same numbers of 0.5 Stiretrus sp.

Table 10. Abundance of predators in various soybean cropping systems (10 weeks after planting) at the Multiple Cropping Center Experimental Farm, Chiang Mai (1989).

Cropping System	Mean number of predators per 25 plants (± S.E.)						
	Spider	Coccinellid Beetle	*Geocoris* sp.	*Podisus* sp.	*Stiretrus* sp.	Syrphid Fly	Total
Soybean Monocultures:							
Weedy throughout the season	3.75±0.95	0.25±0.25	0	0.50±0.50	0	0.75±0.48	5.25
Weed-free for only two weeks after planting	2.50±0.65	0	0	1.50±0.87	0	1.25±0.63	5.25
Weed-free for only four weeks after planting	2.00±1.10	0	0	3.00±1.47	0	1.50±0.65	6.50
Weed-free throughout the season	4.25±0.63	0	0	2.00±0.41	0.50±0.29	0.50±0.29	7.25
Soybean-sweet corn Polycultures:							
Weed-free throughout the season	1.75±0.85	0.25±0.25	0	1.25±0.95	0.50±0.29	0.50±0.50	4.25
Weed-free for only two weeks after planting	2.00±0.82	0	0	1.25±0.25	0	0.75±0.48	4.00
Weed-free for only four weeks after planting	3.00±1.47	0.25±0.25	0	1.75±0.63	3.00±1.75	0.50±0.50	8.50
Weedy throughout the season	1.25±0.95	0	0.25±0.25	1.00±0.41	0	0.25±0.25	2.75

S.E. = The standard error associated with the means.

were counted in both monoculture and polyculture cropping systems weed-free throughout the season. Podisus sp. counts of 1.0 per 25 plants in polycultures weedy throughout the season was higher as compared to counts in monocultures weedy throughout the season of 0.50 per 25 plants. Monocultures weed-free for only two and four weeks after planting with 1.5 and 3.0 Podisus sp. per 25 plants had higher counts than compared to counts of 1.25 and 1.75 obtained from polycultures weed-free for only two and four weeks after planting, respectively. Syrphid counts in monoculture and polyculture plots weed-free throughout the season were the same. The general trend however, was that there were more syrphid flies in all weedy monocultures than all weedy polycultures. Monocultures weedy throughout the season and weed-free for only two and four weeks after planting with 0.75, 1.25 and 1.5 flies per 25 plants had greater syrphid fly densities than counts of 0.25, 0.75, and 0.50 flies per 25 plants taken from polycultures weedy throughout the season and weed-free for only two and four weeks after planting, respectively.

Spider populations attained its peak on the eleventh week after planting of 8 spiders per 25 plants observed in monocultures kept weed-free for only four

weeks after planting as compared to the lowest density of 1.75 spiders per 25 plants in soybean/corn polycultures weed-free for only two weeks after planting (Table 11). Monoculture cropping systems weed-free for only two and four weeks after planting, and weed-free throughout the season had 4.75, 8.0, and 5.75 spiders per 25 plants, respectively. These densities were greater than 1.75, 3.75 and 2.5 spiders per 25 plants obtained from polyculture cropping systems weed-free for only two and four weeks after planting, and weed-free throughout the season, respectively. Counts in monocultures weedy throughout the season with 4.0 spiders per 25 plants was lower compared to 4.75 spiders obtained from polycultures weedy throughout the season. Coccinelid beetle counts of 1.75, 0.5, and 1.5 per 25 plants from polycultures weed-free throughout the season, weed-free for only four weeks after planting, and weedy throughout the season were greater than counts of 0.25, 0, and 0.25 beetles per 25 plants from monocultures weed-free throughout the season, weed-free for only four weeks after planting, and weedy throughout the season, respectively. Monoculture plots weed-free for only two weeks after planting with a density of 1.0 beetles per 25 plants was higher than 0.5 beetles per 25 plants counted in polyculture cropping

Table 11. Abundance of predators in various soybean cropping systems (11 weeks after planting) at the Multiple Cropping Center Experimental Farm, Chiang Mai (1989).

Cropping System	Mean number of predators per 25 plants (± S.E.)						
	Spider	Coccinellid Beetle	*Geocoris* sp.	*Podisus* sp.	*Stiretrus* sp.	Syrphid Fly	Total
Soybean Monocultures:							
Weedy throughout the season	4.00±1.41	0.25±0.25	1.50±0.71	1.75±0.85	0.40±0.25	0.50±0.29	8.40
Weed-free for only two weeks after planting	4.75±1.65	1.00±0.41	1.25±0.48	0.50±0.50	0	0.75±0.75	8.25
Weed-free for only four weeks after planting	8.00±0.71	0	1.00±0.41	3.00±1.15	3.00±2.34	2.00±1.41	17.00
Weed-free throughout the season	5.75±1.65	0.25±0.25	0	2.00±0.71	0.90±0.50	1.00±.71	9.90
Soybean-sweet corn Polycultures:							
Weed-free throughout the season	2.50±0.65	1.75±1.44	0	1.50±0.65	0.75±0.25	1.25±0.75	7.75
Weed-free for only two weeks after planting	1.75±0.85	0.75±0.25	1.00±0.41	2.50±0.65	0	0.75±0.48	7.75
Weed-free for only four weeks after planting	3.75±1.11	0.50±0.50	0	1.25±0.48	0.75±0.75	1.00±0.41	7.25
Weedy throughout the season	4.75±1.25	1.50±0.25	1.00±1.41	1.75±1.03	1.50±0.87	0.75±0.75	11.25

S.E. = The standard error associated with the means.

systems weed-free for only two weeks after planting. Geocoris sp. were not observed in both monocultures and polycultures weed-free throughout the season. More Geocoris sp. were counted in monocultures as the weeding time was reduced. The highest density of 1.5 per 25 plants was attained in monocultures weedy throughout the season. Podisus sp. densities were the same for both monocultures and polycultures weedy throughout the season. Monocultures weed-free for only four weeks after planting and weed-free throughout the season with a density of 3.0 and 2.0 Podisus sp. per 25 plants were higher than counts of 1.25 and 1.5 Podisus sp. per 25 plants from polycultures weed-free for only four weeks after planting and weed-free throughout the season, respectively. Polycultures weed-free for only two weeks after planting with 2.5 Podisus sp. per 25 plants were higher than counts of 0.50 per 25 plants obtained from monocultures weed-free for only two weeks after planting. Stiretrus sp. counts of 1.5 per 25 plants in polycultures weedy throughout the season were higher than counts of 0.4 per 25 plants in monocultures weedy throughout the season. Monocultures weed-free for only four weeks after planting and weed-free throughout the season with densities of 3.0 and 0.9 per 25 plants were greater than

counts of 0.75 and 0.75 obtained from polycultures weed-free for only four weeks after planting and weed-free throughout the season, respectively. No Stiretrus sp. was counted in monocultures weed-free for only two and four weeks after planting. Syrphid flies in polycultures weed-free and weedy throughout the season of 1.25 and 0.75 flies per 25 plants were greater than 1.0 and 0.5 flies per 25 plants obtained from monocultures weed-free and weedy throughout the season, respectively. Monocultures weed-free for only two weeks after planting had the same syrphid fly counts with polycultures weed-free for only two weeks after planting. Monocultures weed-free for only four weeks after planting with a density of 2.0 flies per 25 plants were greater than fly densities of 1.0 per 25 plants obtained from polycultures weed-free for only four weeks after planting.

Spiders and coccinellid beetles were still the most predominant predators counted during the twelfth week after planting (Table 12). The same counts of 2.75 spiders per 25 plants were observed in both monocultures and polycultures weed-free throughout the season whereas spider counts in monocultures weedy throughout the season, weed-free for only two and four weeks after planting of 3.25, 6.25, and 5.0 per 25 plants were

Table 12. Abundance of predators in various soybean cropping systems (12 weeks after planting) at the Multiple Cropping Center Experimental Farm, Chiang Mai (1989).

Cropping System	Mean number of predators per 25 plants (± S.E.)						
	Spider	Coccinellid Beetle	*Geocoris* sp.	*Podisus* sp.	*Stiretrus* sp.	Syrphid Fly	Total
Soybean Monocultures:							
Weedy throughout the season	3.25±1.11	1.00±0.58	0.25±0.25	1.25±0.48	0.50±0.50	0.25±0.25	6.50
Weed-free for only two weeks after planting	6.25±1.89	2.75±0.85	0.25±0.25	0.75±0.25	0	1.00±0.58	11.00
Weed-free for only four weeks after planting	5.00±1.47	1.00±0	0.25±0.25	2.25±0.95	0.25±0.25	1.75±0.85	10.50
Weed-free throughout the season	2.75±1.38	1.00±0.71	0	0.75±0.48	0.25±0.25	2.25±0.85	7.00
Soybean-sweet corn Polycultures:							
Weed-free throughout the season	2.75±1.03	4.00±1.35	0.75±0.75	0.50±0.50	0	1.75±0.63	9.75
Weed-free for only two weeks after planting	2.00±1.00	2.50±1.50	0.50±0.29	1.00±1.00	0	1.25±0.75	7.25
Weed-free for only four weeks after planting	3.25±0.85	4.00±2.42	0.25±0.25	0.50±0.29	0.25±0.25	1.75±1.11	10.00
Weedy throughout the season	1.50±0.65	1.25±0.48	1.00±1.00	0.50±0.29	0.25±0.25	0	4.50

S.E. = The standard error associated with the means.

higher than counts of 1.5, 2.0, and 3.25 per 25 plants in polycultures weedy throughout the season, weed-free for only two and four weeks after planting, respectively. Coccinellid beetle counts of 4.0, 4.0, and 1.5 per 25 plants in polycultures weed-free for only four weeks after planting, weed-free throughout the season, and weedy throughout the season were higher than counts of 1.0, 1.0, and 1.0 beetles per 25 plants in monocultures weed-free for only four weeks after planting, weed-free and weedy throughout the season, respectively. However, coccinellid beetles in monocultures weed-free for only two weeks after planting of 2.75 per 25 plants was higher than in polycultures weed-free for only two weeks after planting with 2.50 per 25 plants. Geocoris sp. of 1.0, 0.75 and 0.5 in polycultures weedy and weed-free throughout the season, and weed-free for only two weeks after planting were higher than 0.25, 0, 0.25 Geocoris sp. per 25 plants in monocultures weedy and weed-free throughout the season and weed-free for only two weeks after planting, respectively. The same densities of Geocoris sp. of 0.25 per 25 plants was counted in monocultures and polycultures weed-free for only four weeks after planting. No Geocoris sp. was counted in monocultures weed-free throughout the season. Podisus sp.

densities of 1.25, 2.25, and 0.75 per 25 plants in monocultures weedy throughout the season, weed-free for only four weeks after planting and weed-free throughout the season were greater than 0.5, 0.5, and 0.5 per 25 plants in polycultures weedy throughout the season, weed-free for only four weeks after planting and weed-free throughout the season, respectively. Monocultures weed-free for only two weeks after planting with a density of 0.75 per 25 plants was lower compared to a density of 1.0 in polycultures weed-free for only two weeks after planting. Stiretrus sp. densities in monocultures weedy throughout the season, weed-free for only four weeks after planting, and weed-free throughout the season of 0.5, 1.75, and 2.25 per 25 plants were greater than densities of 0.25, 0.25 and 0 per 25 plants in polycultures weedy throughout the season, weed-free for only four weeks after planting and weed-free throughout the season, respectively. Monocultures weed-free for only two weeks after planting with a density of none per 25 plants was the same as with the density in polycultures weed-free for only two weeks after planting. Syrphid fly numbers was 0.25 and 2.25 per 25 plants in monocultures weedy and weed-free throughout the season. These counts were higher than in polycultures weedy and weed-free

throughout the season of 0 and 1.75 syrphid flies per 25 plants, respectively. Polycultures weed-free for only two weeks after planting had 1.25 syrphid flies per 25 plants greater than monocultures weed-free for only two weeks after planting with 1.0 syrphid flies per 25 plants. Monocultures and polycultures weed-free for only four weeks after planting had the same syrphid fly densities of 1.75 per 25 plants.

The fluctuation of spiders wherein highest counts occurred on the eleventh week after planting in all the cropping systems are shown in Table 11 and Figure 27. Soybean monocultures whether kept weed-free or weedy for only two and four weeks after planting have greater number of spiders (2.54 to 3.55 spiders per 25 plants) than polycultures whether kept weed-free or weedy for only two or four weeks after planting or weedy throughout the season (0.42 to 1.67 spiders per 25 plants).

The soybean/corn polycultures which were kept weed-free throughout the season were found to have the greatest coccinellid densities averaging 1.33 beetles per 25 plants (Table 13). Only 0.25 beetles per 25 plants appeared on soybean in monocultures kept weed-free throughout the season. Figure 28 shows that polycultures had more coccinellid beetles than monocultures regardless

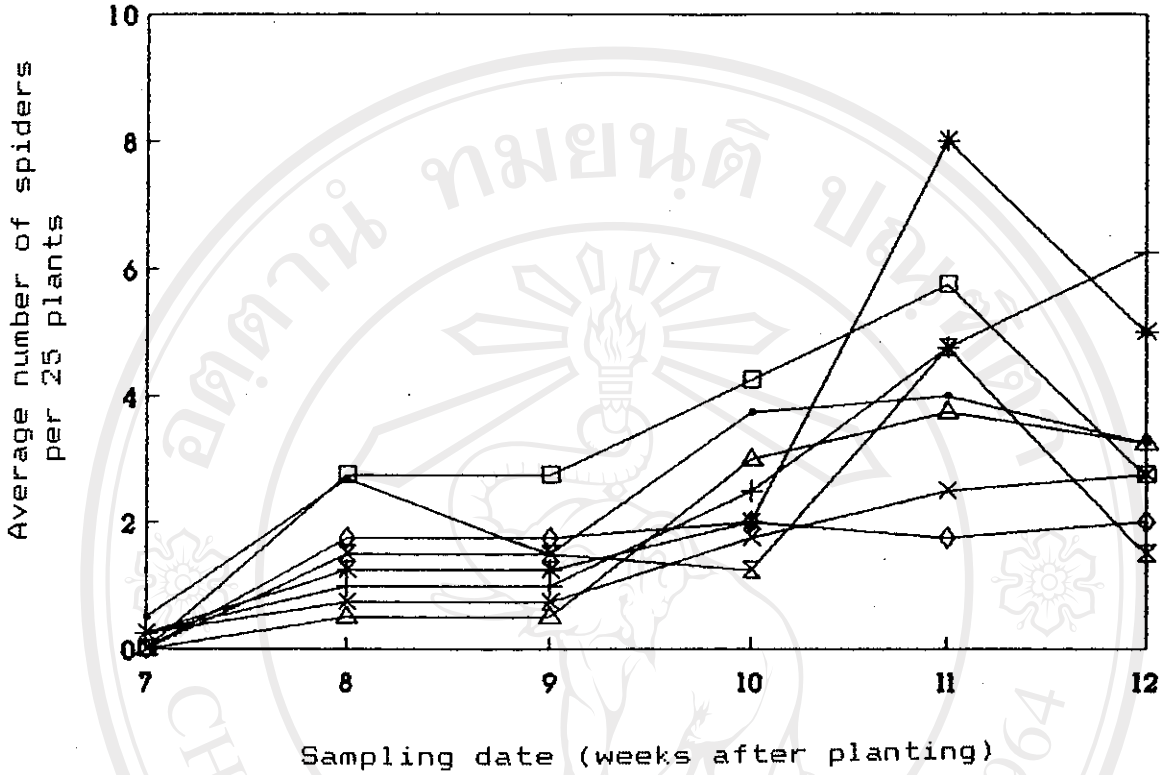

Figure 27. Mean spider densities in soybean monocultures: (*) weedy throughout the season, (+) weed-free for only two weeks after planting, (✳) weed-free for only four weeks after planting, (□) weed-free throughout the season, and soybean/corn polycultures: (X) weed-free throughout the season, (◇) weed-free for only two weeks after planting, (△) weed-free for only four weeks after planting, and (⧖) weedy throughout the season at the Multiple Cropping Center Experimental Farm, Chiang Mai (1989).

Table 13. Mean predator densities in various soybean cropping systems at the Multiple Cropping Center Experimental Farm, Chiang Mai (1989). 1/

Cropping System	Mean number of predators per 25 plants (±S.E.)2/						
	Spider	Coccinellid Beetle	*Geocoris* sp.	*Podisus* sp.	*Stiretrus* sp.	Syrphid Fly	Total
Soybean Monocultures:			ns		ns		
Weedy throughout the season	2.62±0.44 c	0.38±0.10 de	0.29±0.24	0.92±0.24 c	0.21±0.12	0.63±0.16 bc	5.05 b
Weed-free for only two			ns		ns		
weeks after planting	2.54±0.58 c	0.79±0.16 bcd	0.25±0.04	1.00±0.35 c	0	0.92±0.26 ab	5.50 b
Weed-free for only four			ns		ns		
weeks after planting	3.17±0.46 b	0.54±0.14 cde	0.21±0.08	2.42±0.40 a	0.54±0.43	1.33±0.26 a	8.21 a
Weed-free			ns		ns		
throughout the season	3.55±0.31 a	0.25±0.44 e	0	1.63±0.21 b	0.25±0.11	1.00±0.34 ab	6.68 b
Soybean/sweet corn Polycultures:							
Weed-free			ns		ns		
throughout the season	1.54±0.37 d	1.33±0.41 a	0.13±0.13	0.80±0.36 c	0.25±0.11	0.92±0.35 ab	4.97 b
Weed-free for only two			ns		ns		
weeks after planting	1.67±0.23 d	1.23±0.30 ab	0.25±0.08	1.12±0.14 c	0	0.83±0 bc	5.10 b
Weedy for only four			ns		ns		
weeks after planting	0.67±0.24 e	0.96±0.40 abc	0.04±0.04	0.88±0.14 c	0.68±0.56	0.67±0.24 bc	3.90 b
Weedy			ns		ns		
throughout the season	0.42±0.11 f	0.50±0.22 de	0.37±0.17	0.84±0.17 c	1.54±0.91	0.42±0.11 c	4.09 b

1 Means are averages of six sampling dates.

2 Data were analyzed by analysis of variance and Duncan's Multiple Range Test; treatment means within a row followed by the same letter are not significantly different (P>0.05)

S.E. = The standard error associated with the means.

ns = Not significant as determined by the F-test.

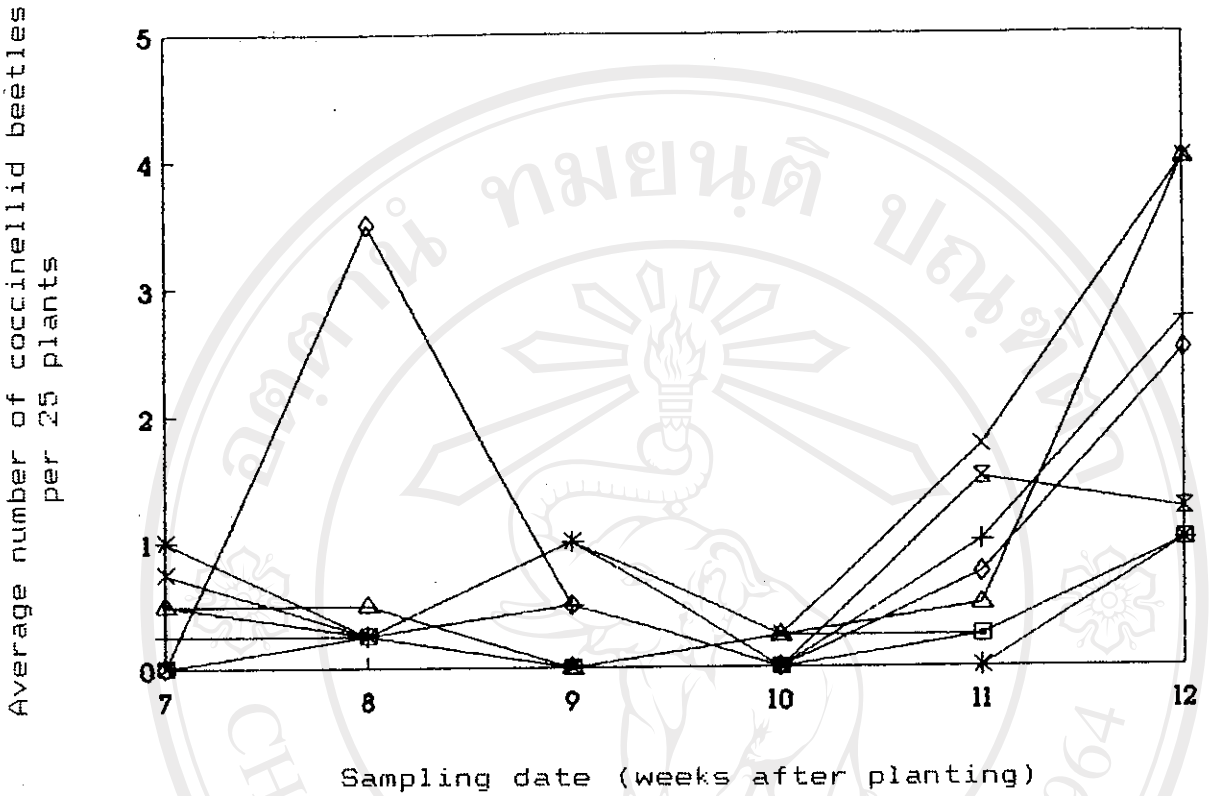

Figure 28. Mean coccinellid beetle densities in soybean monocultures: (▪) weedy throughout the season, (+) weed-free for only two weeks after planting, (✳) weed-free for only four weeks after planting, (□) weed-free throughout the season, and soybean/corn polycultures: (X) weed-free throughout the season, (◇) weed-free for only two weeks after planting, and (△) weed-free for only four weeks after planting and (⧖) weedy throughout the season at the Multiple Cropping Center Experimental Farm, Chiang Mai (1989).

of weeding regimes.

The highest densities of the pentatomid predator Podisus sp. of 2.42 pentatomids per 25 plants were observed in monocultures kept weed-free for only four weeks after planting followed by 1.63 pentatomids per 25 plants in monocultures kept weed-free throughout the season. Figure 29 shows that monocultures kept weed-free for only four weeks after planting and monocultures kept weed-free throughout the season had the highest population densities of Podisus sp. The population of pentatomids in monocultures kept weedy throughout the season or weed-free for only two weeks after planting had no statistically significant differences from population densities in polycultures kept weed-free or weedy throughout the season as determined by the F-test.

There were no statistically significant differences among treatments for Geocoris sp. densities. However, data in Table 13 shows that Geocoris sp. densities increases with the time the plots were weeded with the highest densities of 0.29 and 0.32 per 25 plants counted in both monocultures and polycultures kept weedy throughout the season, respectively. No Geocoris sp. were observed in soybean monocultures kept weed-free throughout the season in all the sampling dates (Figure

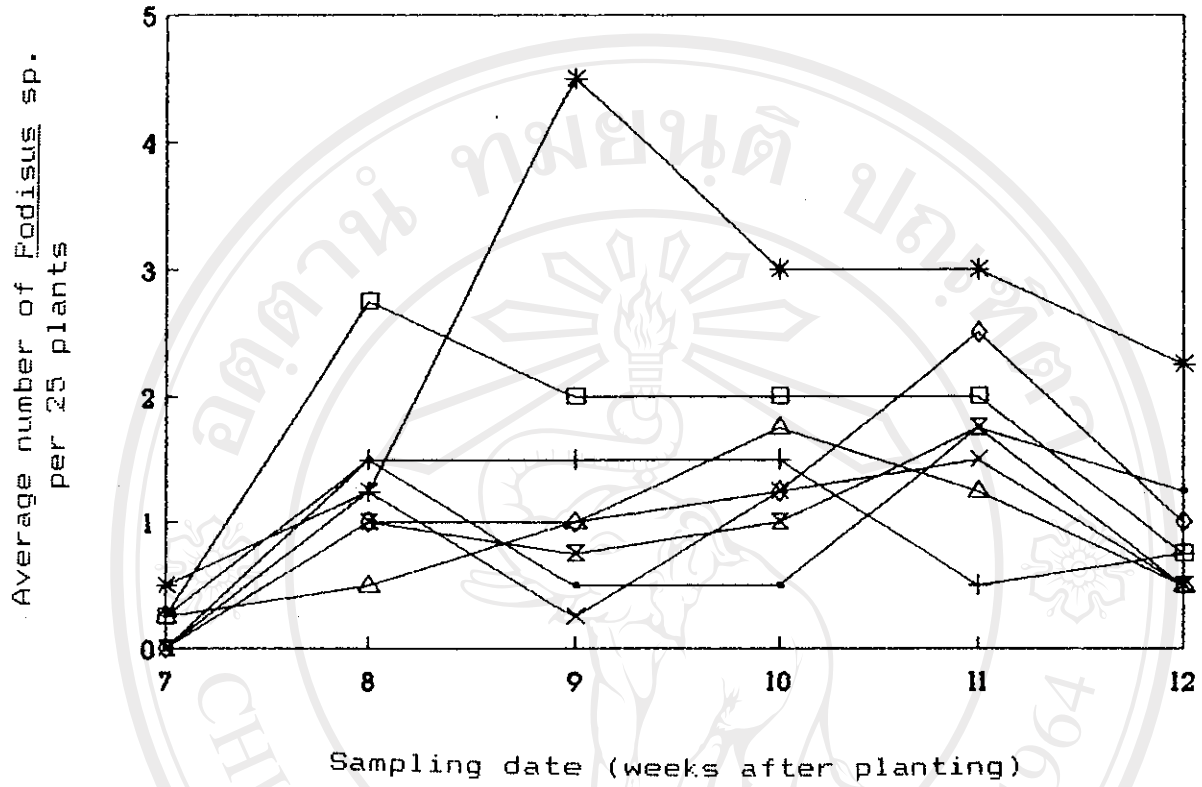

Figure 29. Mean pentatomid bug Podisus sp. densities in soybean monocultures: (•) weedy throughout the season, (+) weed-free for only two weeks after planting, (✳) weed-free for only four weeks after planting, (□) weed-free throughout the season, and soybean/corn polycultures: (X) weed-free throughout the season, (◇) weed-free for only two weeks after planting, (△) weed-free for only four weeks after planting, and (⧖) weedy throughout the season at the Multiple Cropping Center Experimental Farm, Chiang Mai (1989).

30).

Stiretrus sp. densities were not statistically significantly different among all treatments in both monocultures and polycultures. Highest density of 1.54 Stiretrus sp. per 25 plants were observed in soybean polycultures kept weed-free throughout the season while lowest density of 0.21 Stiretrus sp. per 25 plants were observed in monocultures kept weedy throughout the season. No Stiretrus sp. were found in both soybean monocultures and polycultures kept weed-free for only two weeks after planting (Figure 31).

Syrphid fly densities counted in soybean monocultures kept weed-free for only four weeks after planting were statistically significantly different ($P<0.05$) from soybean polycultures except for polycultures which were kept weed-free throughout the season. Figure 32 shows that a rapid increase in syrphid fly densities was observed on the eighth week which was followed by a gradual decrease until the twelfth week when monocultures kept weed-free for only four weeks after planting attained the highest population numbers of 2.25 syrphid flies per 25 plants. Syrphid fly densities of 0.40 to 0.63 flies per 25 plants in both soybean monocultures and polycultures kept weed-free throughout

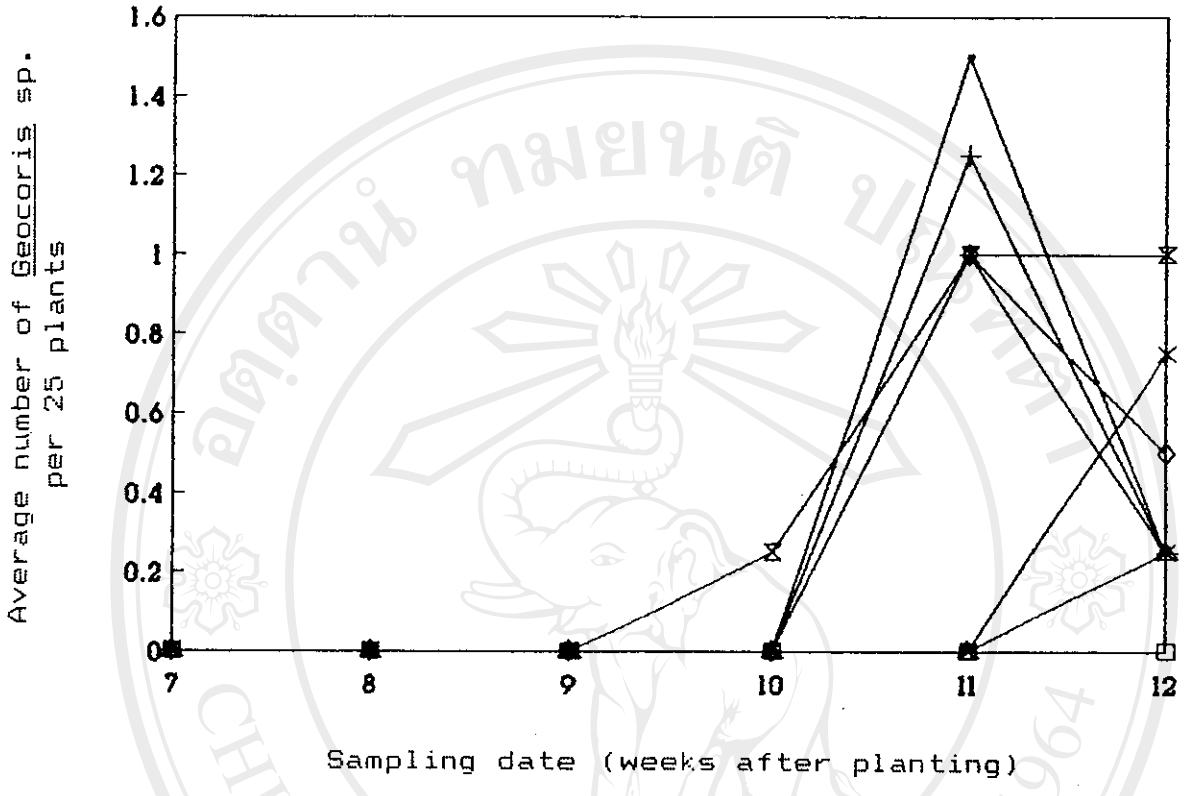

Figure 30. Mean big-eyed bug, Geocoris sp. densities in soybean monocultures: (•) weedy throughout the season, (+) weed-free for only two weeks after planting, (✳) weed-free for only four weeks after planting, (□) weed-free throughout the season, and soybean/corn polycultures: (X) weed-free throughout the season, (◇) weed-free for only two weeks after planting, and (△) weed-free for only four weeks after planting, and (⧖) weedy throughout the season at the Multiple Cropping Center Experimental Farm, Chiang Mai (1989).

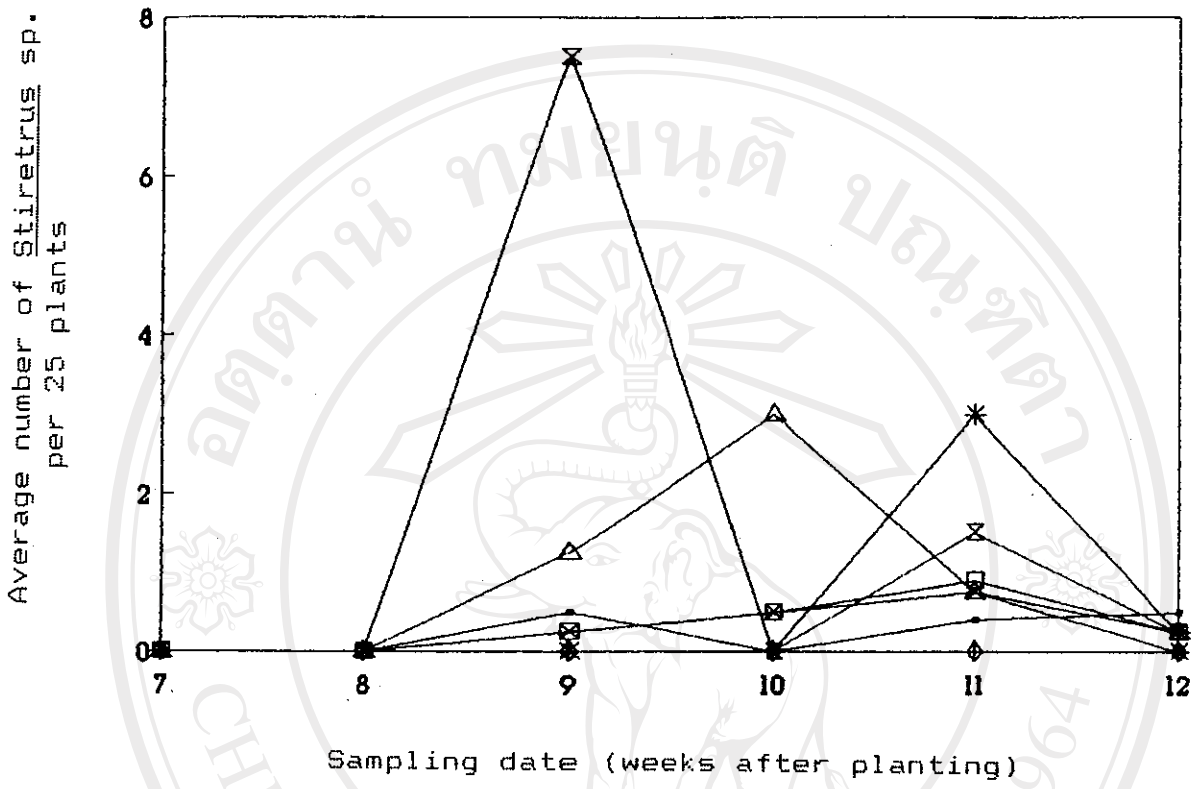

Figure 31. Mean pentatomid bug, Stiretrus sp. densities in soybean monocultures: (•) weedy throughout the season, (+) weed-free for only two weeks after planting, (✳) weed-free for only four weeks after planting, (□) weed-free throughout the season, and soybean/corn polycultures: (X) weed-free throughout the season, (◇) weed-free for only two weeks after planting, (△) weed-free for only four weeks after planting, and (⧖) weedy throughout the season at the Multiple Cropping Center Experimental Farm, Chiang Mai (1989).

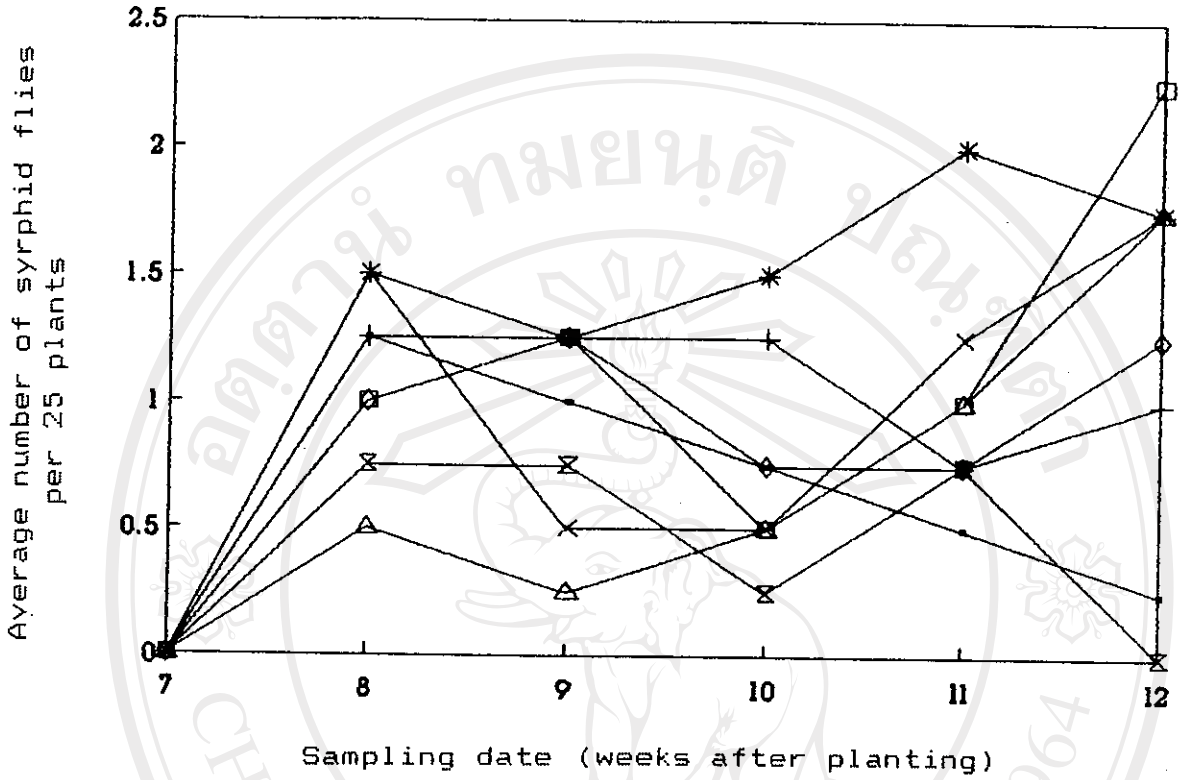

Figure 32. Mean syrphid fly densities in soybean monocultures: (▪) weedy throughout the season, (+) weed-free for only two weeks after planting, (✳) weed-free for only four weeks after planting, (□) weed-free throughout the season, and soybean/corn polycultures: (X) weed-free throughout the season, (◇) weed-free for only two weeks after planting, (△) weed-free for only four weeks after planting, and (⧖) weedy throughout the season at the Multiple Cropping Center Experimental Farm, Chiang Mai (1989).

the season were the lowest densities among all the cropping systems.

The mean densities of spiders, coccinellid beetles, Geocoris sp., Podisus sp., Stiretrus sp. and syrphid fly throughout the study periods is summarized in Table 13.

Throughout the season the highest mean total number of individuals of natural enemies was 10.11 per 25 plants collected from monocultures kept weed-free for only four weeks after planting. This was statistically significantly different from all other means obtained from the seven other cropping systems which did not show statistically significant differences from each other (Table 14). According to both the Simpson and Shannon measures (expressed as a mean of D and H' values for each 25 sample plants obtained in five sampling dates), the species diversity of natural enemies in all the polyculture cropping systems exceeded those in the monoculture cropping systsms. Soybean/corn polycultures weedy throughout the season with an H' of 1.81 was 0.21 higher than soybean monocultures weedy throughout the season with an H' of 1.6. Soybean/corn polycultures kept weed-free for only two weeks after planting with an H' of 1.67 was 0.06 higher than soybean monocultures

Table 14. Natural enemy species diversity measures in various soybean cropping systems at the Multiple Cropping Center Experimental Farm, Chiang Mai (1989). 1/

Diversity Measure	Soybean monocultures				Soybean/sweet corn polycultures 2/			
	1	2	3	4	5	6	7	8
Total Number of morphospecies, S	7	6	7	6	7	6	7	7
	Number of natural enemies per 25 plants							
Spider	2.62	2.54	3.17	3.55	1.54	1.67	0.67	0.42
Coccinellid Beetle	0.38	0.79	0.54	0.25	1.33	1.23	0.96	0.50
Geocoris sp.	0.29	0.25	0.21	0	0.13	0.25	0.04	0.37
Podisus sp.	0.92	1.00	2.42	1.63	0.80	1.12	0.88	0.84
Stiretrus sp.	0.21	0	0.54	0.25	0.25	0	0.68	1.54
Syrphid fly	0.63	0.92	1.33	1.00	0.92	0.83	0.67	0.42
Eurytoma sp.	0.70	1.70	1.90	1.20	1.30	1.90	1.60	0.95
Total Number of Individuals, N	5.75 b	7.20 b	10.11 a	7.88 b	6.27 b	7.00 b	5.50 b	5.04 b
Shannon-Wiener Function, (H')	1.60	1.61	1.68	1.45	1.75	1.67	1.76	1.81
Simpson-Yule, D	0.73	0.77	0.79	0.71	0.81	0.79	0.81	0.81
Species Richness (rMA)	5.68	4.83	6.00	4.88	5.75	4.82	5.65	5.58
Evenness, J	1.89	2.06	1.99	1.87	2.07	2.14	2.09	2.14

1 All values are means of six sampling dates (7, 8, 9, 10, 11, 12 weeks after planting).

2 Soybean monoculture numbers: 1 = weedy throughout the season, 2 = weed-free for only two weeks after planting, 3 = weed-free for only four weeks after planting, 4 = weed-free throughout the season. Soybean/Sweet corn polycultures: 5 = weed-free throughout the season, 6 = weed-free for only two weeks after planting, 7 = weed-free for only four weeks after planting, 8 = weedy throughout the season.

kept weed-free for only two weeks after planting with an H' of 1.61. Soybean polycultures kept weed-free for only four weeks after planting with an H' of 1.76 was 0.08 higher than soybean monocultures kept weed-free for only four weeks after planting with an H' of 1.68. Soybean/corn polycultures kept weed-free throughout the season with an H' of 1.75 was 0.3 higher than soybean monocultures kept weed-free throughout the season with an H' of 1.45. Likewise, soybean/corn polycultures weedy throughout the season with a D of 0.81 was 0.08 higher than soybean monocultures weedy throughout the season with a D of 0.73. Soybean/corn polycultures kept weed-free for only two weeks after planting with a D of 0.79 was 0.02 higher than soybean monocultures kept weed-free for only two weeks after planting with a D of 0.77. Soybean/corn polycultures kept weed-free for only four weeks after planting with a D of 0.81 was 0.02 higher than soybean monocultures kept weed-free for only four weeks after planting with a D of 0.79. Soybean/corn polycultures kept weed-free throughout the season with a D of 0.81 was 0.1 higher than soybean monocultures kept weed-free throughout the season with a D of 0.71. The same trend observed for the Shannon-Wiener function and Simpson-Yule index was also observed for species richness

in soybean/corn polycultures kept weed-free throughout the season with an rMa of 5.75 which was 0.87 higher than soybean monocultures kept weed-free throughout the season with an rMa of 4.88. However, soybean monocultures weedy throughout the season with an rMa of 5.68 was slightly higher than soybean/corn polycultures kept weedy throughout the season with an rMa of 5.58. Soybean/corn polycultures kept weed-free for only two weeks after planting with an rMa of 4.82 is slightly lower by 0.01 than soybean monocultures kept weed-free for only two weeks after planting with an rMa of 4.83. Soybean/corn polycultures kept weed-free for only four weeks after planting with an rMa of 5.65 was 0.35 lower than soybean monocultures kept weed-free for only four weeks after planting with an rMa of 6.0. Evenness (used as an index of the distribution of individuals among species) was also higher for all soybean/corn polycultures compared to all soybean monoculture cropping systems. Soybean/corn polycultures weedy throughout the season with a J of 2.14 was 0.25 higher than soybean monocultures kept weedy throughout the season with a J of 1.89. Soybean/corn polycultures kept weed-free for only two weeks after planting with a J of 2.14 was 0.08 higher than soybean monocultures kept weed-free for only two

weeks after planting with a J of 2.06. Soybean/corn polycultures kept weed-free for only four weeks after planting with a J of 2.09 was 0.1 higher than soybean monocultures kept weed-free for only four weeks after planting with a J of 1.99. Soybean/corn polycultures weed-free throughout the season with a J of 2.7 was 0.2 higher than soybean monocultures weed-free throughout the season with a J of 1.89.

Vegetation Diversity
in Cropping Systems

The densities of weeds were highly variable between monocultures and polycultures. Greatest densities of 303.25 weeds per m^2 and 233.75 weeds per m^2 were observed in polycultures kept weed-free for only four weeks after planting and monocultures kept weedy throughout the season (Table 15). The Shannon-Wiener function (H') and Simpson-Yule (D) indeces of diversity indicated that all soybean/corn polyculture cropping systems had higher diversity compared to all soybean monoculture cropping systems.

For the Shannon-Wiener function, soybean

Table 15. Vegetation diversity associated with soybeans grown in monocultures and polycultures at the Multiple Cropping Center Experimental Farm, Chiang Mai (1989).

Diversity Measure	Soybean monocultures				Soybean/Sweet corn polycultures 1/			
	1	2	3	4	5	6	7	8
Total Number of Morphospecies, S	9	12	9	0	0	11	14	13
	Weed density (individuals per m^2)							
Echinochloa colonum (L.) Link	26.50	5.50	3.00	0	0	6.25	2.50	20.25
Leptochloa chinensis (L.) Neers	66.75	6.25	3.00	0	0	6.50	9.75	18.50
Eleusine indica (L.) Goertn.	101.25	24.75	20.25	0	0	33.00	55.50	31.25
Ageratum conyzoides (L.)	28.00	53.25	154.00	0	0	70.75	197.25	45.75
Digitaria adscendens (Henr.)	7.75	0.75	0.25	0	0	2.00	0.25	9.75
Ludwigia sp.	1.75	5.75	8.50	0	0	4.75	13.00	2.25
Cyperus iria (L.)	0.75	0	0.25	0	0	1.00	3.50	0.25
Eclipta prostrata (L.) L.	0.50	0.25	0	0	0	0.25	0.50	0.25
Hedyotis corymbosa (L.) Lamk.	0.50	0.25	0.25	0	0	0	0.75	0
Euphorbia hirta (L.)	0	0.25	0	0	0	0.50	0.25	0.75
Dactyloctenium aegyptium (L.)Beauv	0	0.25	0	0	0	0	0	0
Amaranthus gracilis Desf.	0	0.25	0	0	0	0	0.25	0.25
Cleome viscosa (L.)	0	0.25	0	0	0	0.25	0	0
Physallis minima (L.)	0	0	0.75	0	0	0	0	0.50
Fimbristylis littoralis (Gaudich.)	0	0	0	0	0	1.25	17.5	0.25
Cyperus difformis (L.)	0	0	0	0	0	0	2.00	0
Mimosa sp.	0	0	0	0	0	0	0.25	0
Scirpus supinus (non. L.) F. Vill.	0	0	0	0	0	0	0	0.25
Total Number of Individuals, N	233.75	97.75	190.25	0	0	126.50	303.25	130.25
Shannon-Wiener, H'	1.42	1.31	0.73	0	0	1.30	1.34	1.65
Simpson-Yule, D	0.70	0.63	0.33	0	0	0.61	0.54	0.77
Species Richness rMA	7.95	8.07	7.95	0	0	8.04	8.13	8.10
Evenness, J	1.48	1.22	0.76	0	0	1.24	1.17	1.48

1/ Soybean monocultures: 1 = weedy throughout the season, 2 = weed-free for only two weeks after planting, 3 = weed-free for only four weeks after planting, 4 = weed-free throughout the the season. Soybean polycultures: 5 = weed-free throughout the season, 6 = weed-free for only two weeks after planting, 7 = weed-free for only four weeks after planting, 8 = weedy throughout the season.

polycultures weedy throughout the season with the highest H' of 1.65 was greater compared to an H' of 1.42 for soybean monocultures weedy throughout the season. Soybean polycultures weed-free for only two weeks after planting with an H' of 1.3 was slightly lower than soybean monocultures weed-free for only two weeks after planting with an H' of 1.31. Soybean polycultures weed-free for only four weeks after planting with an H' of 1.34 was higher than compared to soybean monocultures weed-free for only four weeks after planting with an H' of 0.73.

For the Simpson-Yule index (D), soybean polycultures weedy throughout the season with a D of 0.77 was 0.07 higher than soybean monocultures weedy throughout the season with a D of 0.70. Polycultures kept weed-free for only four weeks after planting with a D of 0.54 was 0.21 higher than soybean monocultures kept weed-free for only four weeks after planting with a D of 0.33. Soybean monocultures kept weed-free for only two weeks after planting with a D of 0.63 was slightly higher than soybean/corn polycultures kept weed-free for only two weeks after planting with a D of 0.61.

The trend in species richness (rMa) and evenness (J) was also greater in the soybean/corn polycultures than soybean monocultures. Species richness in

soybean/corn polycultures weedy throughout the season of 8.10 was 0.15 higher than in monocultures kept weedy throughout the season with rMa of 7.95. Likewise, polycultures weed-free for only four weeks after planting with rMa of 8.13 was 0.18 higher than monocultures weed-free for only four weeks after planting. Soybean/corn polycultures kept weed-free for only two weeks after planting with rMa of 8.04 was 0.03 lower compared to soybean monocultures kept weed-free for only two weeks after planting with rMa of 8.07.

Evenness (J) of 1.48 for soybean/corn polycultures and monocultures weedy throughout the season was the same to that of monocultures kept weedy throughout the season. However, soybean polycultures kept weed-free for only two weeks after planting with a J of 1.24 and weed-free for only four weeks after planting with a J of 1.17 were 0.02 and 0.41 higher than evenness in soybean monocultures kept weed-free for only two weeks after planting of 1.22 and four weeks after planting of 0.76, respectively. The data suggested that all polyculture plots have slightly greater species diversity than all monoculture plots.

Table 16 showed that the most predominant weed species per square meter found in all the plots was

Table 16. Percentage species composition of weeds in various soybean cropping systems at the Multiple Cropping Center Experimental Farm, Chiang Mai (1989).

Weeds associated with soybean	Percentage distribution per m^2							
	Soybean monocultures				Soybean/Sweet corn polycultures 1/			
	1	2	3	4	5	6	7	8
Echinochloa colonum (L.) Link	11.34	5.63	1.58	0	0	4.94	0.82	15.55
Leptochloa chinensis (L.) Neers	28.56	6.39	1.58	0	0	5.14	3.22	14.20
Eleusine indica (L.) Goertn.	43.33	25.32	10.64	0	0	26.09	18.30	23.99
Aegeratum conyzoides (L.)	11.98	54.48	80.95	0	0	55.93	65.05	35.12
Digitaria adscendens (Henr.)	3.32	0.77	0.13	0	0	1.58	0.08	7.49
Ludwigia sp.	0.75	5.88	4.47	0	0	3.75	4.29	1.73
Cyperus iria (L.)	0.32	0	0.13	0	0	0.79	1.15	0.19
Eclipta prostrata (L.) L.	0.21	0.26	0	0	0	0.20	0.16	0.19
Hedyotis corymbosa (L.) Lamk.	0	0.26	0.13	0	0	0	0.25	0
Euphorbia hirta (L.)	0	0.26	0	0	0	0.40	0.08	0.58
Dactyloctenium aegyptium(L.)Beauv	0	0.26	0	0	0	0	0	0
Amaranthus gracilis Desf.	0	0.26	0	0	0	0	0.08	0.19
Cleome viscosa (L.)	0	0.26	0	0	0	0.20	0	0
Physallis minima (L.)	0	0	0.39	0	0	0	0	0.38
Fimbristylis littoralis (Gaudich)	0	0	0	0	0	0.99	5.77	0.19
Cyperus difformis (L.)	0	0	0	0	0	0	0.66	0
Mimosa sp.	0	0	0	0	0	0	0.08	0
Scirpus supinus (non.L.)F.Vill.	0	0	0	0	0	0	0	0.19
Grass/Broadleaf Weed Ratio	6.65:1	1:1.61	1:6.17	0	0	1:1.53	1:2.4	1.62:1

1/ Soybean monocultures: 1 = Weedy throughout the season, 2 = weed-free for only two weeks after planting, 3 = weed-free for only four weeks after planting, 4 = weed-free throughout the season. Soybean/Sweet corn polycultures: 5 = weed-free throughout the season, 6 = weed-free for only two weeks after planting, 7 = weed-free for only four weeks after planting, 8 = weedy throughout the season.

Aegeratum conyzoides (L.). As many as 80.95% of Aegeratum conyzoides was found in soybean monocultures weed-free for only four weeks after planting, 54.48% in monocultures weed-free for only two weeks after planting, and 11.98% in monocultures weedy throughout the season as compared to a maximum of 65.05% in polycultures weed-free for only four weeks after planting, 55.93% in polycultures weed-free for only two weeks after planting, and 35.12% in polycultures weedy throughout the season. However, Eleusine indica (L.) Goertn. and Echinochloa colonum (L.) Link which were the second most predominant weed species accounted for the highest dry matter content in all the cropping systems. Eleusine indica (L.) Goertn. dry matter weights in soybean monoculture cropping systems were 231.78 g/m^2 in weedy throughout the season, 294 g/m^2 in weed-free for only two weeks after planting, and 56.36 g/m^2 in weed-free for only four weeks after planting. For soybean/corn polyculture cropping systems, Eleusine indica (L.) Goertn. dry matter weights were 177.76 g/m^2 in weedy throughout the season, 281.93 g/m^2 in weed-free for only two weeks after planting, and 47.88 g/m^2 in weed-free for only four weeks after planting. The dry matter weights of Echinochloa colonum (L.) Link in soybean monoculture cropping

systems were 255.21 g/m^2 in weedy throughout the season, 110.57 g/m^2 in weed-free for only two weeks after planting, and 15.28 g/m^2 in weed-free for only four weeks after planting. In soybean/corn polyculture cropping systems, the dry matter weights of Echinochloa colonum (L.) Link were 271.27 g/m^2 in weedy throughout the season, 104.6 g/m^2 in weed-free for only two weeks after planting, and 6.21 g/m^2 in weed-free for only four weeks after planting.

The total number of weed species was greater in all polyculture plots than in all monoculture plots. The proportion of broadleaf weeds in all the cropping systems was higher to that of grasses except for both monoculture and polyculture plots which were kept weedy throughout the season (Table 17). Conversely, the grasses had higher dry matter weights in all the cropping systems (Figure 33).

The Effect of Cropping Systems on Crop and Weed Yields

The results of these tests are summarized in Table 18. Soybean grain yields were statistically

Table 17. Comparison of weed biomass in various soybean cropping systems at the Multiple Cropping Center Experimental Farm, Chiang Mai (1989).

Weeds associated with soybean	Weed biomass (g/m^2) at harvest							
	Soybean monocultures				Soybean/Sweet corn polycultures 1/			
	1	2	3	4	5	6	7	8
Echinochloa colonum (L.) Link	255.21	110.57	15.28	0	0	104.60	6.21	271.27
Leptochloa chinensis (L.) Neers	92.81	41.36	10.45	0	0	28.95	5.09	41.10
Eleusine indica (L.) Goertn.	231.78	294.00	56.36	0	0	281.93	47.88	177.76
Aegeratum conyzoides (L.)	3.61	14.10	36.60	0	0	8.41	20.29	6.26
Digitaria adscendens (Henr.)	13.14	8.84	0.04	0	0	3.19	0.04	10.42
Ludwigia sp.	0.06	1.33	1.05	0	0	0.38	0.98	0.63
Cyperus iria (L.)	0.86	0	0.15	0	0	0.74	0.77	0.10
Eclipta prostrata (L.) L.	0.06	0.06	0	0	0	0.14	0.01	0.03
Hedyotis corymbosa (L.) Lamk.	0.01	0.01	0.01	0	0	0	0.03	0
Euphorbia hirta (L.)	0	0.07	0	0	0	0.17	0.03	0.34
Dactyloctenium aegyptium(L.)Beauv.	0	0.38	0	0	0	0.74	0	0
Amaranthus gracilis Desf..	0	0.19	0.44	0	0	0.38	0	0.08
Cleome viscosa (L.)	0	0.23	0	0	0	0	0	0
Physallis minima (L.)	0	0	0	0	0	0	0	0.72
Fimbristylis littoralis (Gaudich)	0	0	0	0	0	0	0.99	0.02
Cyperus difformis (L.)	0	0	0	0	0	0	0.15	0
Mimosa sp.	0	0	0	0	0	0	0.57	0
Scirpus supinus (non.L.)F.Vill.	0	0	0	0	0	0	0.04	0.01
Total Biomass	597.52	471.13	120.36	0	0	429.60	83.08	508.73
Grass/Broadleaf Biomass Ratio	158.8:1	28.5:1	2.2:1	0	0	44:1	2.8:1	62:1

1/ Soybean monocultures: 1 = weedy throughout the season, 2 = weed-free for only two weeks after planting, 3 = weed-free for only four weeks after planting, 4 = weed-free throughout the season. Soybean polycultures: 5 = weed-free throughout the season, 6 = weed-free for only two weeks after planting, 7 = weed-free for only four weeks after planting, 8 = weedy throughout the season.

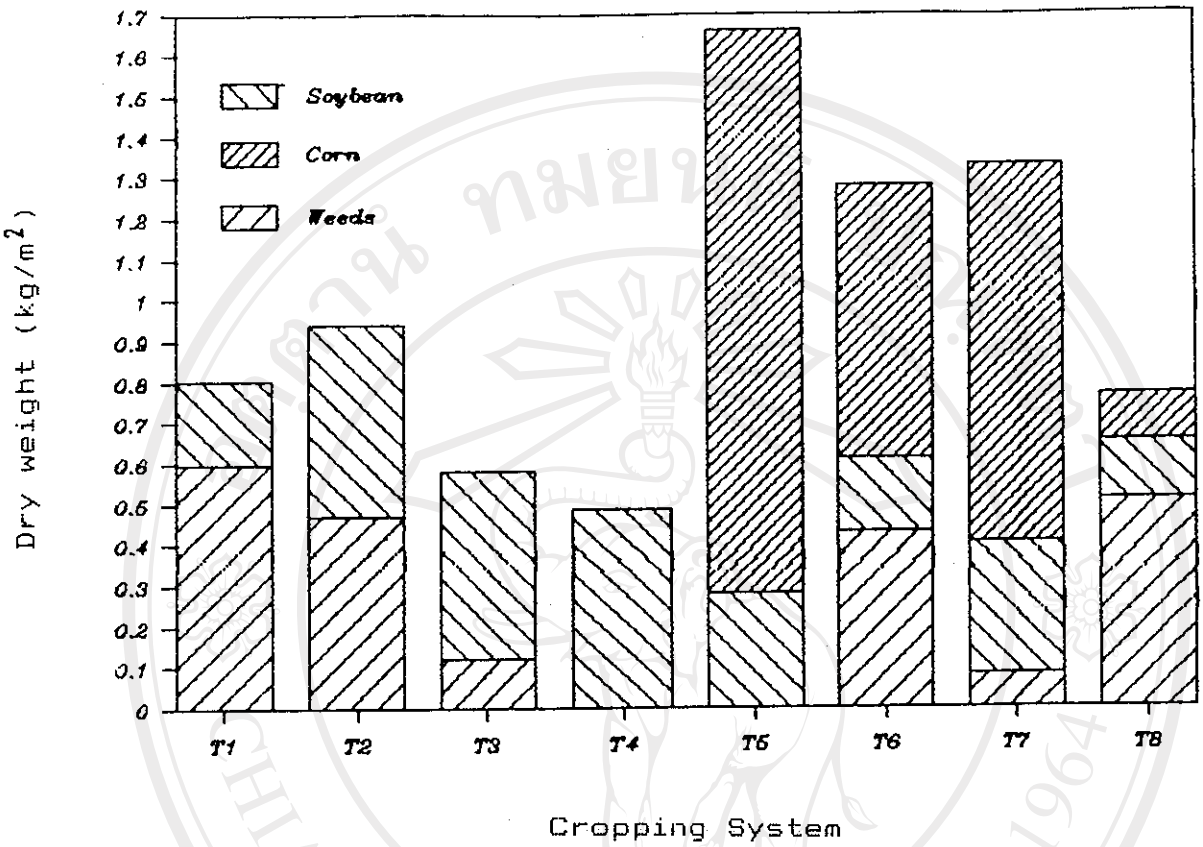

Figure 33. Total biomass in soybean monocultures: weedy throughout the season, weed-free for only two weeks after planting, weed-free for only four weeks after planting, weed-free throughout the season, and soybean/corn polycultures: weed-free throughout the season, weed-free for only two weeks after planting, weed-free for only four weeks after planting, and weedy throughout the season at the Multiple Cropping Center Experimental Farm, Chiang Mai (1989).

Table 18. Crop and weed yields in soybean monoculture and soybean-corn polyculture cropping systems at the Multiple Cropping Center Experimental Farm, Chiang Mai (1989).

Cropping System	Yield (g/25 plants)		Biomass(g/m^2)			
	Soybean (grain)	Corn (cob)	Soybean	Corn	Weeds	Total
Soybean monocultures:						
Weedy throughout the season	72.58 abc	0	204.11 f	0	597.52 a	801.63 e
Weed-free for only two weeks after planting	63.01 bc	0	467.31 b	0	471.13 c	938.44 d
Weed-free for only four weeks after planting	101.77 ab	0	460.31 c	0	120.36 e	580.67 gh
Weed-free throughout the season	94.40 ab	0	485.76 a	0	0	485.76 h
Soybean/Sweet corn polycultures:						
Weed-free throughout the season	120.28 a	5868.39 a	281.33 e	1097.87 a	0	1379.20 a
Weed-free for only two weeks after planting	47.75 bc	2287.39 c	178.25 g	670.03 c	429.60 d	1277.88 c
Weed-free for only four weeks after planting	64.96 bc	3647.76 b	320.10 d	926.00 b	83.08 f	1329.17 b
Weedy throughout the season	36.49 c	570.67 d	144.45 h	114.65 d	508.73 b	767.83 f

Means followed by the same letter in each column are not significantly different (>0.05).

significantly different between treatments ($P<0.05$). The highest soybean grain yield of 120.28 g/25 soybean plants was obtained from soybean/corn polycultures kept weed-free throughout the season which was not statistically significantly different from yields obtained from soybean monocultures kept weedy throughout the season (72.58 g/25 soybean plants), kept weed-free for only two weeks after planting (63.01 g/25 soybean plants), and kept weed-free for only four weeks after planting (101.77 g/25 soybean plants). The lowest soybean grain yield of 36.49 g/25 soybean plants was obtained from soybean/corn polycultures weedy throughout the season which was not statistically significantly different from yields obtained from soybean/corn polycultures kept weed-free for only two weeks after planting (47.75 g/25 soybean plants), soybean monocultures kept weed-free for only two weeks after planting (63.01 g/25 soybean plants), soybean/corn polycultures kept weed-free for only four weeks after planting (64.96 g/25 soybean plants), and soybean monocultures weedy throughout the season (72.58 g/25 soybean plants). Corn yields (cobs/25 corn plants) were statistically significantly different between treatments ($P<0.01$). Highest yields of 5,868.39 g/25 corn plants was obtained from soybean/corn polycultures

kept weed-free throughout the season while lowest yields of 570 g/25 corn plants was obtained from soybean/corn polycultures weedy throughout the season.

Soybean biomass was statistically significantly different between treatments ($P<0.01$). Monoculture cropping systems were observed to have greater soybean biomasss compared to all polyculture cropping systems. Highest soybean biomass of 485.76 g/m^2 was obtained from soybean monocultures kept weed-free throughout the season. Lowest soybean biomass of 114.45 g/m^2 was obtained from soybean/corn polycultures kept weedy throughout the season.

Corn biomass were statistically significantly different between treatments ($P<0.01$). The highest biomass weight of 1,097 g/m^2 was obtained from soybean/corn polycultures kept weed-free throughout the season whereas the lowest biomass of 114.65 g/m^2 was obtained from soybean/corn polycultures weedy throughout the season.

Weed biomass was statistically significantly different between treatments ($P<0.01$). Soybean monoculture cropping systems were observed to have greater weed biomass as compared to soybean/corn polycultures. Highest weed biomass of 597.52 g/m^2 was

obtained from soybean monocultures weedy throughout the season whereas lowest weed biomass of 83.08 g/m^2 was obtained from soybean/corn polycultures kept weed-free for only four weeks after planting.

Total biomass was statistically significantly different among treatments ($P<0.01$) with biomass in soybean/corn polycultures greater than soybean monocultures. Highest biomass of 1,379 g/m^2 was obtained from soybean/corn polycultures weed-free throughout the season whereas lowest biomass of 485.76 g/m^2 was obtained from soybean monocultures kept weed-free throughout the season.