



Appendices

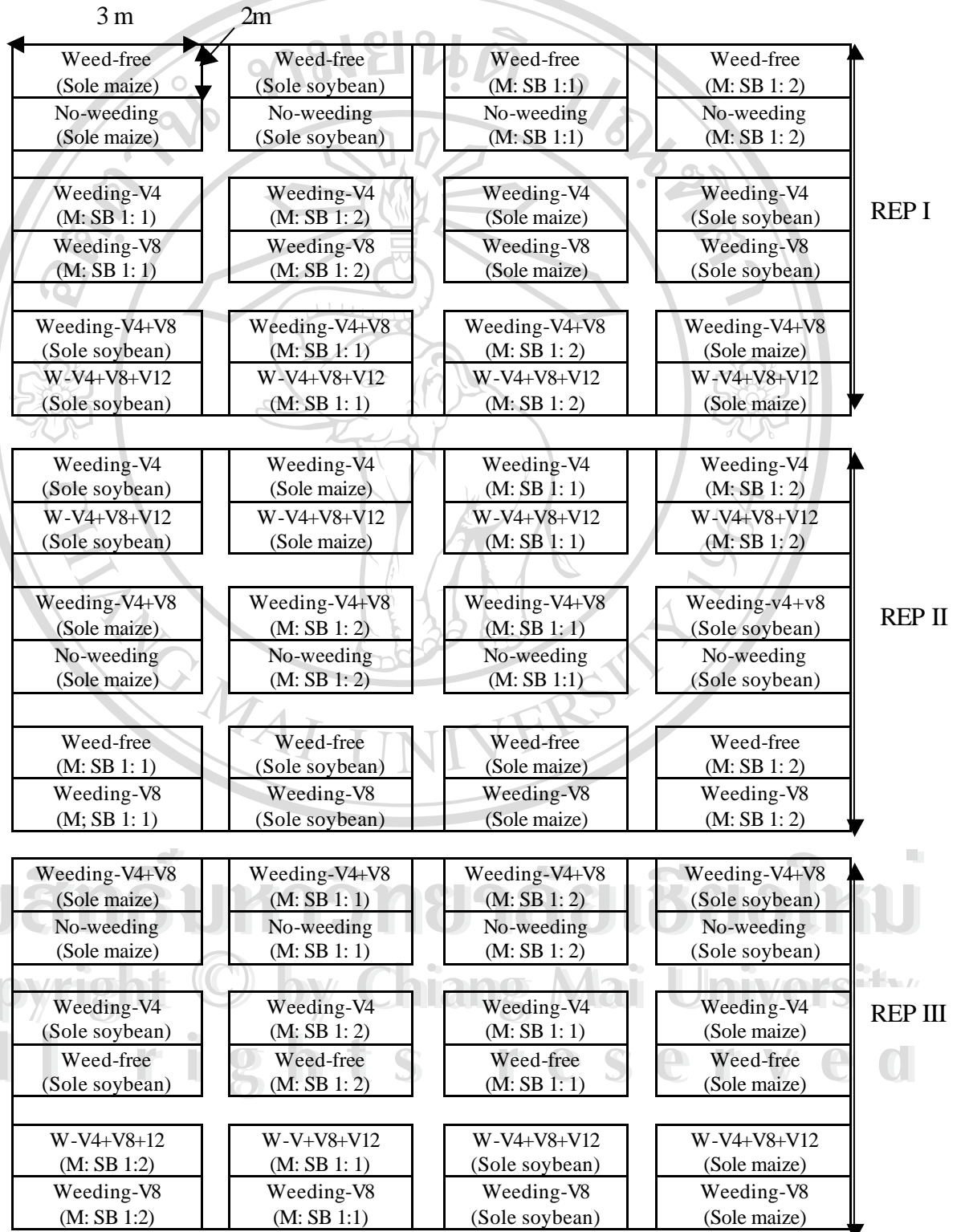
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Appendix A. Figure of field experimental layout

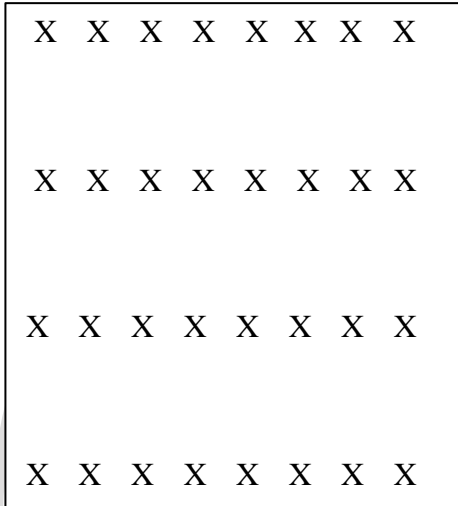
Figure A. 1. Field experimental plot layout



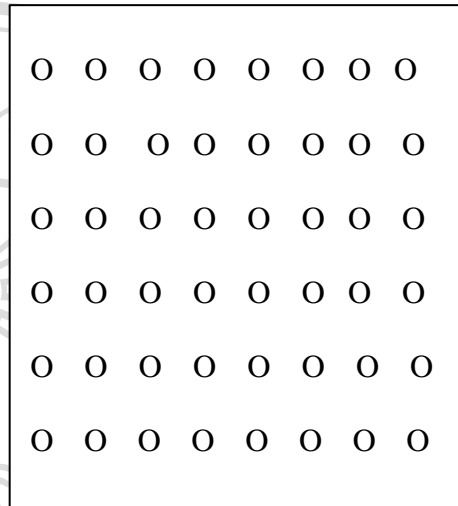
W = weeding; V= vegetative stage of maize growth; M = maize; SB = sole soybean

Figure A. 2. Diagram of crops arrangement in sub-plot treatments in the experiment

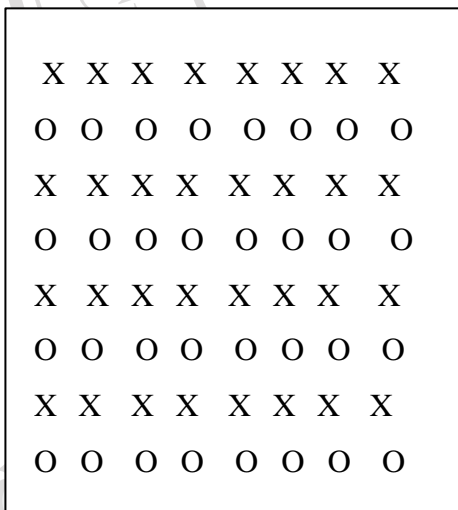
Sole maize treatment (SM)



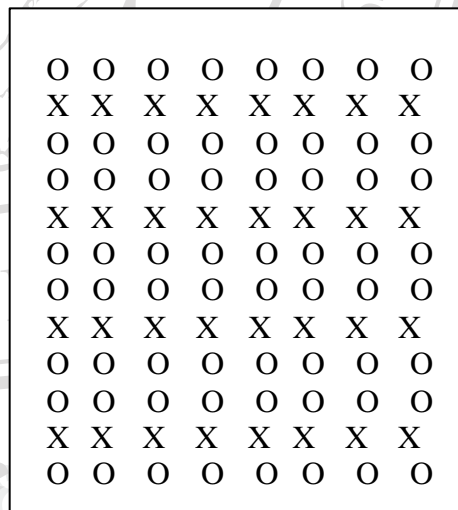
Sole soybean treatment (SSB)



One row of maize: one row of soybean intercrop (M: SB 1: 1) treatment



One row of maize: two row of soybean intercrop (M: SB 1: 2) treatment



Note: X = MAIZE
O = SOYBEAN

Appendix B. The secondary data of oudomxay province and Lao PDR

Table B.1. Air temperature (C°)

YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
1991Max	23.2	27.0	32.2	34.2	33.3	30.0	29.4	30.7	29.8	25.1	25.1	24.9	28.7
Min	09.6	09.6	11.5	16.9	19.5	21.0	21.8	21.2	20.4	13.0	13.0	09.5	15.6
Mean	19.6	18.3	21.8	25.6	26.4	25.5	25.6	26.0	25.1	21.2	19.0	10.2	22.0
1992Max	24.2	28.5	31.1	31.2	31.3	31.1	29.4	28.6	29.8	27.4	26.7	23.5	28.6
Min	10.4	07.7	13.7	16.6	20.1	21.9	22.3	21.8	20.4	17.5	12.8	09.2	16.2
Mean	16.4	18.1	22.4	23.9	25.7	26.5	25.9	25.3	25.1	22.5	19.8	16.4	22.3
1993Max	27.2	30.7	29.1	32.9	30.7	29.1	28.7	28.7	30.1	28.2	25.9	24.7	28.8
Min	09.9	09.7	15.6	17.7	21.0	22.0	22.0	21.3	20.8	16.6	13.1	12.4	16.8
Mean	18.6	20.2	22.4	25.3	25.9	25.6	25.4	25.0	25.5	22.4	19.5	18.6	22.9
1994Max	26.2	26.8	32.1	34.9	31.3	30.0	29.5	28.8	29.4	29.2	26.1	22.8	28.9
Min	11.4	09.0	13.1	18.0	21.2	22.9	22.3	22.0	21.0	19.0	15.8	09.2	17.1
Mean	18.8	17.9	22.6	26.5	26.3	26.5	25.9	25.4	25.2	24.1	21.0	16.0	23.0
1995Max	26.0	25.2	32.3	31.4	31.0	29.5	27.8	28.0	29.1	28.2	26.3	23.5	28.2
Min	07.0	09.0	14.7	18.3	21.4	22.2	22.3	22.0	20.5	18.5	16.7	12.0	17.1
Mean	16.5	17.1	19.0	24.9	26.2	25.9	25.1	25.0	24.8	23.4	21.5	17.8	22.1
1996Max	24.3	28.6	31.7	30.1	32.7	31.9	28.8	28.9	27.6	29.2	26.8	27.0	29.0
Min	09.2	10.0	14.3	16.5	20.8	22.4	23.7	22.5	20.5	19.4	16.0	15.2	17.6
Mean	16.8	19.3	23.0	23.3	26.8	27.2	26.3	25.7	24.1	24.3	21.4	21.1	23.3
1997Max	28.0	30.2	33.4	31.8	31.5	30.9	27.9	30.0	30.1	29.8	27.1	25.2	29.7
Min	11.0	13.0	12.0	17.2	20.1	21.2	20.7	20.1	18.0	16.5	15.5	13.2	16.5
Mean	19.5	21.6	22.7	24.5	25.6	26.1	24.3	25.1	24.0	23.5	21.3	19.2	23.1
1998Max	24.8	29.4	32.2	31.2	28.8	29.5	29.9	28.4	29.8	27.4	26.1	21.4	28.2
Min	12.4	13.2	14.1	26.4	21.4	22.8	23.4	22.4	21.7	19.8	15.3	08.1	18.42
Mean	18.6	21.3	23.2	28.8	25.1	26.2	26.7	25.4	25.8	23.6	20.7	14.8	23.35
1999Max	26.7	21.0	29.6	31.2	28.8	29.1	28.9	29.9	29.1	28.3	27.4	26.6	28.05
Min	10.3	11.6	13.7	18.6	21.0	22.8	15.0	21.8	20.9	19.1	14.4	12.7	16.83
Mean	18.5	19.3	21.7	24.9	24.9	26.0	21.9	28.9	25.0	23.7	20.9	19.7	22.95
2000Max	26.9	29.4	28.7	33.3	28.8	30.1	30.1	30.4	30.1	28.6	25.0	25.1	28.88
Min	10.2	09.8	15.1	17.9	19.6	20.4	20.4	19.4	17.9	10.4	10.1	15.97	
Mean	18.6	19.6	21.9	25.6	24.2	25.3	25.3	25.4	24.8	23.3	10.7	17.6	21.86
Overall Max	25.75	27.68	31.24	32.22	30.82	30.12	29.04	29.24	29.49	28.14	26.25	24.47	28.71
Min	10.14	10.26	13.78	18.41	20.61	21.96	21.39	21.55	20.36	17.73	14.3	11.16	16.80
Mean	18.19	19.27	22.07	25.33	25.71	26.08	25.24	25.72	24.94	23.2	19.58	17.14	22.71

Source: Meteorological station of Oudomxay province, Laos

Table B.2. On average rainfall in year 1991-2000 (mm) of

Y/M	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total	Mean
1991	7	53.8	NT	32	186.5	190.5	223	232.5	166.4	31.5	19.1	78	1220.3	110.9
1992	NT	NT	44.5	144.7	164.6	130.2	171.6	133.3	166.6	124.7	3.4	NT	1083.6	120.4
1993	4.1	NT	54.8	21	160.9	188.4	211.2	274.4	257.5	48.3	6.8	132.9	1360.3	123.7
1994	NT	NT	2.8	27.8	109.5	217.4	202	146.9	157.1	62.6	67.7	NT	993.8	110.4
1995	NT	42.7	39.1	146.1	220.5	120.5	396.5	255.6	95.8	49.3	35.9	4.2	1406.2	127.8
1996	NT	2	20.6	69	82	131.4	366.8	326.6	249.2	52.9	10.2	15	1325.7	120.5
1997	27.8	NT	56.6	146	143	291.4	236.6	220.6	19.2	42.8	19.5	9	1212.5	110.2
1998	24.2	8.7	39.6	90.2	137.9	150.5	118.8	431.9	191.5	77.3	38.7	33.5	1342.8	111.9
1999	2.4	116.4	16.2	94.9	250.6	258.4	292.3	266	80.3	48.3	NT	45.1	1470.9	133.7
2000	20.4	NT	130.2	80.9	284.4	260.6	502.1	210.4	99.2	89.2	0.8	NT	1678.2	167.8
Total	85.9	223.6	404.4	852.6	1739.9	1939	2721	2498.2	1483	626.9	202.1	317.7	13094.3	1091.2
Mean	14.3	44.7	44.9	85.26	174.0	193.9	272.1	249.8	148.3	62.7	22.5	45.4	1357.9	113.16

Source: Meteorological station of Oudomxay province, Laos

Table B. 3. Area (* 1000 ha) and yield (tons ha⁻¹) of maize production in Laos and Oudomxay, Lao PDR

Area/year	1996	1997	1998	1999	2000	AVE
Country	37.38	38	46.4	40.73	49	42.302
Yield (country)	2.09	2.06	2.37	2.36	2.39	2.254
Northern	20.63	21.28	25.2	24.22	23.88	23.042
Central	10.08	12.68	15.8	13.83	18.13	14.104
Southern	6.68	4.04	5.4	2.68	6.99	5.158
Oudomxay province	4.8	4.3	4.5	1.17	2.33	3.42
Yield (Oudomxay)	3.4	2.09	2.3	2.28	2.35	2.484

Source: Ministry of Agriculture and Forestry (2000)

Table B. 4. Area (* 1000 ha) and yield (tons ha⁻¹) of soybean production in Laos and Oudomxay, Lao PDR

Area/Year	1996	1997	1998	1999	2000 AVE	
Country	3.58	3.12	5.87	6.8	6.4	5.154
Yield (country)	0.91	0.74	0.73	0.86	0.84	0.816
Northern	2.32	1.7	3.22	2.73	2.33	2.46
Central	0.35	0.25	0.66	1.46	0.94	0.732
Southern	0.91	1.17	1.99	2.62	3.13	1.964
Oudomxay	0.5	0.05	0.07	0.12	0.14	0.176
Yield (Oudomxay)	1.5	0.8	0.8	0.83	0.83	0.952

Source: Ministry of Agriculture and Forestry (2000)

Appendix C. Analysis of variance

Table C. 1. Analysis of variance table for weed population density

SOURCE	DF	SS	MS	F	P
REP (A)					
TW (B)					
A*B					
CROPS (C)					
B*C					
A*B*C					
TOTAL					

Table C. 2. Analysis of variance table for total dry matter of weed

SOURCE	DF	SS	MS	F	P
REP (A)					0.5980
TW (B)		E		0	0.0000
A*B					
CROPS (C)					
B*C					
A*B*C					
TOTAL		E			

Table C. 3. Analysis of variance table for labor-days use for weeding

SOURCE	DF	SS	MS	F	P
REP (A)					
TW (B)					
A*B					
CROPS (C)					
B*C					
A*B*C					
TOTAL					

Table C. 4. Analysis of variance table for maize plant height at harvest

SOURCE	DF	SS	MS	F	P
REP (A)					
TW (B)					
A*B					
CROPS (C)					0.0043
B*C					0.0106
A*B*C					
TOTAL					

Table C. 5. Analysis of variance table for leaf area index at V12 stage of maize growth

SOURCE	DF	SS	MS	F	P
REP (A)					
TW (B)					
A*B					
CROPS (C)					
B*C					
A*B*C					
TOTAL					

Table C. 6. Analysis of variance table for leaf area index VT stage of maize growth

SOURCE	DF	SS	MS	F	P
REP (A)					
TW (B)					
A*B					
CROPS (C)					
B*C					
A*B*C					
TOTAL					

Table C. 7. Analysis of variance table for leaf area index of maize at harvest

SOURCE	DF	SS	MS	F	P
REP (A)					
TW (B)					
A*B					
CROPS (C)					
B*C					
A*B*C					
TOTAL					

Table C. 8. Analysis of variance table for light intensity at V12 stage of maize growth

SOURCE	DF	SS	MS	F	P
REP (A)	2	29081.9	14540.9	4.27	0.0556
TW (B)	5	41722.3	8344.46	2.45	0.1068
A*B	10	34051.7	3405.17		
CROPS (C)	2	27175	13587.5	5.95	0.0080
B*C	10	32434.6	3243.46	1.42	0.2310
A*B*C	24	54840.5	2285.02		
TOTAL	53	219306			

Table C. 9. Analysis of variance table for light interception at V12 stage of maize growth

SOURCE	DF	SS	MS	F	P
REP (A)					
TW (B)					
A*B					
CROPS (C)					
B*C					
A*B*C					
TOTAL					

Table C. 11. Analysis of variance table for light interception at VT stage of maize growth

SOURCE	DF	SS	MS	F	P
REP (A)					
TW (B)					
A*B					
CROPS (C)					
B*C					
A*B*C					
TOTAL					

Table C. 12. Analysis of variance table for total dry matter at 12 stage of maize growth

SOURCE	DF	SS	MS	F	P
REP (A)					
TW (B)					
A*B					
CROPS (C)					
B*C					
A*B*C					
TOTAL					

Table C. 13. Analysis of variance table for total dry matter at VT stage of maize growth

SOURCE	DF	SS	MS	F	P
REP (A)					
TW (B)					
A*B					
CROPS (C)					
B*C					
A*B*C					
TOTAL					

Table C.14. Analysis of variance table for total dry matter of maize at harvest

SOURCE	DF	SS	MS	F	P
REP (A)					
TW (B)					
A*B					
CROPS (C)					
B*C					
A*B*C					
TOTAL					

Table C. 15. Analysis of variance table for number of row per ear of maize

SOURCE	DF	SS	MS	F	P
REP (A)					
TW (B)					
A*B					
CROPS (C)					
B*C					
A*B*C					
TOTAL					

Table C. 16. Analysis of variance table for number of seeds per row

SOURCE	DF	SS	MS	F	P
REP (A)					
TW (B)					
A*B					
CROPS (C)					
B*C					
A*B*C					
TOTAL					

Table C. 17. Analysis of variance table for number of seed per ear

SOURCE	DF	SS	MS	F	P
REP (A)					
TW (B)					
A*B					
CROPS (C)					
B*C					
A*B*C					
TOTAL					

Table C. 18. Analysis of variance table for 1000 seed weight of maize

SOURCE	DF	SS	MS	F	P
REP (A)					
TW (B)					
A*B					
CROPS (C)					
B*C					
A*B*C					
TOTAL					

Table C. 19. Analysis of variance table for harvest index (HI) of maize

SOURCE	DF	SS	MS	F	P
REP (A)		E-	E-		
TW (B)					
A*B					
CROPS (C)			E-		
B*C					
A*B*C					
TOTAL					

Table C. 20. Analysis of variance table for maize grain yield

SOURCE	DF	SS	MS	F	P
REP (A)					
TW (B)					
A*B					
CROPS (C)					
B*C					
A*B*C					
TOTAL		E			

Table C. 21. Analysis of variance table for plant height of maize at harvest

SOURCE	DF	SS	MS	F	P
REP (A)					
TW (B)					
A*B					
CROPS (C)					0.0000
B*C					
A*B*C					
TOTAL					

Table C. 22. Analysis of variance table for number of soybean branches at harvest

SOURCE	DF	SS	MS	F	P
REP (A)					
TW (B)					
A*B					
CROPS (C)					
B*C					
A*B*C					
TOTAL					

Table C. 23. Analysis of variance table for leaf area index at R2 stage of soybean growth

SOURCE	DF	SS	MS	F	P
REP (A)					
TW (B)					
A*B					
CROPS (C)					
B*C					
A*B*C					
TOTAL					

Table C. 24. Analysis of variance table for leaf area index at R5 stage of soybean growth

SOURCE	DF	SS	MS	F	P
REP (A)					
TW (B)					
A*B					
CROPS (C)					
B*C					
A*B*C					
TOTAL					

Table C. 25. Analysis of variance table for light intensity at R2 stage of soybean growth

SOURCE	DF	SS	MS	F	P
REP (A)	2	850.51	425.255	0.72	0.5121
TW (B)	5	19735.9	3947.19	6.65	0.0056
A*B	10	5938.53	593.853		
CROPS (C)	2	171757	85878.4	81.84	0.0000
B*C	10	13256.1	1325.61	1.26	0.3042
A*B*C	24	25185	1049.37		
TOTAL	53	236723			

Table C. 26. Analysis of variance table for light interception at R2 stage of soybean growth

SOURCE	DF	SS	MS	F	P
REP (A)					
TW (B)					
A*B					
CROPS (C)					
B*C					
A*B*C					
TOTAL					

Table C. 27. Analysis of variance table for light intensity at R5 stage of soybean growth

SOURCE	DF	SS	MS	F	P
REP (A)	2	2977.9	1488.96	1.33	0.3072
TW (B)	5	42563.7	8512.73	7.61	0.0034
A*B	10	11183.5	1118.35		
CROPS (C)	2	343286	171643	117.97	0.0000
B*C	10	21563.6	2156.36	1.48	0.2064
A*B*C	24	34918.7	1454.95		
TOTAL	53	456494			

Table C. 28. Analysis of variance table for light interception at R5 stage of soybean growth

SOURCE	DF	SS	MS	F	P
REP (A)					0.3112
TW (B)					0.0035
A*B					
CROPS (C)					0.0000
B*C					0.2053
A*B*C					
TOTAL					

Table C. 29. Analysis of variance table for total dry matter at R2 stage of soybean growth

SOURCE	DF	SS	MS	F	P
REP (A)					
TW (B)					
A*B					
CROPS (C)					
B*C					
A*B*C					
TOTAL					

Table C. 30. Analysis of variance table for total dry matter at R5 stage of soybean growth

SOURCE	DF	SS	MS	F	P
REP (A)					
TW (B)					
A*B					
CROPS (C)					
B*C					
A*B*C					
TOTAL					

Table C. 31. Analysis of variance table for total dry matter of soybean at harvest

SOURCE	DF	SS	MS	F	P
REP (A)					
TW (B)					
A*B					
CROPS (C)					0.0000
B*C					
A*B*C					
TOTAL					

Table C. 32. Analysis of variance table for number of pods per plant

SOURCE	DF	SS	MS	F	P
REP (A)					
TW (B)					
A*B					
CROPS (C)					
B*C					
A*B*C					
TOTAL					

Table 33. Analysis of variance table for number of fill pods per plant

SOURCE	DF	SS	MS	F	P
REP (A)					
TW (B)					
A*B					
CROPS (C)					
B*C					
A*B*C					
TOTAL					

Table 34. Analysis of variance table for percent of unfilled pods per plant

SOURCE	DF	SS	MS	F	P
REP (A)					
TW (B)					
A*B					
CROPS (C)					
B*C					
A*B*C					
TOTAL					

Table C. 35. Analysis of variance table for 100 seeds weight

SOURCE	DF	SS	MS	F	P
REP (A)					
TW (B)					
A*B					
CROPS (C)					
B*C					
A*B*C					
TOTAL					

Table C. 36. Analysis of variance table for harvest index (HI)

SOURCE	DF	SS	MS	F	P
REP (A)		E-	E-		
TW (B)					
A*B			E-		
CROPS (C)					
B*C			E-		
A*B*C					
TOTAL					

Table C. 37. Analysis of variance table for soybean grain yield

SOURCE	DF	SS	MS	F	P
REP (A)					
TW (B)					
A*B					
CROPS (C)		E			
B*C					
A*B*C					
TOTAL		E			

Table C. 38. Analysis of variance table for land equivalent ratio of maize and soybean intercropping

SOURCE	DF	SS	MS	F	P
REP (A)	2	0.00701	0.0035	0.22	0.8053
TW (B)	5	0.30426	0.06085	3.84	0.0333
A*B	10	0.15826	0.01583		
CROPS (C)	1	0.39271	0.39271	24.79	0.0003
B*C	5	0.19966	0.03993	2.52	0.0880
A*B*C	12	0.19013	0.01584		
TOTAL	35	1.25202			

Table C. 39. Analysis of variance table for total revenue

SOURCE	DF	SS	MS	F	P
REP (A)	2	1500.77	750.384	0.38	0.6903
TW (B)	5	69840.9	13968.2	7.16	0.0043
A*B	10	19507.2	1950.72		
CROPS (C)	3	754283	251428	51	0.0000
B*C	15	50136.5	3342.44	0.68	0.7881
A*B*C	36	177487	4930.20		
TOTAL	71	1072755			

Table 40. C. Analysis of variance table for total variation cost

SOURCE	DF	SS	MS	F	P
REP (A)	2	2760.86	1380.43	1.09	0.3744
TW (B)	5	1447707	289541	227.72	0.0000
A*B	10	12714.5	1271.45		
CROPS (C)	3	4329.18	1443.06	5.51	0.0032
B*C	15	60307.1	4020.47	15.35	0.0000
A*B*C	36	9430.56	261.96		
TOTAL	71	1537249			

Table C. 41. Analysis of variance table for gross margin per unit area (hectare)

SOURCE	DF	SS	MS	F	P
REP (A)	2	8205.35	4102.67	1.49	0.2718
TW (B)	5	924402	184880	67.07	0.0000
A*B	10	27566.9	2756.69		
CROPS (C)	3	687973	229324	46.04	0.0000
B*C	15	147029	9801.91	1.97	0.0483
A*B*C	36	179302	4980.61		
TOTAL	71	1974478			

Table C. 42. Analysis of variance table for gross margin per labor-day use for weeding

SOURCE	DF	SS	MS	F	P
REP (A)	2	0.87607	0.43804	0.57	0.5817
TW (B)	5	574.496	114.899	150.12	0.0000
A*B	10	7.65401	0.7654		
CROPS (C)	3	24.2641	8.08804	5.63	0.0029
B*C	15	47.5873	3.17249	2.2100	0.026
A*B*C	36	51.7189	1.43664		
TOTAL	71	706.596			

Appendix D. Table for interaction between timing of weeding an intercropping

Table D. 1. Interaction between timing of weeding and intercropping for weed population

Treatment	Weed-free	No-weeding	Weeding-V4	Weeding-V8	Weeding-V4+8	Weeding-V4+V8+V12	Mean
Sole maize	0	225.33	147.33	160.67	136.67	152.78	137.13
Sole soybean	0	182.00	117.33	165.67	140.67	136.56	123.70
M: SB 1:1	0	137.00	118.67	164.00	108.00	106.00	105.61
M: SB 1:2	0	124.67	117.33	132.67	110.33	103.56	98.09
Mean	0	167.25	125.17	155.75	123.92	124.72	116.13

Table D. 2. Interaction between timing of weeding and intercropping for total dry matter of weed

Treatment	Weed-free	No-weeding	Weeding-V4	Weeding-V8	Weeding-V4+V8	Weeding-V4+V8+V12	Mean
Sole maize	0	1,783.1	681.5	1,827.5	895.3	626.2	968.9
Sole soybean	0	2,826.4	547.1	1,433.7	1,004.5	509.2	1053.5
M: SB 1: 1	0	1,810.9	450.4	1,410.3	562.4	441.7	779.3
M: SB 1: 2	0	1,302.8	464.9	1,050.1	370.5	306.7	582.5
Mean	0	1,930.8	536.0	1,430.4	708.2	470.9	846.1

Table D. 3. Interaction between timing of weeding and intercropping for labor-days

Treatment	Weed-free	No-weeding	Weeding-V4	Weeding-V8	Weeding-V4+V8	Weeding-V4+V8+V12	Mean
Sole Maize	208.34	0	38.19	26.62	67.13	96.07	57.00
Sole soybean	221.07	0	35.88	35.88	54.40	92.59	54.69
M: SB 1:1	185.19	0	46.30	49.77	82.18	112.27	72.63
M: SB 1:2	153.93	0	47.45	53.24	78.70	106.48	71.47
Mean	192.13	0	41.96	41.38	70.60	101.85	63.95

Table D. 4. Interaction between timing of weeding and intercropping for maize plant

Treatment	height						Mean
	Weed-free	No-weeding	Weeding-V4	Weeding-V8	Weeding-V4+V8	Weeding-V4+V8+V12	
Sole maize	161.89	161.67	165.33	151.67	159.00	176.67	162.70
M: SB 1:1	169.67	173.56	167.33	167.11	160.67	178.55	169.48
M: SB 1:2	165.22	179.44	168.22	163.78	177.11	176.67	171.74
Mean	165.59	171.56	166.96	160.85	165.59	177.30	167.98

Table D. 5. Interaction between timing of weeding and intercropping for leaf area index at V12 stage of maize growth

Treatment	leaf area index at V12 stage of maize growth						Mean
	Weed-free	No-weeding	Weeding-V4	Weeding-V8	Weeding-V4+V8	Weeding-V4+V8+V12	
Sole maize	2.63	1.84	2.15	2.33	2.54	2.40	2.32
M: SB 1:1	2.52	1.78	2.08	1.96	2.18	2.38	2.15
M: SB 1:2	1.95	1.86	1.71	1.71	2.05	2.11	1.90
Mean	2.37	1.83	1.98	2.00	2.26	2.30	2.12

Table D. 6. Interaction between timing of weeding and intercropping for leaf area index at VT stage of maize growth

Treatment	leaf area index at VT stage of maize growth						Mean
	Weed-free	No-weeding	Weeding-V4	Weeding-V8	Weeding-V4+V8	Weeding-V4+V8+V12	
Sole maize	2.56	2.37	2.59	2.54	2.76	2.54	2.56
M: SB 1:1	2.38	2.32	2.43	1.88	2.31	2.32	2.28
M: SB 1:2	2.27	2.04	2.27	1.57	2.01	2.30	2.08
Mean	2.40	2.25	2.43	2.00	2.36	2.39	2.31

Table D. 7. Interaction between timing of weeding and intercropping for leaf area index of maize at harvest

Treatment	Weed-free	No-weeding	Weeding-V4	Weeding-V8	Weeding-V4+V8	Weeding-V4+V8+V12	Mean
Sole maize	2.31	1.99	1.88	1.82	2.05	2.25	2.05
M: SB 1: 1	1.99	1.80	1.77	1.29	1.83	1.86	1.76
M: SB 1: 2	2.01	1.75	1.71	1.32	1.70	1.74	1.70
Mean	2.10	1.85	1.79	1.48	1.86	1.95	1.84

Table D. 8. Interaction between timing of weeding and intercropping for light intensity at V12 stage of maize growth

Treatment	Weed-free	No-weeding	Weeding-V4	Weeding-V8	Weeding-V4+V8	Weeding-V4+V8+V12	Mean
Sole maize	526.25	591.12	538.55	550.48	562.39	614.12	563.82
M: SB 1:1	526.06	649.52	602.99	653.83	648.23	623.59	617.37
M: SB 1:2	563.16	638.89	623.74	639.22	590.03	552.52	601.26
Mean	538.49	626.51	588.43	614.51	600.22	596.74	594.15

Table D. 9. Interaction between timing of weeding and intercropping for light interception at V12 stage of maize growth

Treatment	Weed-free	No-weeding	Weeding-V4	Weeding-V8	Weeding-V4+V	Weeding-V4+V+V2	Mean
Sole maize	52.4	60.3	60.2	56.1	61.4	60.2	58
M: SB 1:1	56.3	67.6	61.7	72.0	68.0	68.3	66
M: SB 1: 2	56.3	67.8	59.5	64.2	59.2	61.3	61
Mean	55.0	65.2	60.5	64.1	62.9	63.3	62

Table D. 10. Interaction between timing of weeding and intercropping for light intensity at VT stage of maize growth

Treatment	Weed-free	No-weeding	Weeding-V4	Weeding-V8	Weeding-V4+V8	Weeding-V4+V8+V12	Mean
Sole maize	612.07	759.13	723.19	533.28	528.68	504.90	610.21
M: SB 1:1	670.56	674.21	673.18	649.08	710.26	648.26	670.92
M: SB 1 :2	690.53	627.89	596.20	621.20	587.27	594.11	619.53
Mean	657.72	687.08	664.19	601.19	608.74	582.42	633.56

Table D. 11. Interaction between timing of weeding and intercropping for light interception at VT stage of maize growth

Treatment	Weed-free	No-weeding	Weeding-V4	Weeding-V8	Weeding-V4+V8	Weeding-V4+V8+V12	Mean
Sole maize	49.5	61.4	58.5	43.2	42.8	40.9	49
M: SB 1:1	54.3	54.6	54.5	52.5	57.5	52.5	54
M: SB 1: 2	55.9	50.8	48.3	50.3	47.6	48.1	50
Mean	53.2	55.6	53.8	48.7	49.3	47.1	51

Table D. 12. Interaction between timing of weeding and intercropping for total dry matter at V12 stage of maize growth

Treatment	Weed-free	No-weeding	Weeding-V4	Weeding-V8	Weeding-V4+V8	Weeding-V4+V8+V12	Mean
Sole maize	135.35	108.63	123.18	113.27	124.21	138.64	123.88
M: SB 1: 1	126.35	96.44	101.23	105.93	104.63	96.12	105.11
M: SB 1: 2	128.65	106.05	116.28	111.05	113.42	117.67	115.52
Mean	130.12	103.70	113.56	110.08	114.09	117.48	114.84

Table D. 13. Interaction between timing of weeding and intercropping for total dry matter at VT stage of maize growth

Treatment	Weed-free	No-weeding	Weeding-V4	Weeding-V8	Weeding-V4+V8	Weeding-V4+V8+V12	Mean
Sole maize	254.64	172.33	221.88	203.97	232.73	236.84	220.40
M: SB 1:1	236.97	154.24	210.26	207.15	221.40	226.06	209.35
M: SB 1:2	172.00	180.67	150.44	187.41	216.73	220.58	187.97
Mean	221.21	169.08	194.19	199.51	223.62	227.83	205.91

Table D. 14. Interaction between timing of weeding and intercropping for total dry matter of maize at harvest

Treatments	Weed-free	No-weeding	Weeding-V4	Weeding-V8	Weeding-V4+V8	Weeding-V4+V8+V12	Mean
Sole maize	212.70	173.21	181.37	187.26	204.24	208.33	194.52
M: SB 1:1	193.66	161.01	166.61	169.98	185.27	181.85	176.40
M: SB 1:2	177.43	172.08	168.48	144.82	178.48	182.14	170.57
Mean	194.59	168.77	172.15	167.36	189.33	190.77	180.50

Table D. 15. Interaction between timing of weeding and intercropping for number of rows per ear

Treatment	Weed-free	No-weeding	Weeding-V4	Weeding-V8	Weeding-V4+V8	Weeding-V4+V8+V12	Mean
Sole maize	14.11	13.55	11.89	11.67	12.45	13.45	12.85
M: SB 1:1	13.55	12.34	12.11	11.78	11.33	13.00	12.35
M: SB 1:2	12.22	11.55	12.89	11.67	12.00	11.67	12.00
Mean	13.29	12.48	12.30	11.70	11.93	12.70	12.40

Table D. 16. Interaction between timing of weeding and intercropping for number of seeds per row

Treatment	Weed-free	No-weeding	Weeding-V4	Weeding-V8	Weeding-V4+V8	Weeding-V4+V8+V12	Mean
Sole maize	26.12	24.87	23.45	24.06	24.18	29.66	25.39
M: SB 1: 1	22.07	23.27	24.85	24.88	27.18	20.45	23.78
M: SB 1: 2	23.80	25.02	22.32	21.73	23.99	23.54	23.40
Mean	24.00	24.38	23.54	23.56	25.12	24.55	24.19

Table D. 17. Interaction between timing of weeding and intercropping for number of seeds per ear

Treatment	Weed-free	No-weeding	Weeding-V4	Weeding-V8	Weeding-V4+V8	Weeding-V4+V8+V12	Mean
Sole maize	323.85	295.00	295.67	314.11	317.11	331.11	312.81
M: SB 1: 1	286.44	269.00	284.22	275.11	278.11	270.44	277.22
M: SB 1: 2	299.56	255.56	271.33	251.78	278.33	274.78	271.89
Mean	303.28	273.19	283.74	280.33	291.19	292.11	287.31

Table D. 18. Interaction between timing of weeding and intercropping for 1000 seeds weight of maize

Treatment	Weed-free	No-weeding	Weeding-V4	Weeding-V8	Weeding-V4+V8	Weeding-V4+V8+V12	Mean
Sole maize	296.47	282.11	271.38	276.38	275.44	275.89	279.61
M: SB 1: 1	265.30	259.04	261.06	259.71	259.89	261.94	261.16
M: SB 1: 2	253.63	259.50	260.22	252.96	251.78	252.76	255.14
Mean	271.80	266.88	264.22	263.02	262.37	263.53	265.30

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Table D. 19. Interaction between timing of weeding and intercropping for harvest

Treatment	index						Mean
	Weed-free	No-weeding	Weeding-V4	Weeding-V8	Weeding-V4+V8	Weeding-V4+V8+V12	
Sole maize	0.481	0.405	0.400	0.428	0.428	0.442	0.431
M: SB 1: 1	0.428	0.384	0.370	0.397	0.418	0.389	0.398
M: SB 1: 2	0.400	0.390	0.389	0.378	0.395	0.399	0.392
Mean	0.436	0.393	0.387	0.401	0.414	0.410	0.407

Table D. 20. Interaction between timing of weeding and intercropping for maize yield

Treatment	index						Mean
	Weed-free	No-weeding	Weeding-V4	Weeding-V8	Weeding-V4+8	Weeding-V4+8+12	
Sole maize	5,186	3,985	4,258	4,347	4,441	4,979	4,533
M: SB 1: 1	4,341	3,566	3,937	4,017	4,270	3,803	3,989
M: SB 1: 2	4,224	3,945	4,033	3,367	3,866	3,842	3,879
Mean	4,584	3,832	4,076	3,910	4,192	4,208	4,134

Table D. 21. Interaction between timing of weeding and intercropping for soybean

Treatment	plant height						Mean
	Weed-free	No-weeding	Weeding-V4	Weeding-V8	Weeding-V4+V8	Weeding-V4+V8+V12	
Sole soybean	35.80	42.80	39.03	38.83	37.83	39.13	38.91
M: SB 1:1	39.57	52.43	54.50	45.80	45.00	44.17	46.91
M: SB 1:2	53.97	62.60	62.37	57.27	56.63	53.13	57.66
Mean	43.11	52.61	51.97	47.30	46.49	45.48	47.83

Table D. 22. Interaction between timing of weeding and intercropping for number of soybean branches

Treatment	Weed-free	No-weeding	Weeding-V4	Weeding-V8	Weeding-V4+V8	Weeding-V4+V8+V12	Mean
Sole soybean	3.22	2.11	3.89	4.00	4.33	4.22	3.63
M: SB 1: 1	2.78	2.11	1.67	3.33	2.89	2.78	2.59
M: SB 1: 2	2.22	1.44	2.11	1.22	1.44	1.22	1.61
Mean	2.74	1.89	2.56	2.85	2.89	2.74	2.61

Table D. 23. Interaction between timing of weeding and intercropping for leaf area index At R2 stage of soybean growth

Treatment	Weed-free	No-weeding	Weeding-V4	Weeding-V8	Weeding-V4+V8	Weeding-V4+V8+V12	Mean
Sole soybean	0.67	0.57	0.89	0.71	0.84	0.79	0.75
M: SB 1:1	0.34	0.40	0.26	0.32	0.34	0.33	0.33
M: SB 1: 2	0.54	0.51	0.76	0.67	0.80	0.75	0.67
Mean	0.52	0.49	0.64	0.57	0.66	0.62	0.58

Table D. 24. Interaction between timing of weeding and intercropping for leaf area index at R5 stage of soybean growth

Treatment	Weed-free	No-weeding	Weeding-V4	Weeding-V8	Weeding-V4+V8	Weeding-V4+V8+V12	Mean
Sole soybean	0.37	0.33	0.34	0.39	0.37	0.42	0.37
M: SB 1:1	0.16	0.16	0.16	0.18	0.15	0.17	0.16
M: SB 1: 2	0.34	0.26	0.21	0.35	0.27	0.39	0.30
Mean	0.29	0.25	0.24	0.31	0.26	0.33	0.28

Table D. 25. Interaction between timing of weeding and intercropping for light intensity at R2 stage of soybean growth

Treatment	Weed-free	No-weeding	Weeding-V4	Weeding-V8	Weeding-V4+V8	Weeding-V4+V8+V12	Mean
Sole soybean	180.83	240.53	308.86	234.29	264.34	244.87	245.62
M: SB 1:1	126.06	124.57	146.83	135.88	142.70	103.18	129.87
M: SB 1:2	110.42	104.05	139.63	117.31	137.90	125.30	122.44
Mean	139.10	156.38	198.44	162.49	181.65	157.78	165.98

Table D. 26. Interaction between timing of weeding and intercropping for light interception at R2 stage of soybean growth

Treatment	Weed-free	No-weeding	Weeding-V4	Weeding-V8	Weeding-V4+V8	Weeding-V4+V8+V12	Mean
Sole soybean	17.9	22.8	32.6	19.2	25.7	23.2	24
M: SB 1:1	13.5	13.5	16.2	16.7	17.5	12.6	15
M: SB 1:2	11.2	13.0	16.8	13.4	14.7	14.9	14
Mean	14.2	16.4	21.8	16.4	19.3	16.9	17.5

Table D. 27. Interaction between timing of weeding and intercropping for light intensity at R5 stage of soybean growth

Treatment	Weed-free	No-weeding	Weeding-V4	Weeding-V8	Weeding-V4+V8	Weeding-V4+V8+V12	Mean
Sole soybean	340.30	310.87	332.32	386.42	312.65	327.60	335.03
M: SB 1:1	190.19	216.85	242.98	304.38	165.16	166.22	214.30
M: SB 1:2	174.86	143.87	132.20	162.80	135.14	101.39	141.71
Mean	235.12	223.86	235.83	284.54	204.32	198.40	230.35

Table D. 28. Interaction between timing of weeding and intercropping for light interception at R5 stage of soybean growth

Treatment	Weed-free	No-weeding	Weeding-V4	Weeding-V8	Weeding-V4+V8	Weeding-V4+V8+V12	Mean
Sole soybean	27.5	25.2	26.9	31.3	25.3	26.5	27
M: SB 1:1	15.4	17.5	19.7	24.6	13.4	13.5	17
M: SB 1:2	14.2	11.6	10.7	13.2	11.0	8.2	11
Mean	19.0	18.1	19.1	23.0	16.5	16.1	19

Table D. 29. Interaction between timing of weeding and intercropping for total dry matter at R2 stage of soybean growth

Treatment	Weed-free	No-weeding	Weeding-V4	Weeding-V8	Weeding-V4+8	Weeding-V4+8+12	Mean
Sole soybean	12.32	11.65	17.60	13.79	16.55	16.98	14.82
M: SB 1:1	9.90	8.69	6.25	9.99	8.76	9.91	8.92
M: SB 1:2	8.16	6.62	7.82	8.41	9.56	12.04	8.77
Mean	10.13	8.99	10.56	10.73	11.62	12.98	10.83

Table D. 30. Interaction between timing of weeding and intercropping for total dry matter at R5 stage of soybean growth

Treatment	Weed-free	No-weeding	Weeding-V4	Weeding-V8	Weeding-V4+V8	Weeding-V4+V8+V12	Mean
Sole soybean	20.57	19.32	24.28	20.98	22.26	22.26	21.61
M: SB 1:1	12.24	11.50	14.49	14.37	15.38	14.31	13.72
M: SB 1:2	14.85	12.38	12.49	13.08	11.96	13.78	13.09
Mean	15.89	14.40	17.09	16.15	16.53	16.78	16.14

Table D. 31. Interaction between timing of weeding and intercropping for total dry matter of soybean at harvest

Treatment	Weed- free	No- weeding	Weeding- V4	Weeding- V8	Weeding- V4+V8	Weeding- V4+V8+V12	Mean
Sole soybean	12.02	11.36	15.70	14.82	16.98	17.79	14.78
M: SB 1:1	7.82	7.10	6.79	7.64	8.34	8.24	7.65
M: SB 1 :2	6.67	6.62	6.24	6.84	6.97	7.26	6.77
Mean	8.84	8.36	9.58	9.77	10.76	11.10	9.73

Table D. 32. Interaction between timing of weeding and intercropping for number of pods per plant

Treatment	Weed- free	No- weeding	Weeding- V4	Weeding- V8	Weeding- V4+8	Weeding- V4+8+12	Mean
Sole soybean	38.30	28.67	34.11	36.00	40.03	37.27	35.73
M: SB 1: 1	20.50	21.23	18.07	22.03	22.27	23.67	21.29
M: SB 1: 2	19.07	19.97	16.97	19.22	21.77	18.27	19.21
Mean	25.96	23.29	23.05	25.75	28.02	26.40	25.41

Table D. 33. Interaction between timing of weeding and intercropping for number of filled pods per plant

Treatment	Weed- free	No- weeding	Weeding- V4	Weeding- V8	Weeding- V4+8	Weeding- V4+V8+V12	Mean
Sole soybean	36.60	25.53	27.30	34.57	37.97	35.00	32.83
M: SB 1: 1	19.47	20.87	17.07	17.07	21.13	22.43	19.67
M: SB 1: 2	17.70	16.93	16.03	16.40	20.63	17.23	17.49
Mean	24.59	21.11	20.13	22.68	26.58	24.89	23.33

Table D. 34. Interaction between timing of weeding and intercropping for percent of unfilled pods per plant

Treatment	Weed- free	No- weeding	Weeding- V4	Weeding- V8	Weeding- V4+V8	Weeding- V4+V8+V12	Mean
Sole soybean	5.9	6.0	4.9	4.8	5.4	5.9	5.5
M: SB 1: 1	8.3	5.2	7.5	6.8	6.9	6.7	6.9
M: SB 1: 2	8.4	6.3	7.3	7.0	6.8	9.4	7.5
Mean	7.5	5.8	6.6	6.2	6.4	7.3	6.6

Table D. 35. Interaction between timing of weeding and intercropping for 100 seeds weight

Treatment	Weed- free	No- weeding	Weeding- V4	Weeding- V8	Weeding- V4+V8	Weeding- V4+V8+V12	Mean
Sole soybean	13.41	12.82	13.33	13.49	13.46	13.88	13.40
M: SB 1: 1	12.86	12.58	12.42	12.75	12.50	12.85	12.66
M: SB 1: 2	12.83	13.15	12.65	13.74	13.40	13.84	13.27
Mean	13.03	12.85	12.80	13.33	13.12	13.52	13.11

Table D. 36. Interaction between timing of weeding and intercropping for harvest index

Treatment	Weed- free	No- weeding	Weeding- V4	Weeding- V8	Weeding- V4+V8	Weeding- V4+V8+V12	Mean
Sole soybean	0.570	0.510	0.517	0.493	0.497	0.497	0.514
M: SB 1: 1	0.550	0.550	0.533	0.513	0.513	0.513	0.529
M: SB 1: 2	0.510	0.503	0.477	0.457	0.517	0.470	0.489
Mean	0.543	0.521	0.509	0.488	0.509	0.493	0.511

Table D. 37. Interaction between timing of weeding and intercropping for soybean yield

Treatment	Weed-free	No-weeding	Weeding-V4	Weeding-V8	Weeding-V4+V8	Weeding-V4+V8+V12	Mean
Sole soybean	1967.6	1660.8	1946.9	1938.3	2144.0	2181.8	1973.2
M: SB 1: 1	724.0	633.0	587.9	739.7	600.7	785.1	678.4
M: SB 1: 2	1277.6	1238.5	1076.3	1233.6	1210.7	1264.8	1216.9
Mean	1323.1	1177.4	1203.7	1303.9	1318.5	1410.6	1289.5

Table D. 38. Interaction between timing of weeding and intercropping for land equivalent ratio of maize and soybean intercropping

Treatment	Weed-free	No-weeding	Weeding-V4	Weeding-V8	Weeding-V4+V8	Weeding-V4+V8+V12	Mean
Maize: Soybean 1: 1	1.38	1.26	1.23	1.18	1.23	1.24	1.25
Maize: Soybean 1: 2	1.57	1.26	1.36	1.32	1.69	1.68	1.48
Mean	1.47	1.26	1.29	1.25	1.46	1.46	1.37

Table D. 39. Interaction between timing of weeding and intercropping for total revenue for maize and soybean intercropping

Treatment	Weed-free	No-weeding	Weeding-V4	Weeding-V8	Weeding-V4+V8	Weeding-V4+V8+V12	Mean
Sole maize	603.01	495.16	463.35	505.48	516.40	579.00	527.07
Sole soybean	503.34	424.85	498.03	495.83	548.48	558.13	504.78
M: SB 1:1	689.97	576.58	608.13	656.33	650.23	643.05	637.38
M: SB 1:2	817.98	775.50	744.32	707.05	759.21	770.27	762.39
Mean	653.58	568.02	578.46	591.17	618.58	637.61	607.90

Table D. 40. Interaction between timing of weeding and intercropping for total variable costs for maize and soybean intercropping

Treatment	Weed-free	No-weeding	Weeding-V4	Weeding-V8	Weeding-V4+V8	Weeding-V4+V8+V12	Mean
Sole maize	686.00	201.49	290.31	263.41	357.61	424.90	370.62
Sole soybean	718.39	204.28	287.73	287.72	330.80	419.62	374.76
M: SB 1:1	637.28	206.61	314.28	322.35	397.72	467.70	390.99
M: SB 1:2	569.71	211.73	322.08	335.55	394.75	459.36	382.20
Mean	652.84	206.03	303.60	302.25	370.22	442.90	379.64

Table D. 41. Interaction between timing of weeding and intercropping for gross margin per unit area for maize and soybean intercropping

Treatment	Weed-free	No-weeding	Weeding-V4	Weeding-V8	Weeding-V4+V8	Weeding-V4+V8+V12	Mean
Sole maize	(-82.98)	293.67	173.03	242.07	158.80	154.10	156.45
Sole soybean	(-215.05)	220.57	210.31	208.12	217.68	138.51	130.02
M: SB 1:1	52.70	369.97	293.86	333.99	252.51	175.35	246.40
M: SB 1:2	248.27	563.77	422.24	371.50	364.46	310.91	380.19
Mean	0.73	361.99	274.86	288.92	248.36	194.72	228.26

Table D. 42. Interaction between timing of weeding and intercropping for costs for gross margin per labor-day use for weeding in maize and soybean intercropping

Treatment	Weed-free	No-weeding	Weeding-V4	Weeding-V8	Weeding-V4+V8	Weeding-V4+V8+V12	Mean
Sole maize	(-0.38)	0	4.68	9.16	2.38	1.62	2.91
Sole soybean	(-0.96)	0	5.90	5.78	4.32	1.51	2.76
M: SB 1:1	0.29	0	6.34	6.68	3.08	1.56	2.99
M: SB 1:2	1.62	0	8.83	7.16	4.73	2.94	4.21
Mean	0.14	0	6.44	7.20	3.63	1.91	3.22

Appendix E. Household survey questionnaire

Lao PDR.

Province:.....

District:.....

Village:.....

No of Household:.....

Name of interviewers:; **Date:**...../...../ **2002.**

Name of Householder/Head family:.....

I. General information

- How long have your family been in this village?.....Year. From.....To.....
- Where did your family before come in this village?.....
- When did you move came here?.....
- Why did you come here?.....

1. How many persons are there in your family?.....people;

How many children have been born?.....and how many of them alive?

Name	Sex	Age	Role in the family	Cultural	Works
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					

2. How many labors are there in you family..... How many male:...and female:.....

3. Do you family have land? Yes / No why?.....

4. How many hectares do your family have? Total area:ha.

5. Which crops/plants do you family have?

- 1).....ha,
- 2).....ha
- 3).....ha,
- 4).....ha
- 5).....ha,

II. Agriculture production systems.

2.1 Upland rice

6. Did you family cultivate upland rice? Yes / No. Why?.....

7. How many hectares of upland rice do you family have?ha.

- How many seeds are needed in it?..... Kg;

- Where is it came from?.....

- How many years of forests fallowed before you plant upland rice? ... Years.

- What kind of forest?.....

- How about the soil fertility status? Very good /good / middle / bad

- What is the soil color?

8. What are the varieties of upland rice planted?

1).....; Early Var.....days; Medium Va.....days; Late Var.....days.

2)..... ; Early Var.....days; Medium Var.....days; Late Var.....days.

3)..... ; Early Var.....days; Medium Var.....days; Late Var.....days.

4)..... ; Early Var.....days; Medium Var.....days; Late Var.....days.

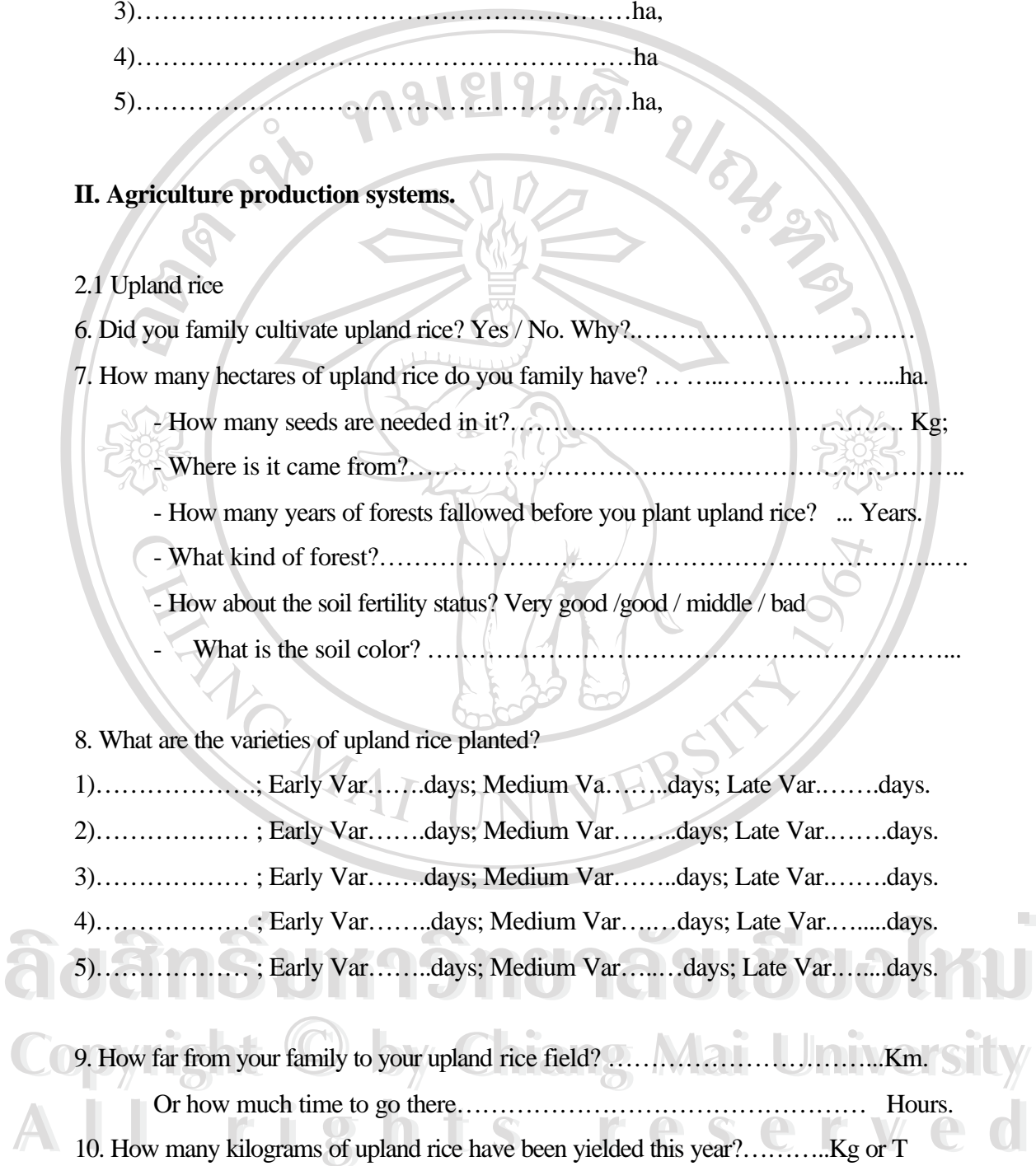
5)..... ; Early Var.....days; Medium Var.....days; Late Var.....days.

9. How far from your family to your upland rice field?Km.

Or how much time to go there..... Hours.

10. How many kilograms of upland rice have been yielded this year?.....Kg or T

11. How many processes are needed in upland rice cultivation and how many labor days are needed in each process?



No.	Activities/Processes	How many days?/each days how many labors	How many labor days?
1.	Cutting		
2.	Burning		
3.	Clearing		
4.	Fencing		
5.	Planting		
6.	Weeding first time		
7.	Weeding-2 times		
8.	Harvesting		
9.	Post harvesting		
10.	Other activities		

12. What is the usage of upland rice?

- How many kilograms of rice for consumption in your family ?.....Kg.
- If sale, howKg.
- Where?.....
- And what is the price?.....Kip.

13. When the upland rice sowed? Date.....; and when harvested? Date.....

14. What are the limiting factors prevent planting upland rice?

- 1).....2).....
- 3).....4).....
- 5).....6).....
- 7).....8).....
- 9).....10).....

15. How do you think about the limiting factors prevent planting upland rice? And rank of the constraints above.....

16. Did your family use fertilizer? Yes / No. Why?.....

- What kind of fertilizer do you family applied?

- 1).....2).....3).....

- How many kilograms per hectares?.....Kg/ha.

- What is the price?..... Kip

- How many times per a season.....Times.

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17. Did your family use insecticides? Yes / No. Why?.....
- What kind of insecticides do you family applied?
 - 1).....2).....3).....
 - How many kilograms of insecticides do you used per hectares?.....Kg/ha.
 - How many liters of insecticides do you used per hectares?Liter/ha.
 - What is the price?..... Kip.
18. Did your family use herbicides? Yes / No. Why?.....
- What kind of herbicides do you family applied?
 - 1.....2.....3.....
 - How many kilograms/liter of herbicides do you used per hectares?.....Kg/ha.
 - How many liter of herbicides do you used per hectares?.....Liter/ha.
 - What is the price?..... Kip.
19. How many weed species in you upland rice?
- 1).....2).....
 - 3).....4).....
 - 5).....6).....
 - 7).....8).....
 - 9).....10).....
- And which specific is big problem? 1; 2; 3; 4; 5; 6; 7; 8; 9 and 10.
20. How about the insect pests in your upland rice?.....
21. How about the diseases in your upland rice?.....

2.2 Paddy field/rainfed lowland rice

22. Did you family cultivated paddy field? Yes / No. Why?.....
23. How many hectares of paddy field do you family have?ha.
- How many seeds are needed in it?.....Kg.
 - Where is it came from?.....
 - How about the soil fertility status? Excellent / Good/ Middle / Bad
 - What is the soil color?
24. What are the varieties of paddy field planted?

- 1)..... ; Early Var.....days; Medium Var.....days; Late Var.....days.
- 2)..... ; Early Var.....days; Medium Var.....days; Late Var.....days.
- 3)..... ; Early Var.....days; Medium Var.....days; Late Var.....days.
- 4)..... ; Early Var.....days; Medium Var.....days; Late Var.....days.
- 5)..... ; Early Var.....days; Medium Var.....days; Late Var.....days.
25. How far from your family to your paddy field?Km.

Or how much time to go there.....Hours.

26. How many kilograms of paddy field have been yielded this year?.....Kg or T.
27. How many processes are needed in paddy field cultivation and how many labor days are needed in each process?

No.	Activities/Processes	How many days?/each days how many labors	How many labor days?
1.	Clearing-burning		
2.	Land preparation (plowing)		
3.	Harrowing		
4.	Seedling		
5.	Planting		
6.	Weeding first time		
7.	Weeding-2 times		
8.	Harvesting		
9.	Post harvesting		
10.	Other activities		

28. What is the usage of paddy rice?

- How many kilograms of paddy rice for consumption in your family?.....Kg.
- If, sale, how much?.....Kg.
- Where?.....
- And what is the price?.....Kip.

29. When the paddy field sowed? Date. and when harvested? Date.....

30. What are the limiting factors prevent planting paddy field?

- 1).....2).....
- 3).....4).....

- 5)..... 6).....
- 7)..... 8).....
- 9)..... 10).....

31. How do you think about the limiting factors prevent planting paddy field? And rank of the constraints above.

32. Did your family use fertilizer? Yes / No. Why?.....

- What kind of fertilizer do you family applied?

- 1)..... 2)..... 3).....

- How many kilograms per hectares?.....Kg/ha.

- What is the price?.....Kip.

- How many times per a season.....Times.

33. Did your family use insecticides? Yes / No. Why?.....

- What kind of insecticides do you family applied?

- 1)..... 2)..... 3).....

- How many kilograms of insecticides do you used per hectares?.....Kg/ha.

- How many liters of insecticides do you used per hectares?.....Liters/ha.

- What is the price?..... Kip.

34. Did your family use herbicides? Yes / No. Why?.....

- What kind of herbicides do you family applied?

- 1)..... 2)..... 3).....

- How many kilograms of herbicides do you used per hectares?.....Kg/ha.

- How many liter of herbicides do you used per hectares?.....Liter/ha.

- What is the price?..... Kip.

35. How many weed species in you paddy field?

- 1)..... 2).....

- 3)..... 4).....

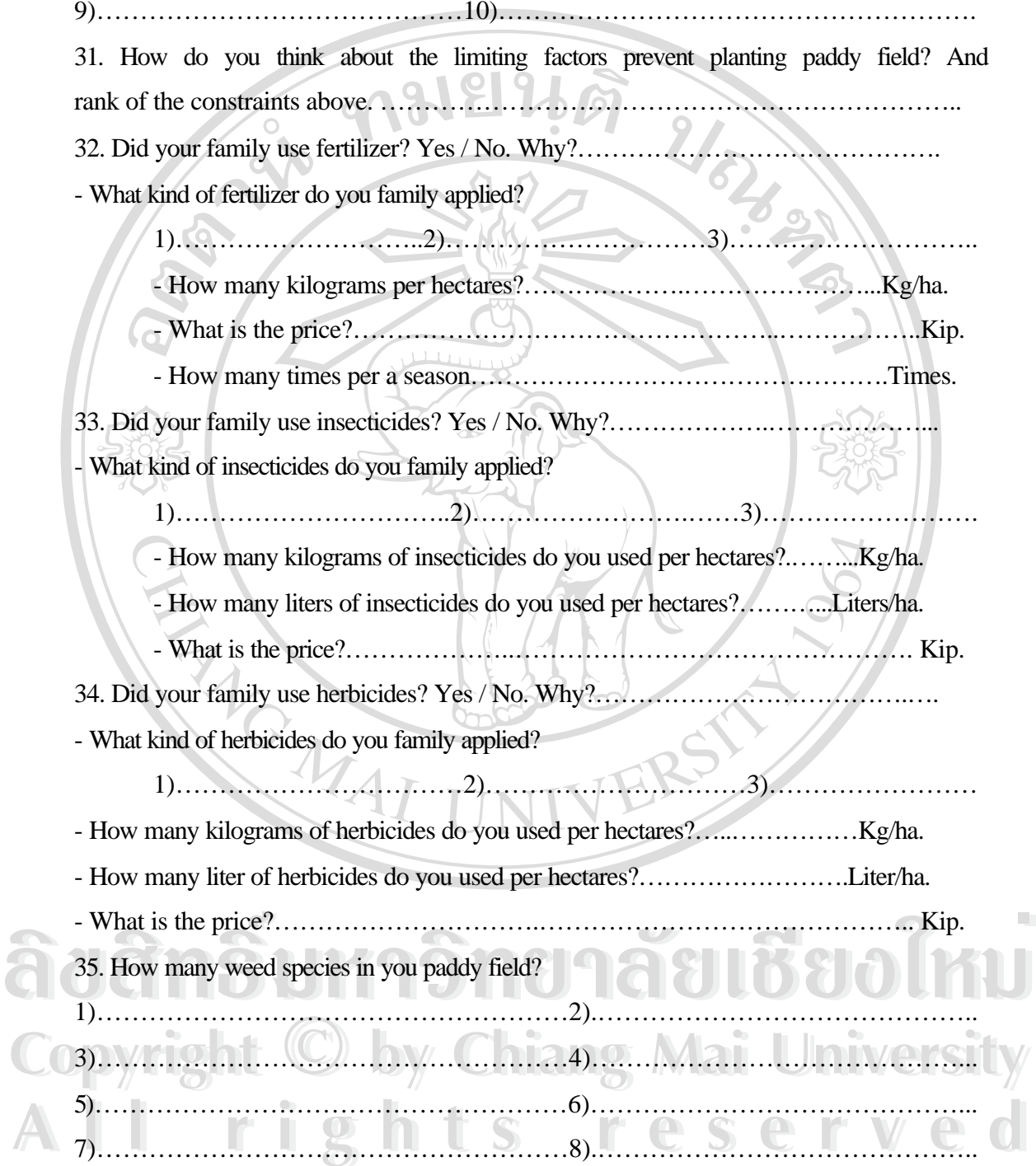
- 5)..... 6).....

- 7)..... 8).....

- 9)..... 10).....

And which specific is big problem? 1 ; 2 ; 3; 4; 5; 6; 7; 8; 9 and 10

36. How about the insect pests in your paddy field?.....



37. How about the diseases in your paddy field?.....

2.3 Maize/Corn

38. Do your family plant maize? Yes/ No. Why?.....

39. What is the size of maize field?

- How many hectares of maize field do you family have?ha.

- How many seeds are needed in it?.....Kg.

- Where is it came from?.....

40. How many processes are needed in maize cultivation and how many labor days are needed in each process?

No.	Activities/Processes	How many days?/each days how many labors	How many labor days?
1.	Cutting		
2.	Burning		
3.	Clearing		
4.	Fencing		
5.	Planting		
6.	Weeding first time		
7.	Weeding-2 times		
8.	Harvesting		
9.	Post harvesting		
10.	Other activities		

41. What are the varieties of maize planted?

1).....; Early Var.....days; Middle Var.....days; Late Var.....days.

2).....; Early Var.....days; Middle Var.....days; Late Var.....days.

3).....; Early Var.....days; Middle Var.....days; Late Var.....days.

4).....; Early Var.....days; Middle Var.....days; Late Var.....days.

5).....; Early Var.....days; Middle Var.....days; Late Var.....days.

42. How far from your family to your maize field?Km.

- Or how much time to go there.....Hours.

43. How many kilograms of maize have been yielded this year?.....Kg or T.
44. How many processes are needed in maize cultivation and how many labor days are needed in each process?
45. What is the usage of maize?
- How many kilogram of maize for consumption?.....
 - If sale, how much?.....
 - Where?.....
 - And what is the price?.....Kip.
 - How many kilograms of maize usage for feed animals?.....
46. When the maize sowed? Date.; and when harvested? Date.....
47. What are the limiting factors preventing planting maize?
- 1.....2.....
 - 3.....4.....
 - 5.....6.....
 - 7.....8.....
 - 9.....10.....
48. Did your family use fertilizer? Yes/ No. Why?.....
- What kind of fertilizer did you apply?
 - 1.....2.....3..... - How many kilograms per hectares?.....Kg/ha.
 - What is the price?.....Kip.
49. Did your family use insecticides? Yes/ No Why?.....
- What kind of insecticides do you family applied?
 - 1.....2.....3..... - How many kilograms per hectares?.....Kg; /ha.
 - How many liter per hectare?.....Kg; Liter/ha.
 - What is the price?.....Kip.
50. Did your family use herbicides? Yes...../ No..... Why?.....
- What kind of herbicides do you family used?
 - 1).....2).....3)..... - How many kilograms per hectare?.....Kg; /ha.
 - How many liter per hectare?.....Liter/ha.

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- What is the price?..... Kip
- How many times per a season?.....Times.

2.4 Soybean

51. Do your family plant soybean? . Yes.....; No.....; Why?.....
52. What is the size of soybean field?
- How many hectares of soybean field do you family have?ha.
 - How many seeds are needed in it?.....Kg/ha.
 - Where is it came from?.....
53. What are the varieties of soybean planted?
- 1).....;Early Var..... days; Moderate; Var.....days; Late Var.....days.
 - 2).....;Early Var.....days; Moderate; Var.....days; Late Var.....days.
 - 3).....;Early Var.....days; Moderate; Var.....days; Late Var.....days.
 - 4).....;Early Var.....days; Moderate; Var.....days; Late Var.....days.
 - 5).....;Early Var..... days; Moderate Var.....days; Late Var.....days.
54. How far from your family to your soybean field?Km.
- Or how much time to go there?.....Hours.
55. How many kilograms of soybean have been yielded this year?.....Kg or T.
56. How many processes are needed in soybean cultivation and how many labor days are needed in each process?

No.	Activities/Processes	How many days?/each days how many labors	How many labor days?
1.	Cutting		
2.	Burning		
3.	Clearing		
4.	Fencing		
5.	Planting		
6.	Weeding first time		
7.	Weeding-2 times		

8.	Harvesting		
9.	Post harvesting		
10.	Other activities		

57. What is the usage of soybean?

- How many kilogram of soybean for consumption in your family ?.....Kg.
- If sale, how much?.....Kg.
- where?.....
- And what is the price?.....Kip.
- How many kilograms of soybean usage for animals?.....Kg.

58. When the soybean sowed? Date.; and when harvested? Date.....

59. Do you grow soybean in the upland rice area? Yes/No Why.....

- Or other area site?.....

60. What are the limiting factors prevent planting soybean?

- 1.....2.....
- 3.....4.....
- 5.....6.....
- 7.....8.....
- 9.....10.....

61. Did your family use fertilizer? Yes/ No Why?.....

-What kind of fertilizer did you apply? 1.....2.....3.....

- How many kilograms per hectares?.....Kg/ha.

- What is the price?.....Kip.

62. Did your family use insecticides? Yes/ No..... Why?.....

- What kind of insecticides do you family applied?

- 1).....2).....3).....

- How many kilograms of insecticides do you used per hectares?.....Kg/ha.

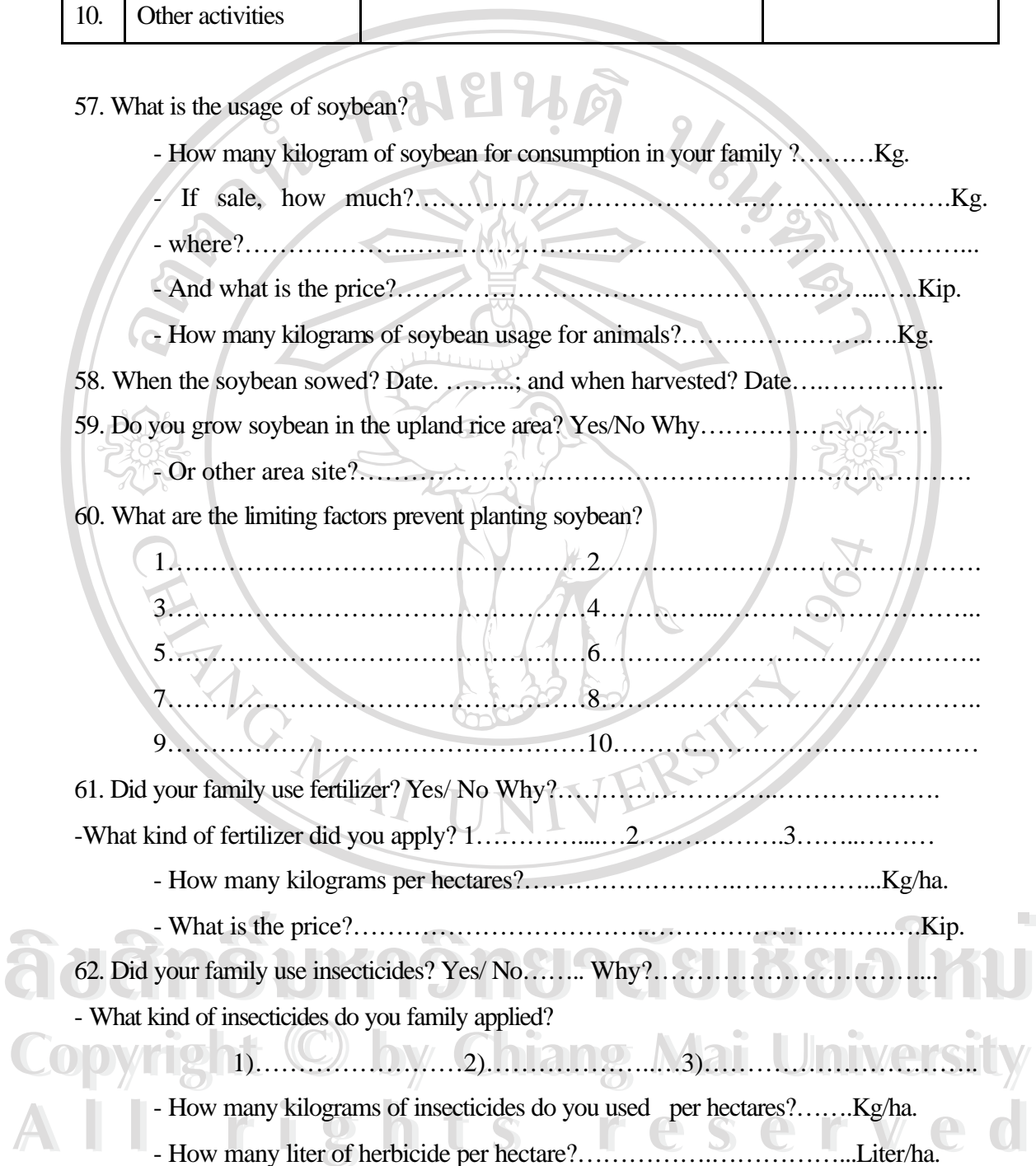
- How many liter of herbicide per hectare?.....Liter/ha.

- What is the price?.....Kip.

63. Did your family use herbicide? Yes/. No. Why?.....

- What kind of herbicide did you apply?

- 1.....2.....3.....



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- How many kilograms of herbicide per hectare?.....Kg/ha.
 - How many liter of herbicide per hectare?.....Liter/ha.
 - What is the price?.....Kip.
64. Do your family plant another crops in the upland rice area? Yes/ No. Why?.....
-

65. What are there crops?

No	Type of crop varieties	Seeds (Kg)	Date of growing	Date of harvesting	Productivity
1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

65.What are the major problems with crop and which prevent growing of crops?.....

.....

66. Beside the crops that have been mentioned above, do your family plant others?

Yes/No.....

67. Which kind of crops?.....

68. Where are they planted?.....

69. What are they yields of these crops?.....

70. What are the useful of these crops?.....

- For consumption in your family?
- If sale, how much?.....
- Which are these crops?.....
- What is the price?.....kip.

III. Other information about Socio-Economic and Environments

80. Do you family have other economic revenue this year? Yes / No. Why?.....
81. What is it?.....
 - How much?.....
82. Does your family have enough food supply in this year? Yes / No.....
83. How long is your family with food surplus in each year?.....
84. How long is your family with food deficit in each year?.....
85. How do your family overcome the food shortage problem.....
86. What do you think about the food deficit?.....
87. How many kind of farming tools your family, have bought this year?.....
 - How much you paid for these?.....
88. How much you family have spent in your daily life?.....
89. What kinds of wild vegetables that your family usually obtained?.....
 - From where?.....
100. What kind of food crop do you prefer?
 - Upland rice, paddy rice corn, soybean or other cash crops ?.....
 - Why?.....
101. What kind of cash crops do you prefer?.....
 - Why?.....
102. The labor distribution?.....
103. Do you family member usually go hunting? Yes / No. Why.....
104. What kind of wild animals always your family member or other village had shot?.....

 - How many time per year?.....
105. How much firewood do you family consume per year or per day in average?.....
106. Where these fire wood come from?.....
 - How far is there?.....
 - Usually, who is collecting it?.....
107. Which kinds of disease your family member always catches?.....

108. When you're family member catch disease, were the herbal medicines used?.....

- If no, what kind of herb, with which part, and how to use it?.....

109. The ownership of the durable goods in this family?.....

110. Which family in your village has the best living condition you think?.....

Why?.....

111. Which family in your village has the worse living condition you think?.....

Why?.....

112. How do you think about agriculture and forestry in the 5; 10; 15; 20; 25 and 50 years ago and present?

113. How about land use planning?.....

114. How about forestation?.....

115. How do you think about social-economic in this community?.....

116. How do you think about socio-economic development in this community?.....

Appendix F. Parameters determination

1. Plant height

Plant height was measured from ground to the base of tassel for maize and from ground to the tip of the longest or highest stem for soybean by centimeter (cm).

2. Leaf Area (LA) and Leaf Area Index (LAI)

$$LA / plant = \frac{aW}{w}$$

Where: a = total leaf area of sample plant

w = dry weight of leaves from sample

W = dry weight of all leaves for the plant

$$LAI = \frac{\sum LA (cm^2)}{GA (cm^2)}$$

Where: S LA = Sum of Leaf Area /plant of No. Sample plants (cm²)

GA = Ground Area

3. Grain yield (kg/ha)

$$Yield(kg / ha) = \frac{(100 - M_1)}{(100 - M_2)} \times \frac{W}{1000} \times \frac{10,000}{A}$$

Where: M₁ = Moisture content of crop (tested) (%); M₂ = Standard of moisture content (%); W = Weight of grain from harvest (g); 1 kg = 1000 g

A = Area of harvest (m²); 1 ha = 10,000 m².

4. % of un-filled-pods per plant

Number of un-filled-pods per plant x 100

% of un-filled-pods per plant = $\frac{\text{Number of un-filled-pods per plant} \times 100}{\text{Total number of pods per plant}}$

5. Harvest Index

$$HI = \frac{TGY}{TDM}$$

Where: HI = Harvest Index

TGY = Total Grain Yield

TDM = Total Dry Matter

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