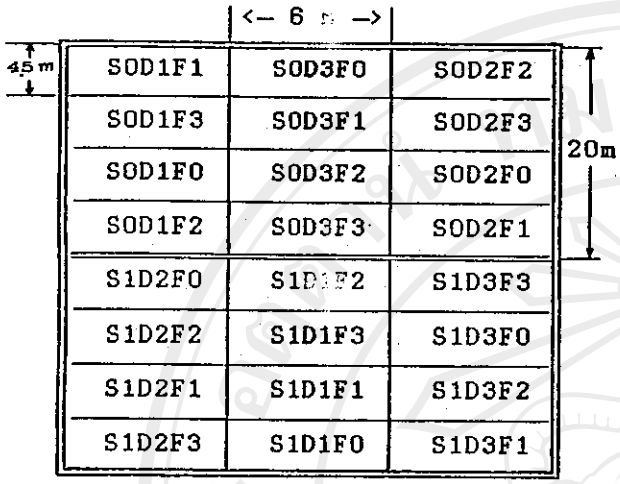
APPENDIX

Appendix A. Layout of experimental field



S0D1F1	S0D3F0	S0D2F2
S0D1F3	S0D3F1	S0D2F3
S0D1F0	S0D3F2	S0D2F0
S0D1F2	S0D3F3	S0D2F1
S1D2F0	S1D3F2	S1D3F3
S1D2F2	S1D1F3	S1D3F0
S1D2F1	S1D1F1	S1D3F2
S1D2F3	S1D1F0	S1D3F1

Replication I

S1D2F0	S1D1F3	S1D3F2
S1D2F1	S1D1F0	S1D3F1
S1D2F3	S1D1F2	S1D3F0
S1D2F2	S1D1F1	S1D3F3
S0D1F1	S0D3F1	S0D2F2
S0D1F0	S0D3F3	S0D2F0
S0D1F3	S0D3F2	S0D2F1
S0D1F2	S0D3F0	S0D2F3

Replication II

Note:

1. S_0 = nonstaking
2. S_1 = staking
3. D_1 = 75 x 15 cm
4. D_2 = 75 x 30 cm
5. D_3 = 75 x 45 cm
6. F_0 = 0 kg/ha of K_2O
7. F_1 = 100 kg/ha of K_2O
8. F_2 = 200 kg/ha of K_2O
9. F_3 = 300 kg/ha of K_2O

S1D3F2	S1D1F0	S1D2F0
S1D3F3	S1D1F3	S1D2F2
S1D3F1	S1D1F1	S1D2F3
S1D3F0	S1D1F2	S1D2F1
S0D1F1	S0D2F3	S0D3F2
S0D1F0	S0D2F1	S0D3F0
S0D1F2	S0D2F0	S0D3F3
S0D1F3	S0D2F2	S0D3F1

Replication III

Appendix B. Analysisof Variance Tables

Table B-1. Analysis of variance table for marketable yield

Source	DF	SS	MS	F	P
Replication (A)	2	222.10	111.05	0.38	0.7246
Staking (B)	1	581.67	581.67	1.99	0.2937
A x B	2	584.34	292.17		
Spacing (C)	2	1735.3	867.64	17.43	0.0012**
B x C	2	454.95	227.47	4.57	0.0475*
A x B x C	8	398.22	497.78		
Fertilizer (D)	3	37.912	12.637	0.22	0.8802
B x D	3	271.43	90.476	1.59	0.2087
C x D	6	336.59	56.098	0.99	0.4488
B x C x D	6	29.832	49.720	0.88	0.5231
A x B x C x D	35	1988.7	56.820		
Total	70	6909.5			
Grand average	1	2.4635E+05			

Table B-2. Analysis of variance table for unmarketable yield

Source	DF	SS	MS	F	P
Replication (A)	2	181.62	90.810	23.72	0.0405*
Staking (B)	1	111.79	111.79	29.20	0.0326*
A x B	2	7.6565	3.8283		
Spacing (C)	2	96.817	48.409	3.03	0.1047
B x C	2	52.505	26.252	1.64	0.2523
A x B x C	8	127.75	15.969		
Fertilizer (D)	3	2.0566	6.8553E-01	0.21	0.8875
B x D	3	1.0809	3.6032E-01	0.11	0.9529
C x D	6	16.306	2.7177	0.84	0.5476
B x C x D	6	18.765	3.1276	0.97	0.4618
A x B x C x D	35	113.23	3.2350		
Total	70	729.57			
Grand average	1	3866.4			

Table B-3. Analysis of variance table for number of fruits per plant

Source	DF	SS	MS	F	P
Replication (A)	2	148.58	74.288	2.42	0.2928
Staking (B)	1	11.987	11.987	0.39	0.5962
A x B	2	61.516	30.758		
Spacing (C)	2	1.1720E+04	5859.8	62.98	0.0000**
B x C	2	115.54	57.772	0.62	0.5615
A x B x C	8	744.39	93.049		
Fertilizer (D)	3	93.736	31.245	1.70	0.1840
B x D	3	32.361	10.787	0.59	0.6267
C x D	6	277.31	46.219	2.52	0.0391*
B x C x D	6	233.32	38.887	2.12	0.0755
A x B x C x D	35	641.63	18.332		
Total	70	1.4080E+04			
Grand average	1	6.5768E+04			

Table B-4. Analysis of variance table for average fruit weight

Source	DF	SS	MS	F	P
Replication (A)	2	388.44	194.22	3.62	0.2166
Staking (B)	1	228.12	228.12	4.25	0.1754
A x B	2	107.39	53.693		
Spacing (C)	2	737.56	368.78	5.33	0.0338*
B x C	2	22.589	11.294	0.16	0.8522
A x B x C	8	553.71	69.214		
Fertilizer (D)	3	12.868	4.2893	0.23	0.8777
B x D	3	34.662	11.554	0.61	0.6137
C x D	6	29.670	4.9450	0.26	0.9516
B x C x D	6	112.40	18.734	0.99	0.4485
A x B x C x D	36	683.27	18.980		
Total	71	2910.7			
Grand average	1	2.2256E+05			

Table B-5. Analysis of variance table for yield per plant

Source	DF	SS	MS	F	P
Replication (A)	2	4.8083E-03	2.4042E-03	0.03	0.9669
Staking (B)	1	2.1356E-02	2.1356E-02	0.30	0.6365
A x B	2	1.4029E-01	7.0143E-02		
Spacing (C)	2	24.643	12.321	428.31	0.0000**
B x C	2	1.1219E-01	5.6903E-02	1.95	0.2043
A x B x C	8	2.3014E-01	2.8767E-02		
Fertilizer (D)	3	8.9344E-02	2.9781E-02	0.70	0.5560
B x D	3	3.8811E-02	1.2937E-02	0.31	0.8210
C x D	6	3.6908E-01	6.1513E-02	1.45	0.1128
B x C x D	6	2.3358E-01	3.8930E-02	0.92	0.4920
A x B x C x D	36	1.5232	4.2312E-02		
Total	71	27.406			
Grand average	1	120.44			

Table B-6. Analysis of variance table for total acidity

Source	DF	SS	MS	F	P
Replication (A)	2	2.3761E-02	1.1881E-02	2.45	0.2899
Staking (B)	1	2.3347E-05	2.3347E-05	0.00	0.9510
A x B	2	9.7028E-03	4.8514E-03		
Spacing (C)	2	8.3028E-05	4.1514E-05	0.03	0.9718
B x C	2	2.0780E-03	1.0390E-03	0.72	0.5169
A x B x C	8	1.1585E-02	1.4481E-03		
Fertilizer (D)	3	1.5161E-02	5.0536E-03	4.14	0.0128*
B x D	3	2.3758E-03	7.9194E-04	0.65	0.5892
C x D	6	3.6790E-03	6.1316E-04	0.50	0.8027
B x C x D	6	6.0960E-03	1.0160E-03	0.83	0.5534
A x B x C x D	36	4.3981E-02	1.2217E-03		
Total	71	1.1853E-01			
Grand average	1	14.211			

Table B-7. Analysis of variance table for total solids

Source	DF	SS	MS	F	P
Replication (A)	2	6.7717	3.3859	2.29	0.3036
Staking (B)	1	3.3894E-01	3.3894E-01	0.23	0.6791
A x B	2	2.9527	1.4764		
Spacing (C)	2	5.7274E-01	2.8637E-01	0.88	0.4523
B x C	2	7.7884E-01	3.8942E-01	1.19	0.3519
A x B x C	8	2.6103	3.2629E-01		
Fertilizer (D)	3	2.1992E-01	7.3307E-02	0.63	0.5999
B x D	3	1.1480	3.8265E-01	3.29	0.0314*
C x D	6	6.0971E-01	1.0162E-01	0.87	0.5231
B x C x D	6	3.1263	5.2104E-01	4.48	0.0017**
A x B x C x D	36	4.1831	1.1620E-01		
Total	71	23.321			
Grand average	1	1853.6			

Table B-8. Analysis of variance table for soluble solids

Source	DF	SS	MS	F	P
Replication (A)	2	4.4119	2.2060	3.92	0.2032
Staking (B)	1	1.3889E-04	1.3889E-04	0.00	0.9889
A x B	2	1.1253	5.6264E-01		
Spacing (C)	2	8.1111E-02	4.0556E-02	0.19	0.8315
B x C	2	5.7778E-02	2.8889E-02	0.13	0.8761
A x B x C	8	1.7178	2.1472E-01		
Fertilizer (D)	3	4.5375E-01	1.5125E-01	1.47	0.2398
B x D	3	0.9549	3.1829E-01	3.09	0.0393*
C x D	6	8.2667E-01	1.3778E-01	1.34	0.2667
B x C x D	6	1.5256	2.5426E-01	2.47	0.0422*
A x B x C x D	36	3.7117	1.0310E-01		
Total	71	14.867			
Grand average	1	1960.4			

Table B-9. Analysis of variance table for pH values

Source	DF	SS	MS	F	P
Replication (A)	2	1.7786E-02	8.8931E-03	0.27	0.7904
Staking (B)	1	2.7083E-35	2.7083E-35	8.08E-34	1.000
A x B	2	6.7075E-02	3.3537E-02		
Spacing (C)	2	4.3528E-03	2.1764E-03	0.95	0.4251
B x C	2	2.0853E-03	1.0292E-03	0.45	0.6522
A x B x C	8	1.8256E-02	2.2819E-03		
Fertilizer (D)	3	5.2000E-03	1.7333E-03	1.05	0.3832
B x D	3	6.6889E-03	2.2296E-03	1.35	0.2742
C x D	6	1.2092E-02	2.0153E-03	1.22	0.3197
B x C x D	6	1.5519E-02	2.5866E-03	1.56	0.1861
A x B x C x D	36	5.9550E-02	1.6542E-03		
Total	71	2.0858E-01			
Grand average	1	1330.9			

Table B-10. Analysis of variance table for K in the 1st leaf sampling

Source	DF	SS	MS	F	P
Replication (A)	2	2.9068E-01	1.4534E-01	1.67	0.3742
Staking (B)	1	2.3347E-01	2.3347E-01	2.68	0.2430
A x B	2	1.7391E-01	8.6956E-02		
Spacing (C)	2	5.8817E-01	2.9088E-01	2.16	0.1776
B x C	2	5.9270E-01	2.9635E-01	2.20	0.1730
A x B x C	8	1.0764	1.3455E-01		
Fertilizer (D)	3	1.4701	4.9005E-01	4.05	0.0140*
B x D	3	2.4918E-01	8.3061E-02	0.69	0.5663
C x D	6	6.6353E-01	1.1059E-01	0.91	0.4963
B x C x D	6	4.9337E-01	8.2296E-02	0.68	0.6667
A x B x C x D	36	4.3567	1.2102E-01		
Total	71	10.182			
Grand average	1	1014.0			

Table B-11. Analysis of variance table for K in the 2nd leaf sampling

Source	DF	SS	MS	F	P
Replication (A)	2	1.4723	7.3614E-01	0.88	0.5305
Staking (B)	1	2.0000E-02	2.0000E-02	0.02	0.8910
A x B	2	1.6638	8.3191E-01		
Spacing (C)	2	4.7345E-01	2.3673E-01	2.64	0.1315
B x C	2	2.3741E-01	1.1870E-01	1.33	0.3183
A x B x C	8	7.1657E-01	8.9572E-02		
Fertilizer (D)	3	5.3797	1.7932	13.96	1.0000**
B x D	3	2.9934E-01	9.9781E-02	0.78	0.5147
C x D	6	3.2635E-01	5.4391E-02	0.42	0.8585
B x C x D	6	8.6788E-01	1.4465E-01	1.13	0.3671
A x B x C x D	36	4.6252	1.2848E-01		
Total	71	16.082			
Grand average	1	1061.5			

Table B-12. Analysis of variance table for Ca in the 1st leaf sampling

Source	DF	SS	MS	F	P
Replication (A)	2	8.7194E-01	4.3597E-01	1.09	0.4794
Staking (B)	1	8.6806E-02	8.6806E-02	0.22	0.6877
A x B	2	8.0307E-01	4.0153E-01		
Spacing (C)	2	1.4069	7.0343E-01	5.25	0.0349*
B x C	2	8.3733E-01	4.1867E-01	3.13	0.0992
A x B x C	8	1.0711	1.3389E-01		
Fertilizer (D)	3	19.715	6.5717	102.86	0.0000**
B x D	3	3.3906E-01	1.1302E-01	1.77	0.1705
C x D	6	3.2799E-01	5.4664E-02	0.86	0.5364
B x C x D	6	2.7770E-01	4.6284E-02	0.72	0.6327
A x B x C x D	36	2.2999	6.887E-02		
Total	71	28.037			
Grand average	1	611.18			

Table B-13. Analysis of variance table for Ca in the 2nd leaf sampling

Source	DF	SS	MS	F	P
Replication (A)	2	1.0644	5.3220E-01	0.92	0.5220
Staking (B)	1	3.0835E-04	3.0835E-04	0.00	0.9837
A x B	2	1.1622	5.8108E-01		
Spacing (C)	2	3.1192E-02	1.5596E-02	0.10	0.9092
B x C	2	3.4199E-01	1.7100E-01	1.06	0.3916
A x B x C	8	1.2949	1.6186E-01		
Fertilizer (D)	3	20.028	6.6761	44.16	0.0000**
B x D	3	8.7905E-01	2.9302E-02	1.94	0.1408
C x D	6	4.2661E-01	7.1101E-02	0.47	0.8257
B x C x D	6	1.6647E-01	2.7745E-02	0.18	0.9796
A x B x C x D	36	5.4418	1.5116E-01		
Total	71	30.837			
Grand average	1	782.57			

Table B-14. Analysis of variance table for Mg in the 1st leaf sampling

Source	DF	SS	MS	F	P
Replication (A)	2	3.8345E-01	1.9173E-01	6.20	0.1388
Staking (B)	1	1.8721E-02	1.8721E-02	0.61	0.5178
A x B	2	6.1800E-02	3.0900E-02		
Spacing (C)	2	1.5130E-01	7.5650E-02	2.17	0.1771
B x C	2	8.2765E-02	4.1382E-02	1.18	0.3543
A x B x C	8	2.7946E-01	3.4932E-02		
Fertilizer (D)	3	8.3043E-02	2.7681E-02	0.71	0.5544
B x D	3	1.3101E-01	4.3669E-02	1.11	0.3560
C x D	6	2.3715E-01	3.9525E-02	1.01	0.4350
B x C x D	6	2.2541E-01	3.7569E-02	0.96	0.4665
A x B x C x D	36	1.4106	3.9183E-02		
Total	71	3.0647			
Grand average	1	15.547			

Table B-15. Analysis of variance table for Mg in the 2nd leaf sampling

Source	DF	SS	MS	F	P
Replication (A)	2	4.8087E-01	2.4044E-01	26.53	0.0363*
Staking (B)	1	5.6889E-05	5.6889E-05	0.01	0.9441
A x B	2	1.8126E-02	9.0628E-03		
Spacing (C)	2	4.3656E-02	2.0828E-02	5.18	0.0361*
B x C	2	9.3430E-03	4.6715E-03	1.11	0.3761
A x B x C	8	3.3737E-02	4.2171E-03		
Fertilizer (D)	3	3.4117E-02	1.1372E-02	4.96	0.0056**
B x D	3	4.5959E-03	1.5320E-03	1.67	0.5774
C x D	6	1.3627E-03	2.2712E-04	0.10	0.9960
B x C x D	6	1.2889E-02	2.1481E-03	0.94	0.4812
A x B x C x D	36	8.2592E-02	2.2942E-03		
Total	71	7.2134E-01			
Grand average	1	2.4701E-01			

Table B-16. Analysis of variance table for K residual in the soil

Source	DF	SS	MS	F	P
Replication (A)	2	1.2217E+04	6108.4	3.22	0.2372
Staking (B)	1	243.40	243.40	0.13	0.7546
A x B	2	3799.8	1899.9		
Spacing (C)	2	709.88	354.94	0.83	0.4719
B x C	2	395.87	197.93	0.46	0.6466
A x B x C	8	3437.0	429.62		
Fertilizer (D)	3	7.2848E+04	2.4823E+04	59.75	0.0000**
B x D	3	3369.1	1123.0	2.76.	0.0560
C x D	6	2747.6	457.94	1.13	0.3666
B x C x D	6	2001.0	333.50	0.82	0.5614
A x B x C x D	36	1.4631E+04	460.43		
Total	71	1.1640E+05			
Grand average	1	7.3388E+05			

Appendix C. The original data for analysis of variance

Table C-1. The original data of marketable yield (t/ha) for analysis of variance

K treatment ($kg.K_2O/ha$)		Staking			Nonstaking		
		15 cm	30 cm	45 cm	15 cm	30 cm	45 cm
K(0)	Rep I	51.35	58.20	61.75	45.60	61.18	65.43
	Rep II	58.18	58.90	58.97	33.02	52.60	56.62
	Rep III	80.25	70.68	44.42	40.73	46.90	55.11
K(100)	Rep I	50.60	49.80	46.57	58.95	54.60	68.35
	Rep II	64.73	61.45	56.23	43.88	47.15	60.10
	Rep III	53.07	49.48	55.55	48.14	52.20	56.13
K(200)	Rep I	30.85	58.28	61.28	43.17	68.65	58.42
	Rep II	64.10	56.95	57.73	47.37	52.58	55.28
	Rep III	54.09	65.98	67.78	55.26	58.32	44.56
K(300)	Rep I	50.27	50.83	62.15	46.87	64.25	47.92
	Rep II	66.70	54.53	63.15	44.07	58.58	64.47
	Rep III	62.02	69.95	66.30	53.89	45.90	52.57

Table C-2. The original data of unmarketable yield (t/ha) for analysis of variance

K treatment ($kg.K_2O/ha$)		Staking			Nonstaking		
		15 cm	30 cm	45 cm	15 cm	30 cm	45 cm
K(0)	Rep I	10.63	5.28	4.89	15.52	10.61	6.32
	Rep II	5.05	5.55	6.19	9.30	7.58	8.96
	Rep III	3.88	4.91	7.30	6.87	5.65	8.63
K(100)	Rep I	8.85	8.11	3.46	15.92	9.81	5.96
	Rep II	7.18	4.29	4.97	13.13	4.99	6.40
	Rep III	3.78	5.03	7.75	4.63	6.68	5.68
K(200)	Rep I	7.80	8.52	6.16	20.20	10.60	6.44
	Rep II	4.50	6.96	6.78	10.62	6.17	6.38
	Rep III	5.48	4.65	2.75	7.10	6.21	4.70
K(300)	Rep I	9.62	10.00	7.77	14.03	5.50	9.76
	Rep II	5.48	7.88	5.31	11.80	7.05	10.80
	Rep III	3.85	2.97	3.32	7.66	5.60	5.38

Table C-3. The original data of the number of fruits per plant for analysis of variance

K treatment ($kg.K_2O/ha$)		Staking			Nonstaking		
		15 cm	30 cm	45 cm	15 cm	30 cm	45 cm
K(0)	Rep I	15.46	27.77	44.83	14.41	34.46	42.11
	Rep II	15.60	34.25	41.69	12.82	28.00	48.67
	Rep III	16.03	34.65	46.86	9.27	26.00	42.24
K(100)	Rep I	14.75	28.96	41.69	16.55	30.00	48.67
	Rep II	17.31	30.81	43.73	12.31	35.44	41.88
	Rep III	14.57	29.32	48.06	12.62	29.64	55.41
K(200)	Rep I	14.73	30.81	46.68	13.81	35.44	42.24
	Rep II	17.04	27.62	42.89	13.35	29.96	32.95
	Rep III	27.77	36.85	45.21	12.58	32.56	42.76
K(300)	Rep I	17.04	29.32	47.44	15.64	29.64	41.88
	Rep II	17.83	30.59	41.33	12.81	28.96	15.46
	Rep III	15.27	36.00	47.95	10.79	24.46	14.75

Table C-4. The original data of average fruit weight (g) for analysis of variance

K treatment ($kg.K_2O/ha$)		Staking			Nonstaking		
		15 cm	30 cm	45 cm	15 cm	30 cm	45 cm
K(0)	Rep I	48.29	59.95	57.28	47.85	51.55	62.68
	Rep II	46.81	51.36	64.31	43.52	63.69	67.16
	Rep III	52.64	55.86	47.84	58.85	55.60	55.23
K(100)	Rep I	46.19	53.15	49.34	50.45	64.07	59.88
	Rep II	52.09	53.46	63.61	59.27	65.87	66.90
	Rep III	48.56	47.70	60.34	51.30	58.10	50.58
K(200)	Rep I	45.11	50.88	47.70	54.50	58.92	59.23
	Rep II	47.31	60.81	63.08	58.62	56.54	72.76
	Rep III	57.17	53.41	63.85	55.48	55.66	50.90
K(300)	Rep I	43.83	52.58	56.29	47.15	56.84	58.94
	Rep II	52.55	53.53	64.27	52.23	67.05	64.94
	Rep III	53.75	56.29	56.25	57.38	54.48	51.43

Table C-5. The original data of yield per plant (kg) for analysis of variance

K treatment ($kg.K_2O/ha$)		Staking			Nonstaking		
		15 cm	30 cm	45 cm	15 cm	30 cm	45 cm
K(0)	Rep I	0.57	1.34	2.06	0.49	0.41	2.07
	Rep II	0.63	1.47	1.86	0.39	1.13	1.94
	Rep III	0.83	1.63	1.40	0.39	1.13	1.94
K(100)	Rep I	0.51	1.24	1.75	0.61	1.31	2.28
	Rep II	0.76	1.42	2.25	0.48	1.18	2.21
	Rep III	0.55	1.10	1.85	0.53	1.20	1.98
K(200)	Rep I	0.36	1.30	1.94	0.45	1.65	2.06
	Rep II	0.71	1.31	1.92	0.55	1.31	1.75
	Rep III	0.54	1.47	2.14	0.55	1.40	1.57
K(300)	Rep I	0.55	1.22	2.07	0.53	1.38	1.69
	Rep II	0.77	1.21	2.11	1.50	1.41	2.15
	Rep III	0.63	1.61	2.09	0.49	1.06	2.87

Table C-6. The original data of total acidity (%) for analysis of variance

K treatment ($kg.K_2O/ha$)		Staking			Nonstaking		
		15 cm	30 cm	45 cm	15 cm	30 cm	45 cm
K(0)	Rep I	0.486	0.429	0.490	0.386	0.402	0.509
	Rep II	0.443	0.435	0.419	0.429	0.448	0.484
	Rep III	0.387	0.379	0.395	0.408	0.432	0.355
K(100)	Rep I	0.506	0.435	0.480	0.426	0.432	0.483
	Rep II	0.443	0.445	0.430	0.427	0.531	0.418
	Rep III	0.462	0.418	0.374	0.394	0.392	0.398
K(200)	Rep I	0.474	0.493	0.493	0.462	0.462	0.517
	Rep II	0.438	0.445	0.410	0.464	0.477	0.485
	Rep III	0.402	0.422	0.475	0.429	0.448	0.458
K(300)	Rep I	0.522	0.510	0.449	0.406	0.475	0.400
	Rep II	0.435	0.448	0.518	0.504	0.462	0.443
	Rep III	0.397	0.411	0.416	0.502	0.464	0.461

Table C-7. The original data of total solids (%) for analysis of variance

K treatment ($kg.K_2O/ha$)		Staking			Nonstaking		
		15 cm	30 cm	45 cm	15 cm	30 cm	45 cm
K(0)	Rep I	6.19	4.39	5.54	4.68	4.77	4.64
	Rep II	4.86	3.86	5.16	5.32	4.77	4.43
	Rep III	4.93	5.21	5.64	5.33	6.05	5.03
K(100)	Rep I	6.55	4.57	5.50	4.58	4.76	4.68
	Rep II	4.74	3.92	4.72	4.78	5.01	4.59
	Rep III	6.00	5.76	4.95	5.50	5.39	6.13
K(200)	Rep I	5.34	4.45	4.69	4.70	4.89	5.15
	Rep II	4.33	4.13	4.50	5.35	5.21	4.67
	Rep III	5.14	5.56	4.99	5.11	6.14	5.62
K(300)	Rep I	4.72	5.75	4.61	5.08	4.66	4.50
	Rep II	4.66	4.48	4.99	5.71	5.09	4.91
	Rep III	4.72	5.17	5.47	6.38	5.65	5.87

Table C-8. The original data of soluble solids (^{0}Brix) for analysis of variance

K treatment (kg.K_2O/ha)		Staking			Nonstaking		
		15 cm	30 cm	45 cm	15 cm	30 cm	45 cm
K(0)	Rep I	6.0	4.4	5.4	5.0	5.1	5.0
	Rep II	5.1	4.4	5.0	5.5	4.9	4.8
	Rep III	5.0	5.4	5.4	5.2	6.0	5.2
K(100)	Rep I	6.2	5.0	5.9	4.8	4.9	5.0
	Rep II	5.0	4.6	4.9	4.8	5.3	4.9
	Rep III	6.4	6.4	5.4	5.4	5.2	6.0
K(200)	Rep I	4.9	5.1	5.0	4.8	5.0	4.9
	Rep II	4.9	4.9	4.9	5.2	5.0	5.0
	Rep III	4.9	5.8	5.0	5.4	6.0	5.8
K(300)	Rep I	5.0	5.8	4.6	4.8	5.1	4.7
	Rep II	5.0	5.0	5.0	5.6	5.0	5.1
	Rep III	4.9	5.8	5.4	5.9	5.8	5.2

Table C-9. The original data of pH value in tomato juice for analysis of variance

K treatment ($kg.K_2O/ha$)		Staking			Nonstaking		
		15 cm	30 cm	45 cm	15 cm	30 cm	45 cm
K(0)	Rep I	4.24	4.26	4.22	4.33	4.36	4.32
	Rep II	4.38	4.30	4.34	4.34	4.28	4.31
	Rep III	4.33	4.32	4.36	4.26	4.24	4.38
K(100)	Rep I	4.22	4.25	4.22	4.36	4.36	4.34
	Rep II	4.34	4.36	4.36	4.30	4.22	4.31
	Rep III	4.24	4.28	4.33	4.35	4.32	4.29
K(200)	Rep I	4.30	4.24	4.23	4.37	4.34	4.26
	Rep II	4.40	4.40	4.44	4.32	4.27	4.26
	Rep III	4.18	4.28	4.32	4.28	4.26	4.24
K(300)	Rep I	4.24	4.26	4.29	4.25	4.28	4.37
	Rep II	4.33	4.34	4.27	4.23	4.29	4.33
	Rep III	4.25	4.30	4.36	4.23	4.23	4.30

Table C-10. The original data of K% in the leaves (1th sampling) for analysis of variance

K treatment ($kg.K_2O/ha$)		Staking			Nonstaking		
		15 cm	30 cm	45 cm	15 cm	30 cm	45 cm
K(0)	Rep I	3.50	3.67	3.17	3.95	3.17	3.61
	Rep II	4.98	4.32	3.33	3.63	3.50	3.67
	Rep III	3.99	4.32	3.67	4.00	4.15	3.67
K(100)	Rep I	3.67	3.33	3.00	3.67	3.30	3.64
	Rep II	3.65	3.96	3.32	3.63	3.33	3.32
	Rep III	3.49	4.47	3.28	3.29	3.48	3.33
K(200)	Rep I	4.32	3.78	3.97	3.33	3.64	3.97
	Rep II	3.33	4.32	4.33	4.17	3.63	3.64
	Rep III	4.15	3.99	3.50	3.29	3.97	4.00
K(300)	Rep I	3.67	3.93	3.83	4.17	3.65	4.00
	Rep II	3.63	3.67	3.50	4.32	4.33	3.31
	Rep III	3.97	4.15	3.99	3.65	3.67	3.97

Table C-11. The original dta of K% in tomato leaves (2nd sampling) for analysis of variance

K treatment ($kg.K_2O/ha$)		Staking			Nonstaking		
		15 cm	30 cm	45 cm	15 cm	30 cm	45 cm
K(0)	Rep I	3.00	3.30	3.29	3.95	2.99	3.65
	Rep II	4.32	4.30	3.49	3.96	3.50	3.67
	Rep III	3.33	2.99	2.83	2.99	2.81	2.99
K(100)	Rep I	3.65	3.64	3.97	4.33	4.32	3.64
	Rep II	3.99	4.17	4.33	4.00	3.50	3.65
	Rep III	3.65	3.65	3.64	3.65	3.30	3.29
K(200)	Rep I	3.65	3.65	4.17	4.29	3.67	3.99
	Rep II	4.98	4.26	4.17	4.00	4.00	4.49
	Rep III	3.82	4.15	3.65	4.17	3.67	4.67
K(300)	Rep I	4.00	3.33	3.33	4.46	4.29	3.95
	Rep II	4.17	4.13	4.32	3.83	3.67	4.03
	Rep III	4.32	4.32	3.67	4.32	4.65	4.49

Table C-12. The original data of Ca% in tomato leaves (1st sampling) for analysis of variance

K treatment (kg.K_2O/ha)		Staking			Nonstaking		
		15 cm	30 cm	45 cm	15 cm	30 cm	45 cm
K(0)	Rep I	2.780	3.540	3.648	2.993	3.105	3.090
	Rep II	2.555	3.781	3.178	3.111	2.527	3.142
	Rep III	2.771	3.239	2.672	2.635	2.915	3.068
K(100)	Rep I	2.945	3.155	3.080	2.690	3.597	3.429
	Rep II	2.666	3.380	2.960	3.160	2.380	2.960
	Rep III	2.372	2.474	2.777	2.859	2.877	3.228
K(200)	Rep I	3.518	3.954	3.209	3.410	3.924	3.685
	Rep II	3.110	4.173	3.830	3.310	3.139	3.447
	Rep III	2.980	3.698	3.890	3.424	3.924	3.530
K(300)	Rep I	2.183	2.384	2.783	1.924	2.116	2.183
	Rep II	2.459	2.723	1.883	1.698	1.763	2.228
	Rep III	1.573	1.937	1.877	2.056	1.703	2.407

Table C-13. The original data of Ca% in tomato leaves (2nd sampling) for analysis of variance

K treatment (kg.K_2O/ha)		Staking			Nonstaking		
		15 cm	30 cm	45 cm	15 cm	30 cm	45 cm
K(0)	Rep I	3.793	2.645	3.013	4.028	3.816	3.671
	Rep II	3.296	4.402	3.477	3.490	2.690	3.960
	Rep III	3.815	3.658	3.380	3.261	3.526	3.550
K(100)	Rep I	3.365	3.502	3.465	3.302	3.880	3.575
	Rep II	3.550	3.742	3.452	3.417	2.800	3.802
	Rep III	2.754	2.754	3.573	3.477	3.454	3.549
K(200)	Rep I	3.937	4.532	3.867	4.323	4.067	4.233
	Rep II	3.555	4.347	3.921	3.627	3.687	4.033
	Rep III	3.615	2.834	3.013	3.507	4.107	3.687
K(300)	Rep I	2.603	2.903	2.963	1.924	2.459	2.273
	Rep II	3.267	2.637	2.475	2.303	2.003	2.123
	Rep III	2.296	2.176	2.183	2.535	1.937	2.535

Table C-14. The original data of Mg% in tomato leaves (1st sampling) for analysis of variance

K treatment (kg.K_2O/ha)		Staking			Nonstaking		
		15 cm	30 cm	45 cm	15 cm	30 cm	45 cm
K(0)	Rep I	0.373	0.518	0.542	0.474	0.473	0.469
	Rep II	0.409	0.470	0.472	0.393	0.393	0.438
	Rep III	0.339	0.367	0.352	0.352	0.364	0.423
K(100)	Rep I	0.445	0.480	0.485	0.368	0.515	2.118
	Rep II	0.402	0.487	0.468	0.439	0.458	0.412
	Rep III	0.339	0.349	0.380	0.364	0.349	0.425
K(200)	Rep I	0.508	0.536	0.556	0.460	0.520	0.477
	Rep II	0.420	0.548	0.483	0.390	0.462	0.457
	Rep III	0.336	0.385	0.407	0.375	0.411	0.340
K(300)	Rep I	0.480	0.557	0.563	0.459	0.518	0.497
	Rep II	0.498	0.553	0.467	0.488	0.467	0.477
	Rep III	0.378	0.432	0.365	0.425	0.347	0.513

Table C-15. The original data of Mg% in tomato leaves (2nd sampling) for analysis of variance

K treatment (kg.K_2O/ha)		Staking			Nonstaking		
		15 cm	30 cm	45 cm	15 cm	30 cm	45 cm
K(0)	Rep I	0.573	0.551	0.474	0.497	0.565	0.605
	Rep II	0.458	0.550	0.585	0.530	0.428	0.593
	Rep III	0.352	0.341	0.387	0.307	0.375	0.417
K(100)	Rep I	0.518	0.624	0.604	0.512	0.635	0.558
	Rep II	0.477	0.540	0.582	0.523	0.425	0.581
	Rep III	0.331	0.294	0.402	0.400	0.385	0.462
K(200)	Rep I	0.571	0.678	0.703	0.624	0.603	0.661
	Rep II	0.518	0.537	0.603	0.560	0.560	0.575
	Rep III	0.392	0.409	0.379	0.437	0.360	0.453
K(300)	Rep I	0.543	0.640	0.603	0.399	0.531	0.589
	Rep II	0.547	0.545	0.571	0.510	0.480	0.470
	Rep III	0.385	0.365	0.333	0.372	0.359	0.562

Table C-16. The original data of K residual in soil after harvesting for analysis of variance

K treatment (kg.K_2O/ha)		Staking			Nonstaking		
		15 cm	30 cm	45 cm	15 cm	30 cm	45 cm
K(0)	Rep I	50.0	57.5	65.0	75.0	55.0	50.0
	Rep II	77.0	75.0	80.0	79.0	85.0	107.5
	Rep III	50.0	27.5	52.5	82.5	70.0	57.5
K(100)	Rep I	60.0	70.0	100.0	72.0	55.0	70.0
	Rep II	95.0	125.0	126.0	55.0	80.0	110.0
	Rep III	75.0	60.0	65.0	90.0	75.0	80.0
K(200)	Rep I	115.0	70.0	80.0	92.5	85.0	90.0
	Rep II	150.0	150.0	130.0	122.5	132.5	85.0
	Rep III	110.0	80.0	110.0	120.0	100.0	80.0
K(300)	Rep I	122.5	170.0	125.0	190.0	150.0	150.0
	Rep II	140.0	175.0	195.0	175.0	170.0	145.0
	Rep III	125.0	95.0	115.0	140.0	105.0	220.0

Appendix D. The procedure for digesting leaf samples by dry ashing method (Wikner, 1988)

Procedure:

1. Weigh a 300 mg sample of finely ground, dried plant leaves in a crucible;

2. Place the samples in a cool muffle furnace, then raise the temperature to 500^0 C for 8 hours. After that, all the plant materials become greyish or white ash;

3. Take the samples from the muffle, cool, add 1 ml of concentrated hydrochloric acid (conc. HCl) and use 1 ml of deionized water to wash the crucible;

4. Put the samples on a hot plate (electric fry pan) at 50^0 C for 30 minutes to dehydrate silica;

5. Remove the samples from the plate, cool, then the contents from the crucible into a 10 ml polystyrene vial by carefully rinsing the crucible with deionized water and fill to the 10 ml mark;

6. Shake the vials well by hand, then centrifuge (2500 - 300 rpm) the vials to separate the solid particles and the solutions;

7. Remove the samples out from the centrifuge for element analyses.

Appendix E. Questionnaires for the Interview of Farmers' Management Practices

District: _____ Subdistrict: _____
Village: _____ Farmer: _____
Sex: _____ Age: _____
Interviewer: _____ Survey number: _____
Date: _____

Objectives:

1. To understand the farmers' management practices in tomato production;
2. To identify the production constraints in the target areas;
3. To get the information for the experiment planning.

Questionnaires:

Please put in front of your answers and give your answers regarding tomato production in 1989/90.

1. Cropping pattern and land preparation

1.1. In rainy season 1989, how many rais did you grow rice? _____ rai.

1.2. For paddy land, how many rai do you own? _____ rai.
how many rai do you lent? _____rai.

1.3. After wet season rice 1989, what did you grow in the paddy field?

crop	planted area (rai)

1.4. What kind of land did you use for tomatoes? (For the paddy field, the answer must be the same as 1.3)

- O Paddy land, how many rai? _____ rai.
- O Upland, how many rai? _____ rai.

1.5. Did you plow the field? O Yes O No

1.6. If yes, how many times? _____
Why? _____

1.7. If no, why?

- O Not enough labor
- O No power
- O Time limited
- O Thought not necessary

1.8. How many times did you harrow the field? _____

1.9. What kind of equipment did you use?

- O Tractor
- O Traditional tools, specify _____

1.10. How wide is the planting bed? _____

1.11. How high is the planting bed? _____

1.12. How wide is the furrow? _____

1.13. How deep is the furrow? _____

1.14. How did you prepare the land? Could you describe more detail? _____
_____
_____

2. Seedling raising in the nursery

2.1. What variety(ies) did you use? (a) _____ (b) _____

2.2. Where did you get the seed? _____

2.3. When did you sow the seed? _____

2.4. How did you sow the seed?

- O Broadcasting dry seed directly to the seed bed
- O Broadcasting seed mixed some soil or organic matter
- O Other method, please specify _____

2.5. Did you use any chemicals to treat the seed before sowing? O Yes O No

2.6. If yes, what kind of chemicals did you use? and how did you do? (specify) _____

2.7. How did you cover the seed?

O Used soil only
O Used medium
O Other (specify) _____

2.8. If used medium, what were the components? _____
_____

2.9. Did you cover the seed bed? O Yes O No

2.10. If yes, what material did you use?

O Rice straw
O Other (specify) _____

2.11. How did you water?

O Sprinkling from a can
O Used dipper
O Other (specify) _____

2.12. Did you apply chemical fertilizer to the seedling?

O Yes O No

2.13. If yes, what kind of fertilizers did you use? how did you apply?_____

2.14. How long did you raise the seedlings? _____

3. Transplanting

3.1. When did you transplant last year (specific date or days after sowing)? _____

3.2. What was the spacing? 1. Between rows _____ cm.
2. Between plants _____ cm.

3.3. How many rai and plots did you grow last year?
_____ rai, _____ plots

3.4. Did you cover the planting bed? O Yes O No

3.5. If yes, what material did you use?

O Rice straw
O Other (specify) _____

4. Weed control

4.1. What types of weeds (the most important) emerged in your fields?
a. Broad leaf: 1. _____
2. _____
b. Narrow leaf: 1. _____
2. _____

4.2. How did you control the weeds?

O Hand weeding
O Use of herbicides
O No control
O Both hand weeding and use of herbicides

4.3. If you used hand weeding,

a. how many times did you weed? _____
b. what equipment did you use in weeding? (e.g., hoe, sickle or hand pulling) _____

4.4. If you used herbicides,

a. how many times did you use? _____
b. what kind of herbicides did you ues? _____
c. when did you use (date or stage of plant growing, e.g. 1 week after transplanting)?
1st application _____
2nd application _____
d. How did you apply (spray etc.)? _____
_____

4.5. Have you ever used herbicides before? O Yes O No

4.6. If yes, how many years have you used already?
what kinds of herbicides? _____
_____

4.7. If no, why?

O Do not know this technology
O Not effective
O Too expensive

4.8. If someone introduce herbicide to you, will you try in your fields?

O Yes O No

Why? _____

_____

5. Fertilizer

5.1. Did you use organic fertilizer in 1989/90?

O Yes O No

5.2. If yes, what type? how much? and how to apply?

_____

5.3. Chemical fertilizer application recording (Please put the answers in the following table)

Application Number	Grade of Fertilizer	Distri-butor	Price B/kg	Stage of Plant	Rate kg/rai	Method of Application
1						
2						
3						
4						
5						
6						

6. Pest control

6.1. Information on insects and diseases infestation

Item		Name of Pest	Stage of Plant infected	Seriousness*	Chemicals used for controlling
Insect	1				
	2				
	3				
Disease	1				
	2				
	3				

*. 1 = Light, few plants were lightly infected;

2 = Moderate, some plants were infected;

3 = Severe, most plants were infected;

4 = Very severe, most plants or all plants were severely infected.

6.2. Pesticides application recording

Application Number	Name of Pesticides	Distri- butor	Price*	Date of Application	Dose	Method of Application
1						
2						
3						
4						
5						

*. If liquid, B/litre, if powder, B/kg.

7. Irrigation

7.1. How did you irrigate your tomato?

- O Furrow irrigation
- O Fetching water to irrigate

7.2. How many times did you irrigate last season? _____ time

7.3. Was there enough water for irrigating your fields?

O Yes O No

7.4. If no, how did you solve the problem? _____

_____

7.5. At what stage of plant growing you had water shortage problem? (Specify order according to seriousness if water shortage occurred in many stages.)

- O Flowering stage
- O Fruit development stage
- O Early harvesting stage
- O Late harvesting stage

7.6. Did you have drainage problems? O Yes O No

7.7. If yes, what was the seriousness? Please describe.

O Light _____
O Moderate_ _____
O Severe _____

8. Staking

8.1. Did you use staking for tomato growing in the last season?

O Yes O No

8.2. If yes, did you use staking in every plot?

O Yes O No

8.3. If no, a. how many plot did you use staking? _____
b. how many plots didn't you use staking? _____

8.4. Can you tell the difference between using and not using stake?

1. Improving quality O substantially
O moderately
O unobservantly

2. Increasing yield by _____% of not staking

3. Others, please specify _____
_____

8.5. If you never use staking before, why?

O Did not know the technology
O Did not have enough labor
O Too costly

8.6. If someone introduce staking to you, will you try?

O Yes O No

8.7. How much yield loss (total) caused by fruit rotten or other damage due to no staking? _____ kg. or_____ % of total yield (This amount was not marketable).

9. Harvest

9.1. Did you have to grade the fruit? O Yes O No

9.2. If yes, how many grades? What are they?_____

9.3. Harvesting recording (not include the amount reported in 8.7)

Harvest Number	date of Harvest	Quality*	Quantity (kg)** Factory	Quantity (kg)** Market	Price (B/kg)** Factory	Price (B/kg)** Market	Which Factory
1							
2							
3							
4							
5							
6							
Total yield							
Gross income							

*. G = good F = fair NG = not good
**. Classify by quality, if possible.

10. Labor requirement

10.1. How many family labor did you have for tomato production _____

10.2. Did you hire labor for tomato production?

O Yes O No

10.3. If yes, for what activities and how many people were hired?

Activity	No. of People hired	No. of days Per person	Wage per Person*	Remark
Plow				
Harrow				
Bedding				
Transplant				
Staking				
Weeding				
Harvest				
Others				

*. It includes meals or not, please note.

10.4. Could you hire labor at anytime when you need?
O Yes O No

10.5. If no, what did you do? _____

10.6. In case that you use staking, did family members do this activity? O Yes O No

11. Processing quality related to management practices

11.1. What are the specifications of quality are required for processing tomato?
1. Color: _____
2. Ripeness: _____
3. Size: _____
4. Other, specify: _____

11.2. What management factors affect the processing quality (in order of importance)? e.g., pest control, irrigation, fertilizer application. please describe how these factors affect the quality.
1. _____
2. _____

12. Problems on production

12.1. How many years have you grown tomato already? _____

12.2. What are your problems in tomato growing?
1. _____
2. _____

12.3. What kinds of assistance do you need regarding tomato growing?
1. _____
2. _____
3. _____

12.4. Will you grow more tomato next year?

O Yes O No O Reduce

Why?_____

13. Marketing problems

13.1. How did you sell your tomato fruit?

O To the factory through middlemen
O To the factory by yourself
O To the fresh market through middlemen
O To the fresh marketing by yourself

13.2. What marketing problems do you normally encounter in selling tomatoes?
1. _____
2. _____
3. _____

13.3. Do you need any assistance regarding marketing your tomatoes? Please give details

_____

14. Decision making

14.1. In your family, who made the decision regarding crop choice?

- O Husband
- O Wife
- O Both

14.2. Why did you decide to grow tomato? Please describe.

_____

14.3. Who made the decision in tomato management in your family? Please check the answers in the following table.

Activity	Husband	Wife	Both H/W	Other Specify
Sowing				
Transplanting				
Weed control				
Fert. application				
Pest control				
Harvesting				
Selling				

14.4. Where did you obtain technical knowledge regarding tomato production management?

- O From neighbors
- O From extension officers
- O Other (specify) _____

Curriculum Vitae

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