

Supplementary Table S1. Fertilizing rate in total, proportion of basal and top dressing, seeding rate or planting space, sowing date, harvesting date, precipitation, day length, temperature, fertilizer cost, paddy sales

Province Variety	Fertilizer (kg ha ⁻¹)	Proportion of fertilizer application for basal and top dressing	Seeding rate (kg ha ⁻¹) /planting space	Sowing (Transplanting)	Harvesting	Precipitation during cultivation (mm)	Fertilizer cost (US\$ ha ⁻¹)	Paddy sales (US\$ kg ⁻¹)
1. Banteay Meanchey (day length: 12h55m16s - 11h22m59s; precipitation: 834.4mm; daily temp: 37.5°C max, 14.5°C min in Jun - Dec)								
44. Raing Chey	32.0	50% BD; 50% TD	120	Jul 20	Dec 20	666.0	17.5	0.200
46. Neang Khon	32.0	50% BD; 50% TD	120	Jul 14	Dec 15	666.0	17.5	0.200
49. Phka Knhy	27.5	50% BD; 50% TD	100	Jul 14	Dec 25	666.0	13.9	0.200
50. Srop Ngar	116.5	0% BD; 25% 1TD, 50% 2TD, 25% 3TD	120	Jul 9	Nov 15	666.0	56.4	0.200
51. Malis Chin	116.5	0% BD; 25% 1TD, 50% 2TD, 25% 3TD	100	Jul 12	Nov 12	666.0	56.4	0.225
45. Sen Kra Ob	163.0	50% BD; 25% 1TD, 25% 2TD	100	Aug 8	Nov 23	666.0	78.3	0.225
47. Phka Rumduol	55.0	50% BD; 25% 1TD, 25% 2TD	100	Jul 10	Nov 15	666.0	22.6	0.225
48. IR504	120.8	0% BD; 40% 1TD, 30% 2TD, 30% 3TD	120	Sep 13	Dec 25	479.6	58.3	0.200
2. Battambang (day length: 12h52m56s - 11h25m7s; precipitation: 704.6mm; daily temp: 37.5°C max, 16.0°C min in Jun - Dec)								
15. Phka Rumduol	77.5	0% BD; 50% 1TD, 50% 2TD	140	Jul 9	Nov 14	646.3	38.2	0.319
16. Sen Kra Ob	147.2	0% BD; 30% 1TD, 40% 2TD, 30% 3TD	150	Sep 11	Dec 25	334.1	75.3	0.319
17. Malis Chin	100.5	0% BD; 40% 1TD, 40% 2TD, 20% 3TD	130	Jul 20	Nov 20	646.3	47.7	0.319
18. Srop Ngar	104.3	0% BD; 40% 1TD, 40% 2TD, 20% 3TD	180	Jul 17	Nov 23	646.3	52.9	0.209
19. CAR15	109.1	0% BD; 50% 1TD, 25% 2TD, 25% 3TD	150	Aug 22	Nov 27	470.2	50.5	0.209
21. Neang Khon	71.0	20% BD; 40% 1TD, 40% 2TD	140	Jun 24	Dec 10	704.6	35.7	0.209
22. OM5451	109.5	0% BD; 40% 1TD, 40% 2TD, 20% 3TD	160	Aug 26	Dec 5	470.2	55.7	0.209
20. Raing Chey	85.0	0% BD; 30% BD; 70% TD	80, 25×25 cm	Jun 10 (Jul 5)	Dec 13	704.6	41.9	0.209
3. Kampong Thom (day length: 12h52m28s - 11h25m32s; precipitation: 804.6mm; daily temp: 37.0°C max, 17.0°C min in Jun - Dec)								
8. OM5451	195.0	0% BD; 40% 1TD, 30% 2TD, 30% 3TD	150	Sep 23	Dec 27	402.6	95.8	0.217
13. CAR8	0.0		90, 25×25 cm	Jun 10 (Jul 18)	Dec 20	687.7	-	0.217
9. Phka Mealtey	78.0	70% BD; 30% 1TD	80, 20×20 cm	Jul 20 (Aug 13)	Nov 15	687.7	36.4	0.288
10. Raing Chey	64.2	70% BD; 30% 1TD	90, 25×25 cm	Jul 18 (Aug 14)	Dec 23	687.7	30.7	0.217
12. Phka Rumduol	55.0	70% BD; 30% 1TD	90, 20×20 cm	Jul 10 (Aug 2)	Nov 17	687.7	26.9	0.288
14. Phka Chan Sen	78.0	80% BD; 20% TD	90, 25×25 cm	Jul 15 (Aug 10)	Dec 14	687.7	36.4	0.288
Sar						464.3	36.4	0.288
11. Sen Kra Ob	78.0	50% BD; 25% 1TD, 25% 2TD	120	Aug 12	Nov 28	464.3	36.4	0.288
4. Pursat (day length: 12h50m31s - 11h27m20s; precipitation: 654.0mm; daily temp: 38.0°C max, 16.3°C min in Jun - Dec)								
37. Somaly	59.6	50% BD; 25% 1TD, 25% 2TD	130	Jul 13	Nov 15	543.5	28.8	0.254
38. Phka Rumduol	94.2	0% BD; 50% 1TD, 50% 2TD	130	Jul 15	Nov 17	543.5	45.7	0.254
40. Sen Kra Ob	101.0	0% BD; 50% 1TD, 50% 2TD	120	Aug 10	Nov 25	455.2	45.8	0.254
42. Phka Doung	55.0	0% BD; 100% TD	90, 25×25 cm	Jun 14 (Jul 5)	Nov 15	652.4	26.9	0.254
43. Neang Ek	55.0	50% BD; 50%TD	90, 30×30 cm	Jun 20 (Jul 10)	Dec 13	654.0	26.9	0.254
39. Krasang Teap	59.6	50% BD; 50%TD	140	Jul 15	Dec 16	545.1	28.8	0.188
41. CAR9	0.0		130	Jun 12	Dec 20	654.0	-	0.188
5. Siem Reap (day length: 12h55m21s - 11h22m54s; precipitation: 1299.5mm; daily temp: 36.5°C max, 16.5°C min in Jun - Dec)								
85. Phka Malis	0.0		130	Jul 15	Nov 20	1059.1	-	0.282
86. Phka Rumdeng	59.5	50% BD; 50%TD	130	Jun 12	Nov 15	1299.5	31.3	0.282
87. Somaly	64.0	100% BD	130	Jul 20	Nov 18	1059.1	34.0	0.282
88. Phka Rumduol	0.0	100% BD	130	Jul 12	Nov 14	1059.1	-	0.282
83. OM5451	160.0	40% BD; 20% 1TD, 40% 2TD	250	Aug 10	Nov 15	915.0	87.5	0.225
82. Sen Pidao	27.5	0% BD; 100% TD	90, 20×20 cm	Aug 10 (Aug 30)	Nov 29	915.0	13.9	0.282
84. Sen Kra Ob	160.0	40% BD; 20% 1TD, 40% 2TD	90, 20×20 cm	Aug 15 (Sep 5)	Nov 30	915.0	87.5	0.282
6. Kampong Chhnang (day length: 12h49m42s - 11h28m6s; precipitation: 894.7mm; daily temp: 37.0°C max, 17.0°C min in Jun - Dec)								
53. OM5451	87.0	50% BD; 50%TD	250	Jul 7	Oct 14	702.0	44.4	0.205
58. IR504	46.0	50% 1TD, 50% 2TD	250	Aug 10	Nov 25	500.4	18.9	0.205
52. Phka Rumduol	87.0	50% BD; 50%TD	80, 20×20 cm	Jul 13 (Aug 9)	Nov 17	706.8	44.4	0.285
54. Sen Kra Ob	87.0	50% BD; 50%TD	100, 20×20 cm	Aug 9 (Sep 5)	Nov 24	500.4	44.4	0.285
57. Phka Chan Sen	55.0	50% BD; 50%TD	80, 20×20 cm	Jun 11	Dec 20	894.7	27.7	0.285
Sar						894.7	27.7	0.285
59. CAR15	55.0	100% BD	100, 20×20 cm	Aug 10	Nov 25	500.4	27.7	0.205
56. Raing Chey	23.0	0% BD; 100% TD	160	Jul 10	Dec 17	706.8	9.4	0.205
55. Neang Krim	41.0	50% BD; 25& 1TD, 25% 2TD	80, 20×20 cm	Jul 14 (Aug 7)	Dec 15	706.8	18.5	0.205
7. Kampong Speu (day length: 12h47m48s - 11h29m50s; precipitation: 893.5mm; daily temp: 37.5°C max, 17.0°C min in Jun - Dec)								
68. Kong Chheng	67.8	50% BD; 50%TD	120	Jul 9	Dec 15	774.0	33.9	0.210
69. Chulasa	98.5	50% BD; 50%TD	100	Sep 15	Dec 23	542.5	49.1	0.210
70. Ka Ngork	96.2	50% BD; 50%TD	120	Jul 26	Dec 25	774.0	48.2	0.210
Pong						774.0	48.2	0.210
71. Sen Kra Ob	87.0	40% BD; 30% 1TD, 30% 2TD	70, 25×25 cm	Sep 15 (Oct 5)	Dec 28	542.5	44.4	0.305
72. Phka Rumduol	48.2	50% BD; 50%TD	80, 25×25 cm	Jul 11 (Aug 4)	Nov 17	774.0	22.2	0.305
74. Phka Malis	84.4	40% BD; 30% 1TD, 30% 2TD	120	Jul 15	Nov 20	774.0	39.8	0.305
73. Smar Prum	67.8	40% BD; 30% 1TD, 30% 2TD	70, 20×20 cm	Jul 13 (Aug 7)	Dec 18	774.0	33.9	0.210
8. Kampot (day length: 12h44m40s - 11h32m43s; precipitation: 1820.5mm; daily temp: 35.3°C max, 21.9°C min in Jun - Dec)								
1. Phka Rumduol	126.0	50% BD; 25% 1TD, 25% 2TD	130	Jul 13	Nov 16	1607.3	63.0	0.295
2. Phka Malis	126.0	50% BD; 25% 1TD, 25% 2TD	130	Jul 16	Nov 15	1607.3	63.0	0.295
3. Sen Pidao	110.0	50% BD; 25% 1TD, 25% 2TD	150	Aug 10	Nov 23	1819.5	55.4	0.295
4. Krochork	89.0	50% BD; 25% 1TD, 25% 2TD	150	Jun 16	Dec 14	1820.5	42.7	0.212
Chab						1820.5	42.7	0.212
5. Phka Romeat	89.0	50% BD; 25% 1TD, 25% 2TD	130	Jun 15	Nov 17	1819.5	42.7	0.295
6. Pong Rolork	89.0	50% BD; 25% 1TD, 25% 2TD	140	Jun 15	Dec 20	1820.5	42.7	0.212
7. Malis Chin	89.0	50% BD; 25% 1TD, 25% 2TD	130	Jul 16	Nov 16	1607.3	42.7	0.295
9. Kampong Cham (day length: 12h52m28s - 11h25m32s; precipitation: 881.1mm; daily temp: 37.7°C max, 18.0°C min in Jun - Dec)								
91. Raing Chey	46.0	0% BD; 50% 1TD, 50% 2TD	140	Jun 12	Dec 15	881.1	18.9	0.209

93. CAR6	46.0	0% BD; 50% 1TD, 50% 2TD	150	Jun 10	Dec 20	881.1	18.9	0.209
94. Phka Rumduol	23.0	0% BD; 100% TD	130	Jul 12	Nov 15	881.1	9.4	0.291
89. IR66	23.0	0% BD; 100% TD	180	Aug 25	Nov 27	556.9	9.4	0.209
90. Sen Kra Ob	23.0	0% BD; 100% TD	80, 25×25 cm	Aug 15 (Sep 5)	Nov 25	556.9	9.4	0.291
92. OM5451	46.0	0% BD; 50% 1TD, 50% 2TD	200	Aug 11	Nov 20	556.9	18.9	0.209
10. Tboung Khmum (day length: 12h48m47s - 11h28m55s; precipitation: 1204.2mm; daily temp:35.8°C max, 18.0°C min in Jun - Dec)								
75. IR504	27.6	50% BD; 50% TD	180	Aug 16	Dec 3	495.9	11.3	0.208
77. CAR9	40.2	50% BD; 50% TD	150	Jun 13	Dec 19	1204.2	16.5	0.208
80. CAR15	55.0	50% BD; 50% TD	150	Aug 20	Nov 27	727.1	26.9	0.208
76. Thmor Krim	23.0	0% BD; 100% TD	100, 25×25 cm	Jul 12 (Aug 8)	Nov 17	952.1	9.4	0.208
78. Phka Rumduol	61.9	50% BD; 50% TD	90, 25×25 cm	Jul 15 (Aug 5)	Nov 18	952.1	29.7	0.290
79. Raing Chey	27.6	0% BD; 100% TD	90, 25×25 cm	Jul 10 (Aug 5)	Dec 21	963.6	11.3	0.208
81. Sen Kra Ob	55.0	50% BD; 50% TD	90, 25×25 cm	Aug 15 (Sep 5)	Dec 5	738.6	26.9	0.290
11. Kandal (day length: 12h46m23s - 11h31m7s; precipitation: 1289.2mm; daily temp:36.9°C max, 18.9°C min in Jun - Dec)								
32. CAR4	27.5	0% BD; 100% TD	70	Jun 13	Dec 15	1289.2	13.5	0.211
33. Angkareach	0.0		90	Jun 15	Dec 13	1289.2	-	0.211
34. Phka Rumduol	23.0	0% BD; 100% TD	150	Jun 15	Nov 15	1289.2	9.4	0.299
35. Raing Chey	23.0	0% BD; 100% TD	60, 30×30 cm	Jun 15 (Jul 3)	Dec 15	1289.2	9.4	0.211
31. OM5451	104.6	0% BD; 100% TD	200	Aug 17	Nov 25	849.4	49.0	0.211
36. IR504	78.0	0% BD; 100% TD	200	Aug 20	Dec 5	849.4	36.4	0.211
12. Takeo (day length: 12h45m20s - 11h32m6s; precipitation (Jun - Dec): 1096.4mm; daily temp:36.0°C max, 17.0°C min)								
95. IR504	45.0	25% BD; 25% 1TD, 25% 2TD, 25% 3TD	250	Jun 15	Oct 2	1045.0	22.7	0.230
97. Sen Kra Ob	68.5	0% BD; 30% 1TD, 40% 2TD, 30% 3TD	130	Aug 15	Dec 2	801.2	30.2	0.271
98. Raing Chey	50.5	0% BD; 30% 1TD, 40% 2TD, 30% 3TD	100	Jul 10	Dec 20	969.6	23.3	0.271
99. Tror Norng	161.0	25% BD; 25% 1TD, 25% 2TD, 25% 3TD	180	Jun 10	Dec 10	1096.4	75.8	0.230
96. Phka Rumduol	55.0	25% BD; 25% 1TD, 25% 2TD, 25% 3TD	80, 20×20 cm	Jul 13 (Aug 5)	Nov 17	969.6	22.6	0.271
100. OM5451	50.5	0% BD; 30% 1TD, 40% 2TD, 30% 3TD	250	Jul 7	Oct 13	918.2	23.3	0.230
13. Prey Veng (day length: 12h46m57s - 11h30m37s; precipitation:1066.8mm; daily temp:35.7°C max, 18.2°C min in Jun - Dec)								
23. IR504	165.0	0% BD; 30% 1TD, 30% 2TD, 40% 3TD	250	Aug 17	Dec 5	665.6	83.1	0.226
24. Krasing Teap	63.0	50% BD; 20% 1TD, 30% 2TD	150	Jul 10	Dec 14	746.6	29.6	0.226
25. OM5451	63.0	0% BD; 30% 1TD, 30% 2TD, 40% 3TD	250	Jul 20	Oct 27	683.6	29.6	0.226
26. Sen Kra Ob	72.2	0% BD; 20% 1TD, 35% 2TD, 45% 3TD	200	Jun 8	Sept 23	708.6	33.4	0.288
28. Raing Chey	67.3	0% BD; 100% TD	100	Jul 15	Dec 15	746.6	31.4	0.226
29. Ka Ngork	70.5	0% BD; 50% 1TD, 50% 2TD	150	Aug 13	Dec 16	665.6	33.4	0.226
Pong						746.4		
27. Phka Rumduol	163.0	50% BD; 20% 1TD, 30% 2TD	80, 20×20 cm	Jul 9	Nov 15	1003.8	78.3	0.288
30. CAR 15	163.0	0% BD; 50% 1TD, 50% 2TD	100, 20×20 cm	Jun 20	Oct 5	1003.8	78.3	0.226
14. Svay Rieng (day length: 12h46m6s - 11h31m24s; precipitation:1299.5mm; daily temp:37.5°C max, 18.5°C min in Jun - Dec)								
60. Raing Chey	89.5	0% BD; 40% 1TD, 30% 2TD, 30% 3TD	150	Jul 10	Dec 20	1069.5	41.8	0.293
61. IR504	204.0	0% BD; 40% 1TD, 30% 2TD, 30% 3TD	250	Aug 10	Nov 25	828.0	105.4	0.233
62. Phka Ampil	89.5	0% BD; 40% 1TD, 30% 2TD, 30% 3TD	150	Jul 15	Nov 20	1068.5	41.8	0.293
63. Phka Rumduol	75.0	0% BD; 50% 1TD, 50% 2TD	150	Jul 11	Nov 16	1068.5	35.9	0.293
64. Jasmine 85	191.0	30% BD; 30% 1TD, 30% 2TD, 10% 3TD	200	Aug 10	Nov 25	828.0	90.8	0.233
65. Krasang Teap	105.5	50% BD; 25% 1TD, 25% 2TD	150	Jul 10	Dec 15	1069.5	51.0	0.233
66. OM5451	191.0	40% BD; 25% 1TD, 25% 2TD, 10% 3TD	200	Aug 10	Nov 20	828.0	90.8	0.233
67. Sen Kra Ob	105.5	0% BD; 40% 1TD, 30% 2TD, 30% 3TD	150	Jul 3	Oct 20	1006.9	51.0	0.293

Supplementary Table S2. Precipitation (mm) during cultivation season of rainfed rice (2019)

Province	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1. Banteay Meanchey	168.4	88.2	98.2	432.4	39.7	7.5	0.0	834.4
2. Battambang	58.3	176.1	136.1	192.4	132.5	9.2	0.0	704.6
3. Kampong Thom	116.9	223.4	61.7	252.8	135.2	14.6	0.0	804.6
4. Pursat	108.9	88.3	124.1	184.2	126.4	20.5	1.6	654.0
5. Siem Reap	240.4	144.1	302.1	483.6	101.9	27.4	0.0	1299.5
6. Kampong Chhnang	187.9	206.4	117.9	319.7	58.0	4.8	0.0	894.7
7. Kampong Speu	119.5	85.0	146.5	209.5	278.0	55.0	0.0	893.5
8. Kampot	212.2	196.5	711.4	362.2	190.8	146.4	1.0	1820.5
9. Kampong Cham	156.3	167.9	199.7	216.8	81.8	58.6	0.0	881.1
10. Tboung Khmum	240.6	225.0	242.7	300.5	104.2	79.7	11.5	1204.2
11. Kandal	302.2	137.6	187.5	291.5	247.0	123.4	0.0	1289.2
12. Takeo	126.8	168.4	226.0	358.0	165.8	51.4	0.0	1096.4
13. Prey Veng	320.2	81.0	141.8	165.6	295.2	62.8	0.2	1066.8
14. Svay Rieng	164.1	240.5	175.0	262.3	329.1	61.6	1.0	1233.6