**Supplementary Table 1.** Values of several soil characteristics and APSIM parameters (defined in Keating *et al.,* 2003) used in the simulation studies.

| Location [A] | APSIM soil description | diffus_const, diffus_slope [B] | U, Cona [C] | Total C (0-0.1 m) (%) | C:N ratio (0-0.1 m) | BOM [D] station number |
|---|---|---|---|---|---|---|
| Wongan Hills, WA | Buntine No 424 [E] | 220 ,22 | 2, 2 (Apr-Nov) 6, 3.5 (Dec-Mar) | 0.52 | 13 | 8138 |
| Dalby, QLD | Macalister No 026 [E] | 40, 16 | 4, 2.5 (Apr-Oct) 6, 3.5 (Nov-Mar) | 1.04 | 12 | 41023 |
| Cootamundra, NSW Ardlethan, NSW | Lilley and Kirkegaard (2007) | 44, 16 | 2, 2 (May-Oct) 6, 3.5 (Nov-Apr) | 0.83 | 8 | C: 73016 A: 74000 |
| Harden, NSW | Lilley *et al*. (2004) | 88, 35.4 | 2, 2 (May-Oct) 6 ,3.5 (Nov-Apr) | 1.30 | 10.8 | 73009 |
| Paskeville, SA | Kulpara No CY024 [E] | 88, 35 | 2, 2 (Apr-Oct) 6, 3.5 (Nov-Mar) | 1.40 | 12.5 | 22012 |
| Esperance, WA | Gibson No 455 [E] | 250, 25 | 2, 2 (Apr-Oct) 6, 3.5 (Nov-Mar) | 0.90 | 14.5 | 9631 |
| Birchip, VIC | Jil Jil No 727 [E] | 40, 16 | 2, 2 (Apr-Oct) 6, 3.5 (Nov-Mar) | 1.30 | 12 | 77007 |

[A] Australian states listed are: QLD – Queensland; NSW – New South Wales; VIC – Victoria; WA – Western Australia.

[B] Diffus_const and diffus_slope are parameters defining diffusivity of unsaturated water flow between soil layers.

[C] U and cona are parameters of a two stage soil evaporation rate.

[D] BOM – Australian Bureau of Meteorology http://www.bom.gov.au

[A,B] Further details at https://www.apsim.info/Documentation/Model,CropandSoil/SoilModulesDocumentation/SoilWat.aspx

[E] Further details at https://www.apsim.info/Products/APSoil.aspx