

1 **Supplementary Material**

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3 Table S1. Experimental light use efficiency values for various crops

$\epsilon^*_{\text{GPP}}(\text{gCMJ}^{-1})$	crop ID	crop type	references	comments
2,46	1	wheat (spring wheat)	Caviglia and Sadras (2001)	
2,53	1	wheat	Muurinen and Peltonen-Sainio (2006)	
2,55	1	wheat	Koizumi et al. (1990)	
2,61	1	wheat	Jamieson et al. (1991)	
2,85	1	wheat barley	Gallagher and Biscoe (1978)	extract from Cannell et al. (1987)
2,93	1	wheat	Foulkes et al. (2007)	
3,21	1	wheat (spring wheat)	Abbate et al. (1997)	
3,33	1	wheat	Kiniry et al. (1989)	
3,80	1	wheat	Kemarian et al. (2004)	
3,23	2	maize	Sinclair and Horie (1989)	
4,16	2	maize	Kiniry et al. (1989)	
4,37	2	maize (dentcorn)	Koizumi et al. (1990)	
4,51	2	maize	Lindquist et al. (2005)	
2,57	3	rice	Koizumi et al. (1990)	
2,61	3	rice	Kiniry et al. (1989)	
2,66	3	rice	Sinclair and Horie (1989)	
2,88	3	rice	Katsura et al. (2007)	
3,25	3	rice	Zhang et al. (2009)	
2,43	4	barley	Whitman et al. (1985)	
2,60	4	barley	Muurinen and Peltonen-Sainio (2006)	
2,61	4	barley (spring barley)	Legg et al. (1979)	extract from Cannell et al. (1987)
2,77	4	barley	Jamieson et al. (1995)	
2,85	4	barley	Koizumi et al. (1990)	

3,12	4	barley	Bingham et al. (2007)	
3,80	4	barley (spring barley)	Kemanian et al. (2004)	
3,09	6	millet	Azamali et al. (1984)	
3,44	6	millet	Begue et al. (1991)	
4,04	6	millet	Mcintyre et al. (1993)	
3,33	7	sorghum	Kiniry et al. (1989)	
3,98	7	sorghum (sweet sorghum)	Varlet-Grancher et al. (1992)	extracted from Dercas and Liakatas (2007)
4,03	7	sorghum (grain sorghum)	Mastrorilli et al. (1995)	
4,11	7	sorghum (grain sorghum)	Rosenthal et al. (1993)	
4,22	7	sorghum (sweet sorghum)	Dercas and Liakatas (2007)	
4,39	7	sorghum (sweet sorghum)	Mastrorilli et al. (1995)	
2,04	8	soybean	Mastrorilli et al. (1995)	
2,09	8	soybean	Muchow et al. (1993)	
2,28	8	soybean	Sinclair and Horie (1989)	
3,04	8	soybean	Unsworth et al. (1984)	
1,98	9	sunflower	Trapani et al. (1992)	
2,61	9	sunflower	Kiniry et al. (1989)	
2,97	9	sunflower	Mastrorilli et al. (1995)	
2,26	10	potato	Shah et al. (2004)	
2,46	10	potato	Haverkort and Harris (1987)	
2,47	10	potato	Kooman et al. (1996)	
2,57	10	potato	Opoku-Ameyaw and Harris (2001)	
3,42	10	potato	Allen and Scott (1980)	extract from Cannell

				et al. (1987)
4,20	11	cassava	Leepipatpaiboon et al. (2009)	
2,99	12	sugarcane	Muchow et al. (1997)	Kunia, H73-6110
3,18	12	sugarcane	Muchow et al. (1997)	Kunia, H78-7234
3,61	12	sugarcane	Muchow et al. (1997)	Macknade, Q117
3,71	12	sugarcane	Muchow et al. (1997)	Macknade, Q138
4,09	12	sugarcane	Muchow et al. (1997)	Ayr, Q96
4,28	12	sugarcane	Muchow et al. (1997)	Ayr, Q117
2,19	13	sugar beet	Martin (1986a)	
2,47	13	sugar beet	Martin (1986b)	
2,70	13	sugar beet	Clover et al. (2001)	
3,23	13	sugar beet	Sott and Jaggard (1993)	extract from Clover et al. (2001)
3,42	13	sugar beet	Biscoe and Gallagher (1977)	extract from Cannell et al. (1987)
1,90	14	oil palm	Hand et al. (1985)	extract from Cannell et al. (1987)
2,14	14	oil palm	Squire (1990)	chapter 11
3,35	15	Summer Rape	Morrison and Stewart (1995)	
2,28	15	oilseed rape	Mendham et al. (1981)	Justes et al. (2000)
2,22	15	oilseed rape	Justes et al. (2000)	
2,07	16	peanuts	Koizumi et al. (1990)	
2,61	16	peanuts	Bell et al. (1987)	
1,82	17	pigeon pea	Nam et al. (1998)	
2,23	17	mungbean	Muchow et al. (1993)	
2,49	17	cow pea	Muchow et al. (1993)	
2,92	17	pigeon pea	Hughes and Keatinge (1983)	
4,87	17	field beans	Fasheun and Dennett (1982)	
1,48	21	cotton	Pinter et al. (1994)	

1,56	21	cotton ‘TamcotCD3H’	Rosenthal and Gerik (1991)	
1,73	21	cotton ‘Deltapine 50’	Rosenthal and Gerik (1991)	
1,87	21	cotton	Pinter et al. (1994)	
1,90	21	cotton ‘Acala SJ-2’	Rosenthal and Gerik (1991)	
2,14	22	cocoa	Squire (1990)	
1,60	24	olive	Mariscal et al. (2000)	
2,61	25	forage and grain legumes	Charles-Edwards (1982)	extract from Cannell et al. (1987)
3,04	25	lucerne	Brown et al. (2006)	
3,90	25	Italian ryegrass	Koizumi et al. (1990)	
1,52	26	bell pepper	Vieira et al. (2009)	
1,73	26	sweet pepper	del Amor and Gomez-Lopez (2009)	
2,26	26	fibre hemp	Meijer et al. (1995)	
2,38	26	Garlic	Rizzalli et al. (2002)	
2,54	26	Oat	Muurinen and Peltonen-Sainio (2006)	
3,18	26	Quinoas	Ruiz and Bertero (2008)	
3,44	26	Garlic	Rizzalli et al. (2002)	
4,16	26	Lettuce	Hand et al. (1985)	extract from Cannell et al. (1987)
2,09	26	Chrysanthemum	Charles-Edwards (1982)	extract from Cannell et al. (1987)

1 Table S2. Rotation history of the eddy covariance flux sites used in our study.

site ID	country	latitude	longitude	crop type	period (year, month)	PI / references
BE_Lon	Belgium	50.5522	4.74494	sugar beet	2004-04, 2004-09	Aubinet et al. (2009); Moors et al. (2010)
				winter wheat	2004-10, 2005-09	
				potato	2006-10, 2006-12 2005-10, 2006-04	
CN_Du1	China	42.0456	116.671	wheat	2005-05, 2005-09	Chen et al. (2009)
DE_Geb	Germany	51.1001	10.9143	rapeseed	2003-08, 2004-08	Kutsch et al. (2010); Moors et al. (2010)
				winter barley	2004-09, 2005-07	
				sugar beet	2005-11, 2006-09	
DE_Kli	Germany	50.8929	13.5225	rapeseed	2004-09, 2005-08	Christian Bernhofer
				winter wheat	2005-10, 2006-09	
DK_Ris	Denmark	55.5303	12.0972	winter wheat	2004-01, 2005-12	Henrik Soegaard ; Ceschia et al. (2010); Moors et al. (2010)
ES_ES2	Spain	39.2755	-0.31522	rice	2004-05, 2004-09	Maria Jose Sanz; Moors et al. (2010); Kutsch et al. (2010); Ceschia et al. (2010)
					2005-05, 2005-09	
					2006-05, 2006-09	
FR_Gri	France	48.844	1.95243	wheat	2005-11, 2006-07	Pierre Cellier
IE_Ca1	Ireland	52.8588	-6.91814	spring barley	2004-03, 2004-07	Mike Jones; Ceschia et al. (2010); Moors et al. (2010)
					2005-03, 2005-07	
					2006-03, 2006-07	
JP_Mas	Japan	36.05397	140.0269	rice	2002-05, 2002-09	Akira Miyata
					2003-05, 2003-09	
NL_Lan	Netherlands	51.9536	4.9029	maize	2005-06, 2005-10	Eddy Moors; Moors et al. (2010);
US_ARM	USA	36.6058	-97.4888	wheat	2003-01, 2003-07	Marc Fischer Fischer et al. (2007)
					2003-09, 2004-06	
US_Bo1	USA	40.0062	-88.2904	maize	2001-05, 2001-10	Meyers and Hollinger,

					2003-05, 2003-10 2005-05, 2005-10 2000-05, 2000-10 2002-05, 2002-10 2004-05, 2004-10 2006-05, 2006-10	(2004); Meyers et al. (2006)
				soybean		
US_Bo2	USA	40.009	-88.29	maize	2004-05, 2004-10 2006-05, 2006-10	Carl Bernacchi
				soybean	2005-05, 2005-10	
US_Ne1	USA	41.1651	-96.4766	maize	2001-06, 2001-10 2002-06, 2002-09 2003-06, 2003-10 2004-06, 2004-10	Shashi Verma; Verma et al. (2005)
US_Ne2	USA	41.1649	-96.4701	maize	2001-05, 2001-10 2003-05, 2003-10	Shashi Verma; Verma et al. (2005)
				soybean	2002-06, 2002-10 2004-06, 2004-10	
US_Ne3	USA	41.1797	-96.4397	maize	2001-05, 2001-10 2003-05, 2003-10	Shashi Verma; Verma et al. (2005)
				soybean	2002-06, 2002-10 2004-06, 2004-10	

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1 **References**

- 2 Abbate, P. E., Andrade, F. H., Culot, J. P., and Bindraban, P. S.: Grain yield in wheat: Effects of radiation
3 during spike growth period, *Field Crop. Res.*, 54, 245-257, 1997.
- 4 Allen, E. J. and Scott, R. K.: An Analysis of Growth of the Potato Crop, *J. Agr. Sci.*, 94, 583-606, 1980.
- 5 Aubinet, M., Moureaux, C., Bodson, B., Dufranne, D., Heinesch, B., Suleau, M., Vancutsem, F., and
6 Vilret, A.: Carbon sequestration by a crop over a 4-year sugar beet/winter wheat/seed potato/winter wheat
7 rotation cycle, *Agr. Forest. Meteorol.*, 149, 407-418, 2009.
- 8 Azamali, S. N, Gregory, P. J, and Monteith, J. L.: Effects of Planting Density on Water-Use and
9 Productivity of Pearl-Millet (*Pennisetum-Typhoides*) Grown on Stored Water .1. Growth of Roots and
10 Shoots, *Exp. Agr.*, 20, 203-214, 1984.
- 11 Begue, A., Desprat, J. F., Imbernon, J., and Baret, F.: Radiation use efficiency of Pearl-Millet in the
12 Sahelian zone, *Agr. Forest. Meteorol.*, 56, 93-110, 1991.
- 13 Bell, M. J., Muchow, R. C., and Wilson, G. L.: The Effect of plant-population on peanuts
14 (*arachis-hypogaea*) in a monsoonal tropical environment, *Field Crop. Res.*, 17, 91-107, 1987.
- 15 Bingham, I. J., Blake, J., Foulkes, M. J., and Spink, J.: Is barley yield in the UK sink limited? I.
16 Post-anthesis radiation interception, radiation-use efficiency and source-sink balance, *Field Crop. Res.*,
17 101, 198-211, 2007.
- 18 Biscoe, P. V., and Gallagher, J. N.: Weather, dry matter production and yield. *Environmental Effects on*
19 *Crop Physiology* (Ed. by J.J. Landsberg & C. V. Cutting), pp. 75-100. Academic Press, London. 1977.
- 20 Brown, H. E., Moot, D. J., and Teixeira, E. I.: Radiation use efficiency and biomass partitioning of
21 lucerne (*Medicago sativa*) in a temperate climate, *Eur. J. Agron.*, 25, 319-327, 2006.
- 22 Charles-Edwards, D. A.: *Physiological determinants of crop growth*. Academic Press, London. 1982.
- 23 Cannell, M. G. R., Milne, R., Sheppard, L. J., and Unsworth, M. H.: Radiation interception and
24 productivity of Willow, *J. Appl. Ecol.*, 24, 261-278, 1987.
- 25 Caviglia, O. P., and Sadras, V. O.: Effect of nitrogen supply on crop conductance, water- and radiation-use

1 efficiency of wheat, *Field Crop. Res.*, 69, 259-266, 2001.

2 Ceschia, E., Beziat, P., Dejoux, J. F., Aubinet, M., Bernhofer, C., Bodson, B., Buchmann, N., Carrara, A.,
3 Cellier, P., Di Tommasi, P., Elbers, J. A., Eugster, W., Grunwald, T., Jacobs, C. M. J., Jans, W. W. P., Jones,
4 M., Kutsch, W., Lanigan, G., Magliulo, E., Marloie, O., Moors, E. J., Moureaux, C., Olioso, A., Osborne,
5 B., Sanz, M. J., Saunders, M., Smith, P., Soegaard, H., and Wattenbach, M.: Management effects on net
6 ecosystem carbon and GHG budgets at European crop sites, *Agr. Ecosyst. Environ.*, 139, 363-383, 2010.

7 Chen, S. P., Chen, J. Q., Lin, G. H., Zhang, W. L., Miao, H. X., Wei, L., Huang, J. H., and Han, X. G.:
8 Energy balance and partition in Inner Mongolia steppe ecosystems with different land use types, *Agr.*
9 *Forest. Meteorol.*, 149, 1800-1809, 2009.

10 Clover, G. R. G., Jaggard, K. W., Smith, H. G., and Azam-Ali, S. N.: The use of radiation interception and
11 transpiration to predict the yield of healthy, droughted and virus-infected sugar beet, *J. Agr. Sci.*, 136,
12 169-178, 2001.

13 del Amor, F. M., and Gomez-Lopez, M. D.: Agronomical response and water use efficiency of sweet
14 pepper plants grown in different greenhouse substrates, *Hortscience*, 44, 810-814, 2009.

15 Dercas, N., and Liakatas, A.: Water and radiation effect on sweet sorghum productivity, *Water Resour.*
16 *Manag.*, 21, 1585-1600, 2007.

17 Fasheun, A., and Dennett, M. D.: Interception of radiation and growth efficiency in field beans
18 (*Vicia-Faba L*), *Agr. Meteorol.*, 26, 221-229, 1982.

19 Fischer, M. L., Billesbach, D. P., Berry, J. A., Riley, W. J., and Torn, M. S.: Spatiotemporal variations in
20 growing season exchanges of CO₂, H₂O, and sensible heat in agricultural fields of the Southern Great
21 Plains, *Earth Interact.*, 11, 2007.

22 Foulkes, M. J., Snape, J. W., Shearman, V. J., Reynolds, M. P., Gaju, O., and Sylvester-Bradley, R.:
23 Genetic progress in yield potential in wheat: recent advances and future prospects, *J. Agr. Sci.*, 145, 17-29,
24 2007.

25 Gallagher, J. N., and Biscoe, P. V.: Radiation absorption, growth and yield of cereals, *J. Agr. Sci.*, 91,
26 47-60, 1978.

- 1 Hand, D. W., Sweeney, D. G., Hunt, R., and Wilson, J. W.: Integrated analysis of growth and light
2 interception in winter lettuce .2. differences between cultivars, *Ann. Bot-London*, 56, 673-682, 1985.
- 3 Haverkort, A. J., and Harris, P. M.: A model for potato growth and yield under tropical highland
4 conditions, *Agr. Forest. Meteorol.*, 39, 271-282, 1987.
- 5 Hughes, G., and Keatinge, J. D. H.: Solar-radiation interception, dry-matter production and yield in
6 pigeonpea (*cajanus-cajan* (l) millspaugh), *Field Crop. Res.*, 6, 171-178, 1983.
- 7 Jamieson, P. D., Porter, J. R., and Wilson, D. R.: A test of the computer-simulation model archwheat1 on
8 wheat crops grown in New-Zealand, *Field Crop. Res.*, 27, 337-350, 1991.
- 9 Jamieson, P. D., Martin, R. J., Francis, G. S., and Wilson, D. R.: Drought effects on biomass production
10 and radiation-use efficiency in barley, *Field Crop. Res.*, 43, 77-86, 1995.
- 11 Justes, E., Denoroy, P., Gabrielle, B., and Gosse, G.: Effect of crop nitrogen status and temperature on the
12 radiation use efficiency of winter oilseed rape, *Eur. J. Agron.*, 13, 165-177, 2000.
- 13 Katsura, K., Maeda, S., Horie, T., and Shiraiwa, T.: Analysis of yield attributes and crop physiological
14 traits of Liangyoupeijiu, a hybrid rice recently bred in China, *Field Crop. Res.*, 103, 170-177, 2007.
- 15 Kemanian, A. R., Stockle, C. O., and Huggins, D. R.: Variability of barley radiation-use efficiency, *Crop
16 Sci.*, 44, 1662-1672, 2004.
- 17 Kiniry, J. R., Jones, C. A., Otoole, J. C., Blanchet, R., Cabelguenne, M., and Spanel, D. A.: Radiation-use
18 efficiency in biomass accumulation prior to grain-filling for 5 grain-crop species, *Field Crop. Res.*, 20,
19 51-64, 1989.
- 20 Koizumi, H., Usami, Y., and Satoh, M.: Annual net primary production and efficiency of solar-energy
21 utilization in 3 double-cropping agroecosystems in Japan, *Agr. Ecosyst. Environ.*, 32, 241-255, 1990.
- 22 Kooman, P. L., Fahem, M., Tegera, P., and Haverkort, A. J.: Effects of climate on different potato
23 genotypes .1. Radiation interception, total and tuber dry matter production, *Eur. J. Agron.*, 5, 193-205,
24 1996.
- 25 Kutsch, W. L., Aubinet, M., Buchmann, N., Smith, P., Osborne, B., Eugster, W., Wattenbach, M.,

- 1 Schrumpf, M., Schulze, E. D., Tomelleri, E., Ceschia, E., Bernhofer, C., Beziat, P., Carrara, A., Di
2 Tommasi, P., Grunwald, T., Jones, M., Magliulo, V., Marloie, O., Moureaux, C., Olioso, A., Sanz, M. J.,
3 Saunders, M., Sogaard, H., and Ziegler, W.: The net biome production of full crop rotations in Europe,
4 *Agr. Ecosyst. Environ.*, 139, 336-345, 2010.
- 5 Leepipatpaiboon, S., Boonyawat, S., and Sarobol, E.: Estimation of solar radiation use efficiency in
6 paddy and cassava fields, *Kasetsart J, Nat. Sci.*, 43, 642 - 649 2009.
- 7 Legg, B. J., Day, W., Lawlor, D. W., and Parkinson, K. J.: Effects of drought on barley growth - models
8 and measurements showing the relative importance of leaf area and photosynthetic rate, *J. Agr. Sci.*, 92,
9 703-716, 1979.
- 10 Lindquist, J. L., Arkebauer, T. J., Walters, D. T., Cassman, K. G., and Dobermann, A.: Maize radiation use
11 efficiency under optimal growth conditions, *Agron. J.*, 97, 72-78, 2005.
- 12 Mariscal, M. J., Orgaz, F., and Villalobos, F. J.: Radiation-use efficiency and dry matter partitioning of a
13 young olive (*Olea europaea*) orchard, *Tree Physiol.*, 20, 65-72, 2000.
- 14 Martin, R. J.: Radiation interception and growth of sugar-beet at different sowing dates in canterbury,
15 *New Zeal J. Agr. Res.*, 29, 381-390, 1986a.
- 16 Martin, R. J.: Growth of sugar-beet crops in Canterbury, *New Zeal J. Agr. Res.*, 29, 391-400, 1986b.
- 17 Mastrorilli, M., Katerji, N., Rana, G., and Steduto, P.: Sweet sorghum in Mediterranean climate:
18 radiation use and biomass water use efficiencies, *Industrial Crops And Products*, 253-260,
19 1995.
- 20 Mcintyre, B. D., Flower, D. J., and Riha, S. J.: Temperature and soil-water status effects on radiation use
21 and growth of pearl-millet in a semiarid environment, *Agr. Forest. Meteorol.*, 66, 211-227, 1993.
- 22 Meijer, W. J. M., Vanderwerf, H. M. G., Mathijssen, E. W. J. M., and Vandenbrink, P. W. M.: Constraints
23 to dry-matter production in fiber hemp (*Cannabis-Sativa L*), *Eur. J. Agron.*, 4, 109-117, 1995.
- 24 Mendham, N. J., Shipway, P. A., and Scott, R. K.: The effects of delayed sowing and weather on growth,
25 development and yield of winter oil-seed rape (*brassica-napus*), *J. Agr. Sci.*, 96, 389-416, 1981.

- 1 Meyers, T. P., and Hollinger, S. E.: An assessment of storage terms in the surface energy balance of maize
2 and soybean, *Agr. Forest. Meteorol.*, 125, 105-115, 2004.
- 3 Meyers, T. P., Luke, W. T., and Meisinger, J. J.: Fluxes of ammonia and sulfate over maize using relaxed
4 eddy accumulation, *Agr. Forest. Meteorol.*, 136, 203-213, 2006.
- 5 Moors, E. J., Jacobs, C., Jans, W., Supit, I., Kutsch, W. L., Bernhofer, C., Beziat, P., Buchmann, N.,
6 Carrara, A., Ceschia, E., Elbers, J., Eugster, W., Kruijt, B., Loubet, B., Magliulo, E., Moureaux, C., Olioso,
7 A., Saunders, M., and Soegaard, H.: Variability in carbon exchange of European croplands, *Agr. Ecosyst.
8 Environ.*, 139, 325-335, 2010.
- 9 Morrison, M. J., and Stewart, D. W.: Radiation-use efficiency in summer rape, *Agron. J.*, 87, 1139-1142,
10 1995.
- 11 Muchow, R. C., Robertson, M. J., and Pengelly, B. C.: Radiation-use efficiency of soybean, mungbean
12 and cowpea under different environmental-conditions, *Field Crop. Res.*, 32, 1-16, 1993.
- 13 Muchow, R. C., Evensen, C. I., Osgood, R. V., and Robertson, M. J.: Yield accumulation in irrigated
14 sugarcane .2. Utilization of intercepted radiation, *Agron. J.*, 89, 646-652, 1997.
- 15 Muurinen, S., and Peltonen-Sainio, P.: Radiation-use efficiency of modern and old spring cereal cultivars
16 and its response to nitrogen in northern growing conditions, *Field Crop. Res.*, 96, 363-373, 2006.
- 17 Nam, N. H., Subbarao, G. V., Chauhan, Y. S., and Johansen, C.: Importance of canopy attributes in
18 determining dry matter accumulation of pigeonpea under contrasting moisture regimes, *Crop Sci.*, 38,
19 955-961, 1998.
- 20 Opoku-Ameyaw, K., and Harris, P. M.: Intercropping potatoes in early spring in a temperate climate. 2.
21 Radiation utilization, *Potato Res.*, 44, 63-74, 2001.
- 22 Pinter, P. J., Kimball, B. A., Mauney, J. R., Hendrey, G. R., Lewin, K. F., and Nagy, J.: Effects of free-air
23 carbon-dioxide enrichment on par absorption and conversion efficiency by cotton, *Agr. Forest. Meteorol.*,
24 70, 209-230, 1994.
- 25 Rizzalli, R. H., Villalobos, F. J., and Orgaz, F.: Radiation interception, radiation-use efficiency and dry
26 matter partitioning in garlic (*Allium sativum* L.), *Eur. J. Agron.*, 18, 33-43, 2002.

- 1 Rosenthal, W. D., and Gerik, T. J.: Radiation use efficiency among cotton cultivars, *Agron. J.*, 83,
2 655-658, 1991.
- 3 Rosenthal, W. D., Gerik, T. J., and Wade, L. J.: Radiation-use efficiency among grain-sorghum cultivars
4 and plant densities, *Agron. J.*, 85, 703-705, 1993.
- 5 Ruiz, R. A., and Bertero, H. D.: Light interception and radiation use efficiency in temperate quinoa
6 (*Chenopodium quinoa* Willd.) cultivars, *Eur. J. Agron.*, 29, 144-152, 2008.
- 7 Scott, R.K., and Jaggard, K. W.: Crop physiology and agronomy. In the sugar beet crop: science into
8 practice (Eds D. A. Cooke & R. K. Scott), pp. 178±237. London: Chapman and Hall. 1993.
- 9 Shah, S. F. A., McKenzie, B. A., Gaunt, R. E., Marshall, J. W., and Frampton, C. M.: Effect of production
10 environments on radiation interception and radiation use efficiency of potato (*Solanum tuberosum*) grown
11 in Canterbury, New Zealand, *New Zeal J. Crop. Hort.*, 32, 113-119, 2004.
- 12 Sinclair, T. R., and Horie, T.: Leaf nitrogen, photosynthesis, and crop radiation use efficiency - a review,
13 *Crop Sci.*, 29, 90-98, 1989.
- 14 Squire, G. R.: The physiology of tropical crop production, C.A.B. International, Wallingford, U.K. ,
15 1990.
- 16 Trapani, N., Hall, A. J., Sadras, V. O., and Vilella, F.: Ontogenic changes in radiation use efficiency of
17 sunflower (*helianthus-annuus* l) crops, *Field Crop. Res.*, 29, 301-316, 1992.
- 18 Unsworth, M. H., Lesser, V. M., and Heagle, A. S.: Radiation interception and the growth of soybeans
19 exposed to ozone in open-top field chambers, *J. Appl. Ecol.*, 21, 1059-1077, 1984.
- 20 Varlet-Grancher, C., Chartier, M., Lemaire, G., Gosse, G., Bonhomme, R., Cruz, P., Castal, F., Lenoble,
21 S.: Productivity of sweet sorghum compared to Sudan-grass and sorghum Sudan grass hybrids: Radiation
22 interception and biomass accumulation under non limiting water and nitrogen conditions. In: Grassi, G.,
23 Collina, A., Zibetta, H. (eds) Proceedings 6th EC Conf, Biomass for Energy Industry and Environment,
24 Elsevier Applied Science, Oxford, pp 265-267, 1992.
- 25 Verma, S. B., Dobermann, A., Cassman, K.. G., Walters, D. T., Knops, J. M., Arkebauer, T. J., Suyker, A.
26 E., Burba, G. G., Amos, B., Yang, H. S., Ginting, D., Hubbard, K. G., Gitelson, A. A., and Walter-Shea, E.

- 1 A.: Annual carbon dioxide exchange in irrigated and rainfed maize-based agroecosystems, *Agr. Forest.*
2 *Meteorol.*, 131, 77-96, 2005.
- 3 Vieira, M. I., de Melo-Abreu, J. P., Ferreira, M. E., and Monteiro, A. A.: Dry matter and area partitioning,
4 radiation interception and radiation-use efficiency in open-field bell pepper, *Sci Hortic-Amsterdam*, 121,
5 404-409, 2009.
- 6 Whitman, C. E., Hatfield, J. L., and Reginato, R. J.: Effect of slope position on the microclimate, growth,
7 and yield of barley, *Agron. J.*, 77, 663-669, 1985.
- 8 Zhang, Y. B., Tang, Q. Y., Zou, Y. B., Li, D. Q., Qin, J. Q., Yang, S. H., Chen, L. J., Xia, B., and Peng, S.
9 B.: Yield potential and radiation use efficiency of "super" hybrid rice grown under subtropical conditions,
10 *Field Crop. Res.*, 114, 91-98, 2009.