

Supplementary materials

Table S1 Details of the field management practices for the cotton cropping system with observations for model validation ^a.

Date (yyyy-mm-dd)	Management practices
2007-11-09	Incorporation of aboveground residues (100%: 1.9 Mg C ha ⁻¹ and 57 kg N ha ⁻¹ on average) by plow tillage (30 cm depth)
2008-04-09	Tillage (20 cm)
2008-04-14	Sowing and film mulch (70% of covered soil surface area)
2008-07-01	Fertilization (band placement, 5 cm depth; urea: 59 kg N ha ⁻¹ ; diammonium hydrogen phosphate: 7 kg N ha ⁻¹)
2008-07-11	Irrigation (88.5 mm)
2008-08-02	Irrigation (95.7 mm)
2008-08-23	First cotton grain harvest (914.75 kg ha ⁻¹)
2008-09-16	Second cotton grain harvest (914.75 kg ha ⁻¹)
2008-10-03	Third cotton grain harvest (914.75 kg ha ⁻¹)
2008-10-26	Last cotton grain harvest (914.75 kg ha ⁻¹)
2008-11-05	Cutting cotton stems (machinery)
2008-11-06	Incorporation of aboveground residues (100%: 2.1 Mg C ha ⁻¹ and 61 kg N ha ⁻¹ on average) by plow tillage (30 cm)
2009-03-14	Tillage (20 cm)
2009-04-09	Irrigation (35.5 mm)
2009-04-10	Sowing and film mulch (70% of covered soil surface area)
2009-06-28	Fertilization (urea: 68 kg N ha ⁻¹ ; diammonium hydrogen phosphate: 7 kg N ha ⁻¹)
2009-07-13	Irrigation (85.3 mm)
2008-08-18	First cotton grain harvest (842.5 kg ha ⁻¹)
2009-08-21	Irrigation (58.5 mm)
2008-09-23	Second cotton grain harvest (842.5 kg ha ⁻¹)
2008-10-09	Third cotton grain harvest (842.5 kg ha ⁻¹)
2008-11-08	Last cotton grain harvest (842.5 kg ha ⁻¹)
2009-12-02	Cutting cotton stems (machinery)
2009-12-04	Incorporation of aboveground residues (100%: 1.6 Mg C ha ⁻¹ and 53 kg N ha ⁻¹ on average) by plow tillage (30 cm)

^aLi et al. (2009), Liu et al. (2010, 2014), Wang et al. (2013a, b), and the authors' unpublished data.

References

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Table S2 Details of the baseline field management practices except for irrigation.

Crop	Date (mm-dd)	Management
Cotton	04-09 ^a	Fertilization (urea: 43 kg N ha ⁻¹)
	04-10	Tillage (20 cm)
	04-14	Sowing and film mulch (70% area)
	06-27	Fertilization (band application, 5 cm; urea: 67 kg N ha ⁻¹)
	10-23 ^b	Final grain harvest
	10-24/11-06 ^c	Stem cutting and fully incorporation by plow tillage (30 cm depth)
Wheat	10-24 ^a	Fertilization (urea: 60 kg N ha ⁻¹)
	10-25	Tillage (20 cm); sowing
	03-06	Fertilization (band application, 5 cm; urea: 120 kg N ha ⁻¹)
	06-03	Harvest; straw incorporation (100%)
Maize	06-06	Tillage (20 cm); sowing
	07-11	Fertilization (band application, 5 cm; urea: 250 kg N ha ⁻¹)
	10-14	Harvest; straw incorporation (100%)

^a As it is assumed that there is no limit of phosphorous and potassium supplies, a minor nitrogen dose (approximately 5–10% of the total fertilizer nitrogen dose) in form of diammonium hydrogen phosphate is regarded as part of applied urea.

^b Although there are four agronomic harvests, the model calculation needs to know the date of the final one to terminate the cotton growing season and accumulation of the daily grain production.

^c The operations were performed immediately after the final cotton grain harvest if the wheat is planted in the following season.

Table S3 Baseline irrigation dates and amounts depending on precipitation.

Year	Cotton		Winter wheat–summer maize	
	Date (mm-dd)	Amount (mm)	Date (mm-dd)	Amount (mm)
1	07-15	106.3	03-15	106.3
	08-20	75	04-25	100
			06-10	50
			08-15	31.3
			12-18	106.3
2	07-11	106.3	03-23	75
	08-13	112.5	04-25	100
			06-08	125
			08-10	31.3
3	08-21	75	01-05	106.3
			03-21	75
			06-18	75
			08-10	31.3
			12-20	106.3
4	07-16	106.3	03-10	106.3
	08-15	112.5	04-19	100
			06-18	75
			08-07	100
			12-21	106.3
5	07-11	106.3	03-15	106.3
	08-21	75	04-28	100
			06-18	75
			07-17	81.3
			08-14	31.3
6	07-09	106.3	03-15	106.3
	08-23	75	04-19	100
			06-08	125
			08-13	31.3
			12-28	75
7	07-18	106.3	03-23	106.3
	08-23	75	04-25	100
			06-07	50
			08-18	31.3
			12-20	75
8	07-15	106.3	03-19	106.3
	08-24	75	04-20	100
			06-18	50
			08-13	31.3

			12-31	106.3
9	04-10	43.8	03-16	106.3
	07-20	106.3	04-22	100
	08-23	75	06-14	50
			08-09	31.3
10	07-15	106.3	01-05	75
	08-25	75	03-15	106.3
			04-25	100
			06-18	75
			08-13	100
			12-22	106.3
11	07-16	106.3	03-15	106.3
	08-10	75	05-04	100
			06-18	50
			08-12	31.3
			12-18	75
12	04-10	43.8	03-24	75
	08-19	75	04-19	100
			06-08	75
			08-18	31.3
			12-22	101.9
13	07-09	110.6	03-21	78.3
	07-31	119.4	06-08	125.6
			08-10	35.8
			12-18	72.8
14	04-09	44.4	03-15	111.8
	07-11	109.1	04-19	117
	08-21	73.1	06-10	52.4
			07-17	81.3
			08-14	26.6
15	04-09	43.8	01-09	111.8
	07-06	106.3	03-23	108.4
	08-17	37.5	05-04	97
			06-18	75.6
			08-07	116.9
			12-18	106.3
16	07-16	106.3	03-15	106.3
	08-16	75	04-29	100
			06-15	100
			08-14	50
			12-22	75
17	07-03	106.3	03-15	106.3

	08-14	75	04-28	100
			06-18	75
			08-12	31.3
			12-22	106.3
18	07-03	106.3	03-23	106.3
	08-21	75	04-30	100
			06-18	50
			08-18	31.3
			12-30	75