

Actions: Land use rights transfer



2013: No.1 Central Government Document

Guide the **orderly transfer** of rural land contractual management **rights**, encourage and support the **transfer of contracted land to large professional households, family farms, farmer cooperatives**, and develop various forms of moderate scale management.

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- Life cycle assessment – farm survey
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- SOC
- Carbon footprints
- Input use efficiency
- Grain production

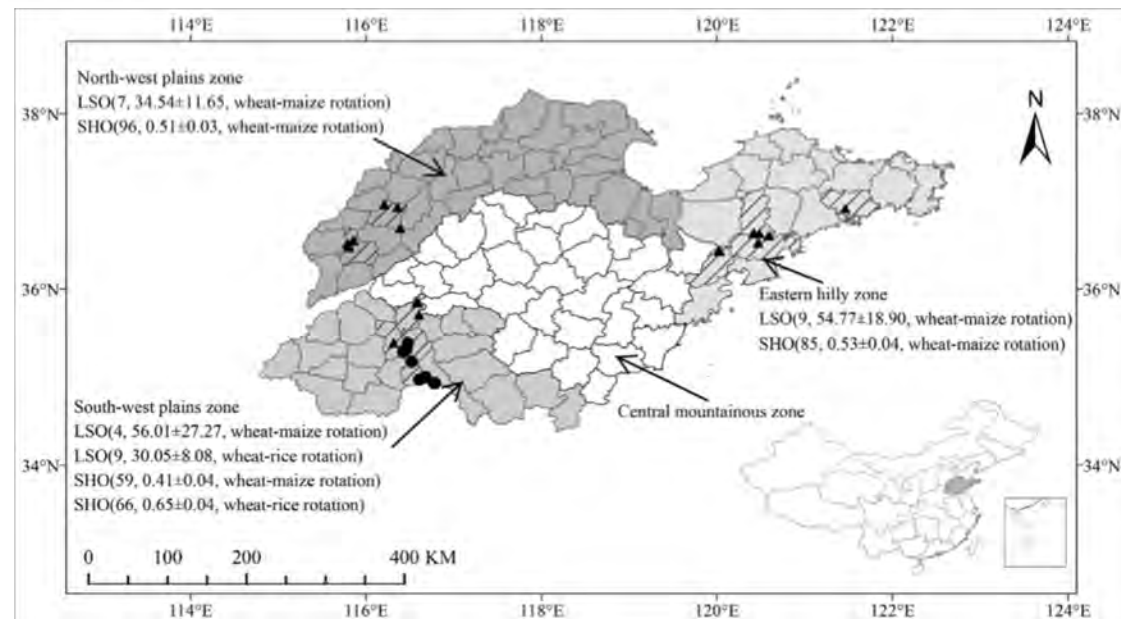
Large-scale farming operations are win-win for grain production, soil carbon storage and mitigation of greenhouse gases

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- Shandong province, major grain producing area of north China
- Wheat-maze and wheat-rice

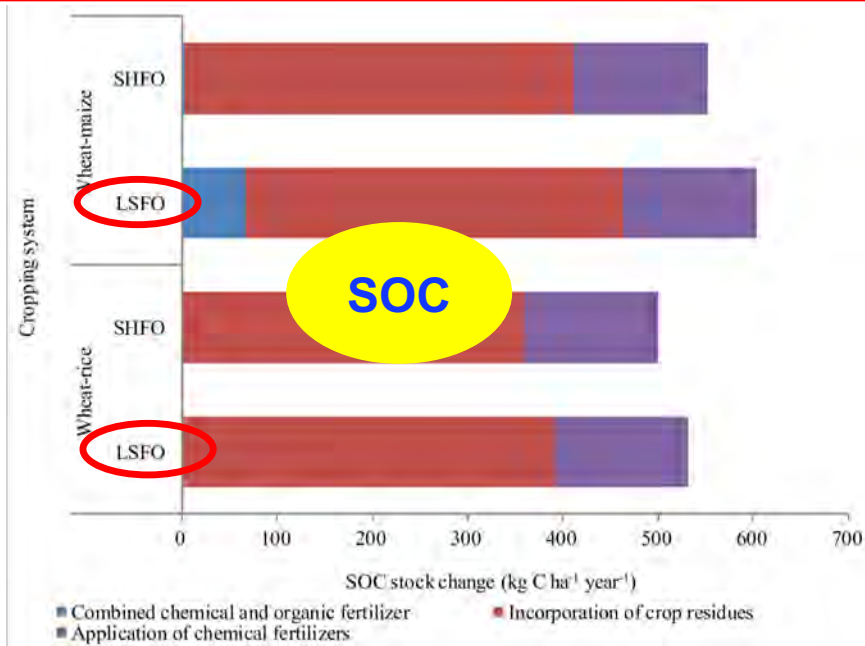
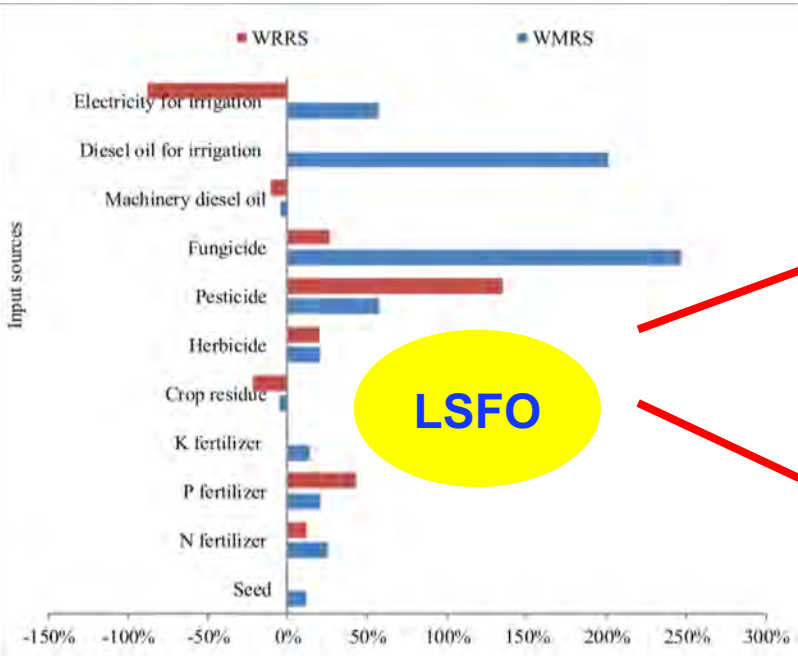


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Item	Abbreviation	Emission factor	Literature
Winter wheat seed	EF _{winter wheat seed}	0.40 kgCO ₂ e kg ⁻¹	West and Marland, 2002
Maize seed	EF _{maize seed}	3.85 kgCO ₂ e kg ⁻¹	West and Marland, 2002
Rice seed	EF _{rice seed}	1.99 kgCO ₂ e kg ⁻¹	This study ^a
N fertilizer	EF _{N fertilizer}	8.30 kgCO ₂ e kg ⁻¹	Zhang et al., 2013
P fertilizer	EF _{P fertilizer}	0.61 kgCO ₂ e kg ⁻¹	West and Marland, 2002
K fertilizer	EF _{K fertilizer}	0.44 kgCO ₂ e kg ⁻¹	West and Marland, 2002
Herbicide	EF _{herbicide}	17.24 kgCO ₂ e kg ⁻¹	West and Marland, 2002
Pesticide	EF _{pesticide}	18.08 kgCO ₂ e kg ⁻¹	West and Marland, 2002
Fungicide	EF _{fungicide}	18.98 kgCO ₂ e kg ⁻¹	West and Marland, 2002
Diesel oil	EF _{diesel oil}	3.10 kgCO ₂ e kg ⁻¹	NDRC, 2011
Electricity	EF _{electricity}	0.80 kgCO ₂ e kW h ⁻¹	NDRC, 2011
Direct N ₂ O emission from N fertilizer on upland crops	EF ₁	0.01 kg N ₂ O-N kg ⁻¹ N	IPCC, 2006
Direct N ₂ O emission from N fertilizer on flooded rice	EF _{1FR}	0.003 kg N ₂ O-N kg ⁻¹ N	IPCC, 2006
Indirect N ₂ O emission from synthetic N fertilizer volatilization	EF _{25N}	0.01 kg N ₂ O-N kg ⁻¹ N	IPCC, 2006
Indirect N ₂ O emission from N content volatilization of organic fertilizer	EF _{20N}	0.01 kg N ₂ O-N kg ⁻¹ N	IPCC, 2006
Indirect N ₂ O emission from N fertilizer leaching	EF ₃	0.0075 kg N ₂ O-N kg ⁻¹ N	IPCC, 2006
CH ₄ emission from rice paddy	EF ₄	215.5 kg CH ₄ ha ⁻¹	NDRC, 2011
Changes in soil organic carbon stocks			
Combined chemical and organic fertilizer		667 kg C ha ⁻¹ year ⁻¹	Li et al., 2017
Straw incorporation		440 kg C ha ⁻¹ year ⁻¹	Li et al., 2017
Application of chemical fertilizer		136 kg C ha ⁻¹ year ⁻¹	Li et al., 2017
Application of organic fertilizer		483 kg C ha ⁻¹ year ⁻¹	Li et al., 2017

GHG emission and SOC stock change factors

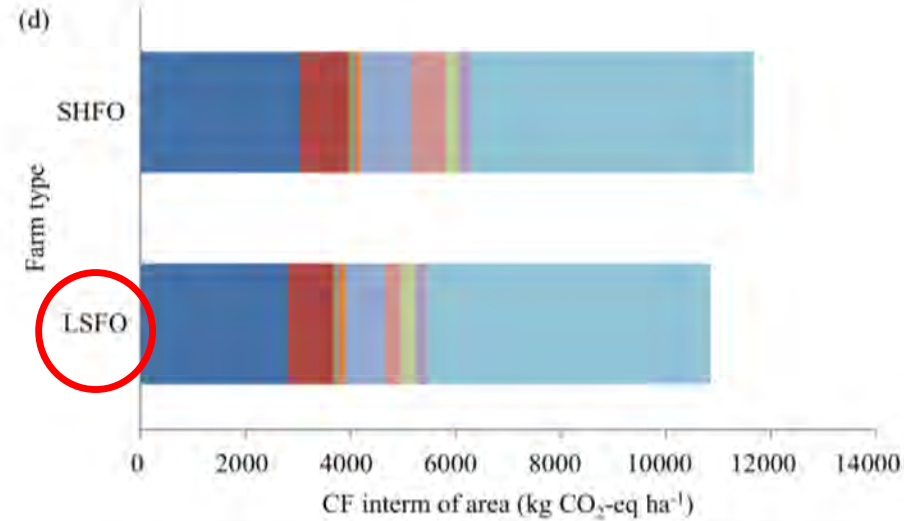
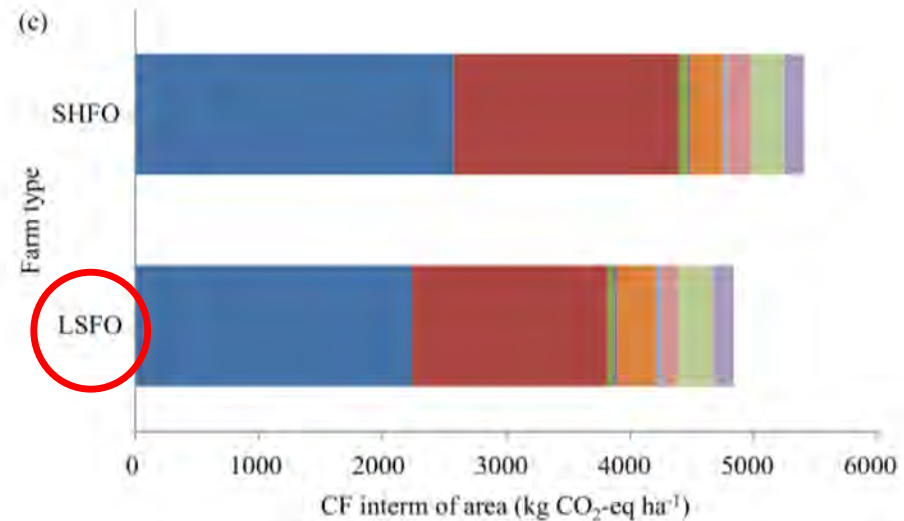
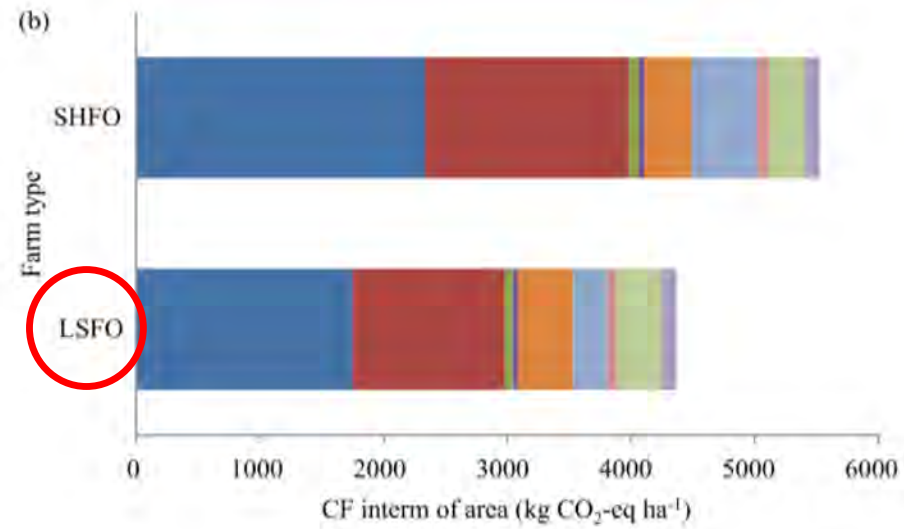
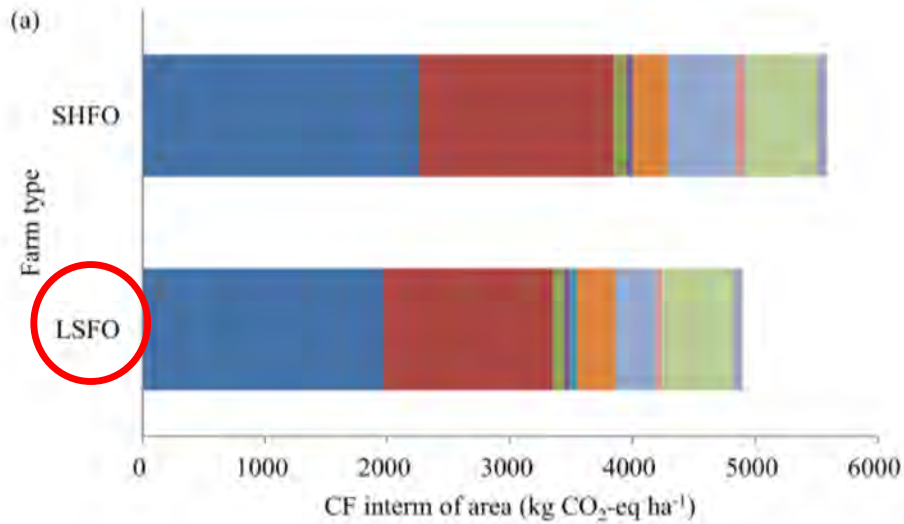
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Input efficiency
increase percentage

Crop	Farm type ^a	Farm size (ha)	Grain yield (kg ha ⁻¹)	Seed (kg ha ⁻¹)	N fertilizer (kg N ha ⁻¹)
Wheat	LSFO (20)	47.94 ± 10.55	7785.0 ± 343.6	208.3 ± 15.2	237.1 ± 16.3
	(WMRS) SHFO (240)	0.49 ± 0.02	7488.4 ± 77.4	211.9 ± 3.3	272.2 ± 6.7
Maize	LSFO (20)	47.94 ± 10.55	9281.3 ± 334.2	30.9 ± 1.2	210.5 ± 17.3
	(WMRS) SHFO (240)	0.49 ± 0.02	8605.6 ± 102.1	29.6 ± 0.4	281.4 ± 7.3
wheat	LSFO (9)	30.05 ± 8.08	7333.3 ± 154.5	420.8 ± 16.3	269.6 ± 21.9
	(WRRS) SHFO (66)	0.65 ± 0.04	6929.7 ± 117.4	415.1 ± 5.8	310.3 ± 9.6
rice	LSFO (9)	30.05 ± 8.08	9375.0 ± 375.0	115.4 ± 21.5	339.2 ± 20.3
	(WRRS) SHFO(66)	0.65 ± 0.04	9602.2 ± 127.6	115.7 ± 10.0	365.7 ± 9.2

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SHFO



LSFO



↑ Organic fertilizer & straw incorporation 16~28%

↑ Grain yield 1~6%

↑ SOC stock 6~9%
(531~ 603 kg C ha⁻¹ a⁻¹)

↓ N input 7~25%

↓ Pesticides, herbicides, fungicides 25~53%

↓ Carbon foot prints 7~21%

In conclusion

- **China is actively promoting the utilization of farmland waste resources and strengthening the research and promotion of soil carbon increase measures**
- **Long-term (≥ 20 years) application of fertilizers and straw return enhances soil carbon storage**
- **Large-scale farming operations are win-win for grain production, soil carbon storage and mitigation of greenhouse gases**



Thanks!