

**Table S1**

Resource consumption for drying-wetting water and fertilizer management (FEM) and the water and fertilizer integration (AIM) in Dongpo District from 2020 and 2021 (2-year average).

S.N.	Items	Units	FEM	AIM
A.	Machinery			
1.	Sowing machine	h ha <sup>-1</sup>	0.50	0.50
2.	Tillage machine	h ha <sup>-1</sup>	4.13	4.13
3.	Leveling machine	h ha <sup>-1</sup>	3.53	3.53
5.	Rice transplanter	h ha <sup>-1</sup>	3.22	3.22
7.	Fertilization machine	h ha <sup>-1</sup>	3.22	3.22
8.	Pesticide sprayer	h ha <sup>-1</sup>	3.22	3.22
9.	Water-fertilizer integration machine	h ha <sup>-1</sup>	0.00	30.23
10.	Drone	h ha <sup>-1</sup>	0.45	0.45
11.	Harvester	h ha <sup>-1</sup>	2.02	2.02
B.	Human labor	man-h ha <sup>-1</sup>	231.60	196.33
C.	Fuel			
1.	Diesel	L ha <sup>-1</sup>	50.88	50.88
2.	Electricity	kWh ha <sup>-1</sup>	1.25	28.29
D.	Fertilizer			
3.	Nitrogen	kg ha <sup>-1</sup>	150.09	123.03
4.	Phosphorus	kg ha <sup>-1</sup>	75.64	61.28
5.	Potassium	kg ha <sup>-1</sup>	149.15	123.02
E.	Others			
1.	Water	m <sup>3</sup> ha <sup>-1</sup>	3854.98	2713.90
2.	Plastic film	kg ha <sup>-1</sup>	1.46	1.46
3.	Insecticide	kg ha <sup>-1</sup>	2.42	1.77
4.	Herbicide	kg ha <sup>-1</sup>	0.53	0.42
5.	Fungicide	kg ha <sup>-1</sup>	0.65	0.50
6.	Seed	kg ha <sup>-1</sup>	18.01	18.01

**Table S2**

Description of parameters needed for estimating energy inputs with machinery.

S. N.	Implements	Type	Unit weight (kg)	Fuel consumption (h <sup>-1</sup> )	Operational life (h)	Field working efficiency( %)	Power source
A.	Field preparation						
1.	Tillage machine	4WD 62.7 kW diesel engine KUBOTA M854K tractor with plough	3400	16.85	2500	65	Diesel
2.	Leveling machine	4WD 62.7 kW diesel engine KUBOTA M854K tractor with harrow	3250	13.40	2500	65	Diesel
B.	Seeds preparation						
	Sowing machine	370W YAZAKI SYS1000C rice seed planter	210	370 W	1500	75	Electricity
C.	Transplanter machine	4WD 16.1 kW diesel engine KUBOTA SPV-8C25 rice transplanter	860	3.60	3000	60	Diesel
D.	Field management						
1.	Fertilization machine for the first fertilizing	KUBOTA FSPV8C25 driven by KUBOTA SPV-8C25 engine and completed synchronously with transplanting/direct seeding	62.5	0.42	1500	70	Diesel
2.	Pesticide sprayer for the first pesticide spraying	KUBOTA CS-6C driven by KUBOTA SPV-8C25 engine and completed synchronously with transplanting seeding	35.0	0.36	1500	70	Diesel
3.	Water-fertilizer integration machine	150 W power engine of BOYUN with fertilizer pipeline	35.0	150W	1800	65	Electricity
4.	Pesticide sprayer	4.6 KW power engine of DJI T16 with fertilizer sprayer	42	4.60 kW	1000	85	Electricity
E.	Harvesting and threshing		3750	16.25	3500	60	Diesel

**Table S3**

Energy equivalents of agricultural inputs and outputs.

Particulars	Unit	Energy equivalent(MJ unit <sup>-1</sup> )	References
A. Inputs			
1. Machinery	h	62.70	[26]
2. Labor	h	1.96	[27]
3. Diesel (including the cost of lubricants)	L	56.31	[28]
4. Electricity	kWh	3.60	[29]
5. Chemical fertilizer			
Nitrogen (N)	kg	66.14	[30]
Phosphorus (P <sub>2</sub> O <sub>5</sub> )	kg	12.44	[30]
Potassium (K <sub>2</sub> O)	kg	11.15	[31]
6. Water	m <sup>3</sup>	1.02	[28]
7. Pesticide			
Insecticide	kg	101.20	[32]
Herbicide	kg	238.00	[32]
Fungicide	kg	216.00	[33]
8. Plastic film	kg	158.00	[29]
9. Seed	kg	14.70	[34]
B. Outputs			
1. Rice grain	kg	17.00	[34]
2. Straw	kg	12.50	[34]

**Table S4**

Emission factors are used for estimating greenhouse gas emissions from manufacturing, packaging, and transportation of agricultural inputs.

Particulars	Unit	Emission factor (kg CO <sub>2</sub> -eq unit <sup>-1</sup> )	References
Machinery	MJ	0.071	[38]
Diesel	l	2.75	[39]
Urea	kg	2.51	[40]
Superphosphate	kg	0.17	[41]
Muriate of potash	kg	0.23	[41]
Insecticide	kg	5.10	[42]
Herbicide	kg	6.30	[42]
Fungicide	kg	3.90	[42]
Rice seed	kg	0.78	[43]
Plastic film	kg	1.47	[44]
Electricity	KWh	1.12	[44]

**Table S5**

Unit prices of rice grain and the various inputs. Data were retrieved from National Development and Reform Commission.

Particulars	Unit	Price (\$ unit <sup>-1</sup> )
1. Machinery		
Tillage, leveling, and harvester	h	13.85
Transplanter	h	16.23
Sowing machine	h	75.00
Fertilization machine for the first fertilizing	h	0.26
2. Drone	h	92.31
3. Labor	h	2.20
4. Diesel	l	0.95
5. Urea	kg	0.29
6. Superphosphate	kg	0.10
7. Muriate of potash	kg	0.45
8. Insecticide	kg	72.26
9. Herbicide	kg	120.44
10. Fungicide	kg	316.16
11. Rice seed	kg	9.55
12. Plastic film	kg	0.45
13. Electricity	kWh	0.08
14. Single-season indica rice	kg	0.40