Supplementary Materials: Mapping Smallholder Wheat Yields and Sowing Dates Using Micro-Satellite Data

Meha Jain, Amit K. Srivastava, Balwinder-Singh, Rajiv K. Joon, Andrew McDonald, Keitasha Royal, Madeline C. Lisaius and David B. Lobell

Table S1. Mask classification accuracy for agriculture versus non-agriculture landcover classes in both the training and validation data using random forest models.

Data	Agriculture	Non-Agriculture	User's Accuracy %
Training	162	0	100
	0	38	100
Validation	61	14	81.33
	4	18	81.81

Table S2. Crop model parameters used to run APSIM models.

Parameter	Range	Description	References
Fertilizer	0 kg, 50 kg urea	Amount of fertilizer added at sowing and 40 days after sowing	Field data
Sow dates	1 Nov., 20 Nov., 10 Dec., 30 Dec.	Date when wheat was sown	Field data
Initial water	32%, 60% and 100% filled	Amount of initial soil water filled	Field data; Singh et al., 2015
Soil water deficit	10 mm, 40 mm	Amount of soil water deficit until farmers apply irrigation	Default in APSIM; Singh et al., 2015
Deficit calculated to this layer	60 cm	Depth at which soil water deficit is calculated	Singh et al., 2015
Water applied when soil water deficit occurs	0 mm, 10 mm, 70 mm	Amount of water applied when deficit occurs (no, low, and typical)	Field data; Singh et al., 2015
Cultivar	PBW-343	Crop cultivar planted	Singh et al., 2015
Soil type	Silt (BARI-05, No. 663)	Type of soil	Field data
Initial surface residue	1000 kg/ha of rice	Amount of initial residue from previous crop	Field data
Sowing density	200 plants/m^2	Density wheat is sown	Singh et al., 2015
Sowing depth	50 mm	Depth at which seed is sown	Singh et al., 2015
Row spacing	200 mm	Spacing between rows	Singh et al., 2015
Reset water, nitrogen, surface organic matter, and phosphorus	Yes, but did not reset phosphorus	Reset all nutrient parameters at the time of sowing except for phosphorus	
CO_2	400 ppm	Amount of CO_2 in atmosphere	

Table S3. Correlation of mean GCVIs for all crop cut polygons for each image date.

	2014–2015 Imagery					
	18 February	**11 March**	**22 March**	**23 March**	**28 March**	**6 April**
18 February	-	0.188	0.098	0.069	−0.131	−0.137
11 March	-	-	0.807	0.801	0.620	0.090
22 March	-	-	-	0.986	0.868	0.510
23 March	-	-	-	-	0.886	0.502
28 March	-	-	-	-	-	0.455
6 April	-	-	-	-	-	-
	2015–2016 Imagery					
	21 December	**3 January**	**11 February**	**16 March**	**4 April**	-
21 December	-	0.636	0.408	−0.056	−0.402	-
3 January	-	-	0.71	0.007	−0.369	-
11 February	-	-	-	0.307	−0.376	
16 March	-	-	-	-	0.458	-
4 April	-	-	-	-	-	-

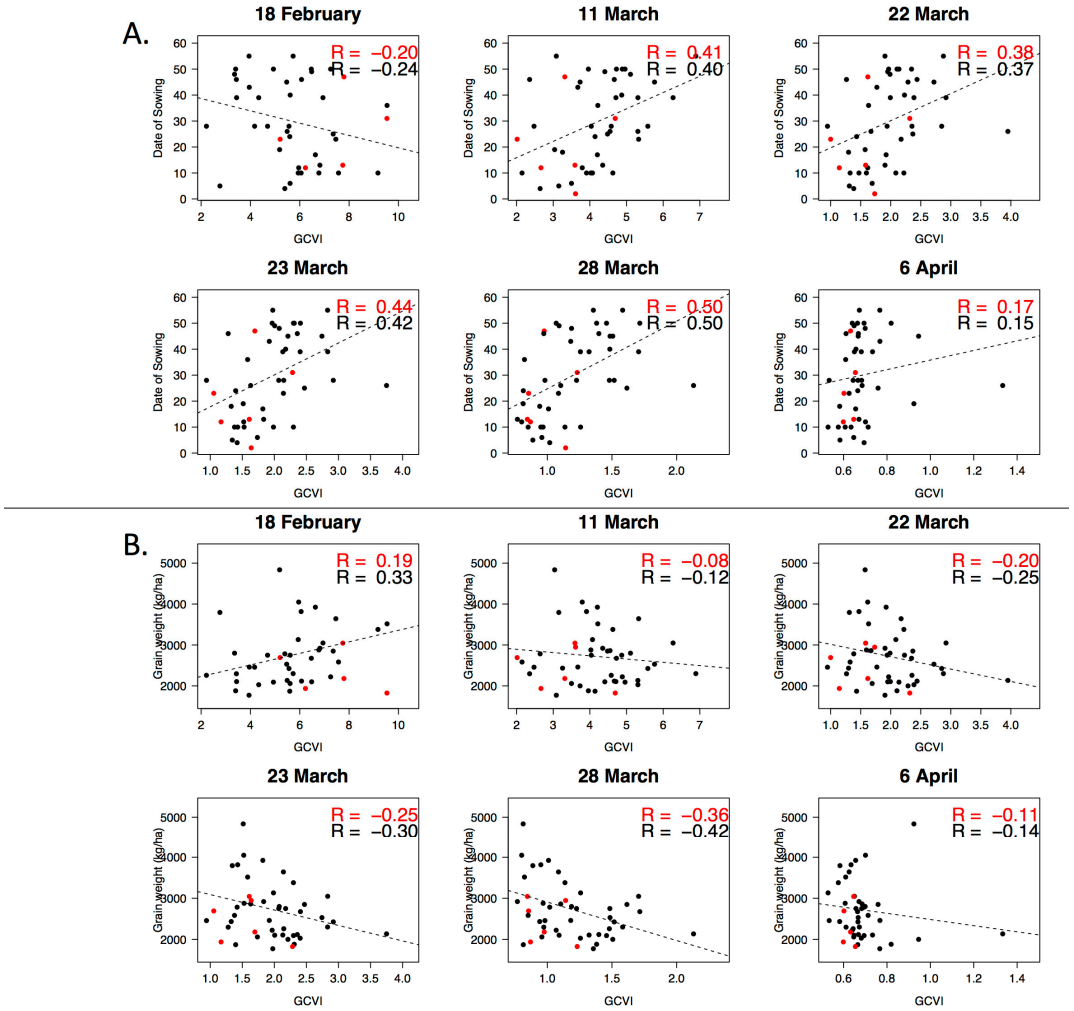

Figure S1. Scatterplots of GCVI versus sow date (**A**) or yield (**B**) for each image date in 2014–2015, with heavily lodged fields in red. Correlation values between GCVI and sow date (**A**) or yield (**B**) are shown. Red text represents correlation values including lodged fields, and black text shows correlation values with these lodged fields removed. The best fit line without lodged plots is highlighted with a dashed line in each graph.

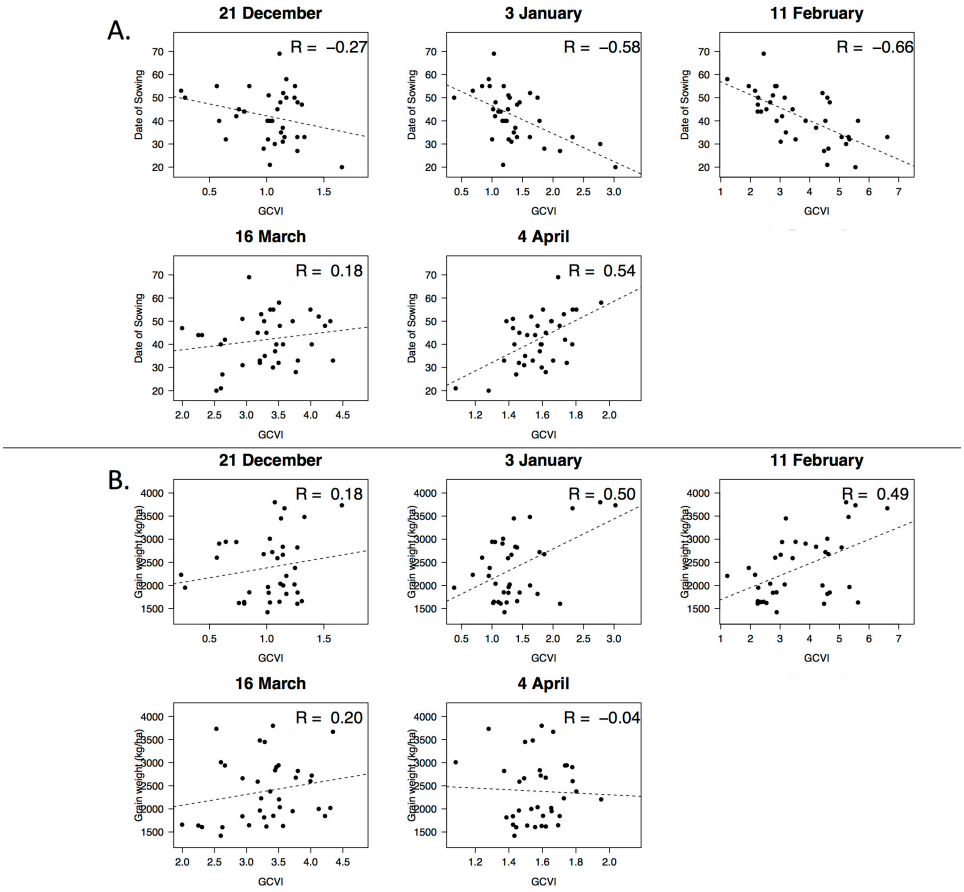

Figure S2. Scatterplots of GCVI versus sow date (**A**) or yield (**B**) for each image date in 2015–2016. Correlation values between GCVI and sow date (**A**) or yield (**B**) are shown. The best fit line is highlighted with a dashed line in each graph.

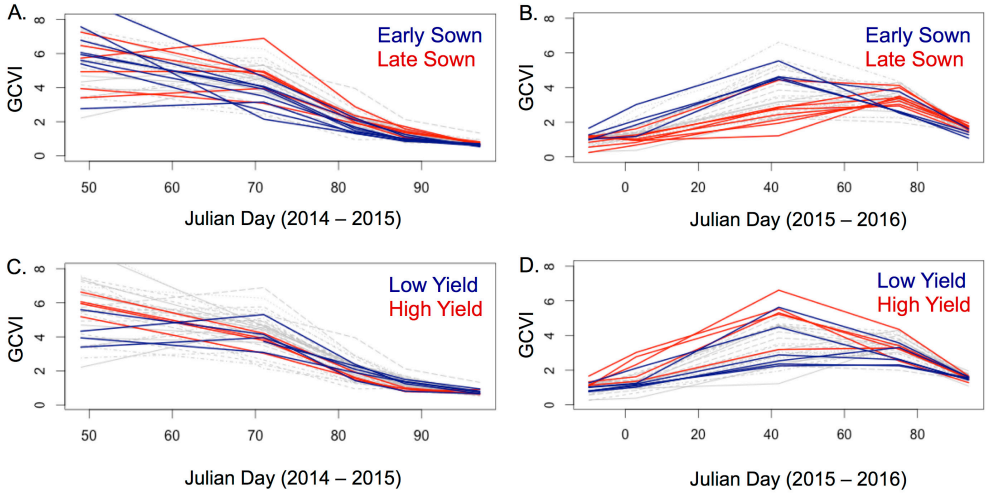

Figure S3. GCVI of each crop cut field throughout the growing season. Early versus late sown fields are highlighted in blue and red, respectively, in panels (**A**) and (**B**); and low versus high yielding fields are highlighted in blue and red respectively in panels (**C**) and (**D**).