

Note: ■ Germination ■ Tillering ■ Grand growth ■ Maturity

**Figure S1.** Association among the parameters in different phenological stages of sugarcane.

**Table S1.** Satge wise performance metrics of machine learning models

	Metrics	Sentinel-1				Sentinel-2				Sentinel-1 and Sentinel-2			
		Stage 1	Stage 2	Stage 3	Stage 4	Stage 1	Stage 2	Stage 3	Stage 4	Stage 1	Stage 2	Stage 3	Stage 4
Decision Tree	Accuracy	0.85	0.73	0.64	0.77	0.93	1.00	0.89	0.81	0.96	0.92	0.83	0.84
	Recall	0.50	0.00	0.47	0.67	0.71	1.00	0.78	0.75	0.80	1.00	0.69	1.00
	Specificity	0.95	0.81	0.64	0.95	0.91	1.00	0.89	0.95	0.95	1.00	0.74	1.00
	F1 score	0.33	0.01	0.54	0.40	0.83	1.00	0.82	0.55	0.89	0.50	0.81	0.60

	MCC	0.28	0.15	0.26	0.32	0.81	1.00	0.75	0.46	0.87	0.55	0.71	0.59
FRBS	Accuracy	0.85	0.92	0.71	0.77	0.89	0.79	0.89	0.76	0.96	1.00	0.86	0.80
	Recall	0.50	1.00	0.53	0.67	0.67	0.43	0.73	1.00	0.80	1.00	0.73	1.00
	Specificity	0.95	1.00	0.61	0.95	0.91	0.83	0.85	1.00	0.95	1.00	0.78	1.00
	F1 score	0.33	0.50	0.67	0.40	0.73	0.50	0.84	0.25	0.89	1.00	0.85	0.44
	MCC	0.28	0.55	0.49	0.32	0.66	0.38	0.79	0.33	0.87	1.00	0.76	0.47
Logistics	Accuracy	0.85	0.85	0.68	0.67	0.89	1.00	0.89	0.76	0.96	0.96	0.93	0.85
	Recall	0.50	0.33	0.50	0.00	0.63	1.00	0.73	1.00	0.80	1.00	0.85	0.80
	Specificity	0.95	0.92	0.61	0.90	0.87	1.00	0.85	1.00	0.95	1.00	0.88	0.95
	F1 score	0.33	0.33	0.62	0.01	0.77	1.00	0.84	0.25	0.89	0.80	0.92	0.67
	MCC	0.28	0.25	0.40	0.17	0.74	1.00	0.79	0.33	0.87	0.80	0.86	0.58
Naïve Bayes	Accuracy	0.85	0.80	0.68	0.82	0.86	0.82	0.79	0.73	0.96	0.96	0.92	0.92
	Recall	0.50	0.29	0.63	0.63	0.56	0.50	0.63	0.50	0.80	0.75	0.91	1.00
	Specificity	0.95	0.81	0.82	0.86	0.83	0.87	0.85	0.95	0.95	0.96	0.93	1.00
	F1 score	0.33	0.40	0.53	0.67	0.71	0.55	0.63	0.22	0.89	0.86	0.91	0.83
	MCC	0.28	0.34	0.30	0.55	0.68	0.44	0.48	0.15	0.87	0.85	0.84	0.80
Neural Net	Accuracy	0.81	0.85	0.73	0.71	0.89	1.00	0.96	0.84	0.96	0.96	0.86	0.84
	Recall	0.00	0.00	0.56	0.40	0.63	1.00	0.89	1.00	0.80	1.00	0.73	1.00
	Specificity	0.95	0.96	0.64	0.86	0.87	1.00	0.94	1.00	0.95	1.00	0.78	1.00
	F1 score	0.01	0.01	0.69	0.33	0.77	1.00	0.94	0.60	0.89	0.80	0.85	0.60
	MCC	0.09	0.07	0.52	0.16	0.74	1.00	0.92	0.59	0.87	0.80	0.76	0.59
Random Forest	Accuracy	0.92	0.80	0.69	0.88	0.86	0.96	0.89	0.76	0.96	1.00	0.93	0.88
	Recall	1.00	0.29	0.60	0.83	0.56	0.83	0.78	1.00	0.80	1.00	0.85	1.00
	Specificity	1.00	0.81	0.78	0.95	0.83	0.95	0.89	1.00	0.95	1.00	0.88	1.00
	F1 score	0.67	0.40	0.57	0.77	0.71	0.91	0.82	0.25	0.89	1.00	0.92	0.73
	MCC	0.68	0.34	0.33	0.70	0.68	0.89	0.75	0.33	0.87	1.00	0.86	0.70
SVM	Accuracy	0.85	0.85	0.73	0.74	0.86	1.00	0.92	0.77	0.96	1.00	0.93	0.88
	Recall	0.50	0.00	0.56	0.50	0.56	1.00	0.88	0.67	0.80	1.00	0.85	1.00
	Specificity	0.95	0.96	0.64	0.90	0.83	1.00	0.94	0.95	0.95	1.00	0.88	1.00
	F1 score	0.33	0.01	0.69	0.36	0.71	1.00	0.88	0.40	0.89	1.00	0.92	0.73
	MCC	0.28	0.07	0.52	0.23	0.68	1.00	0.82	0.32	0.87	1.00	0.86	0.70

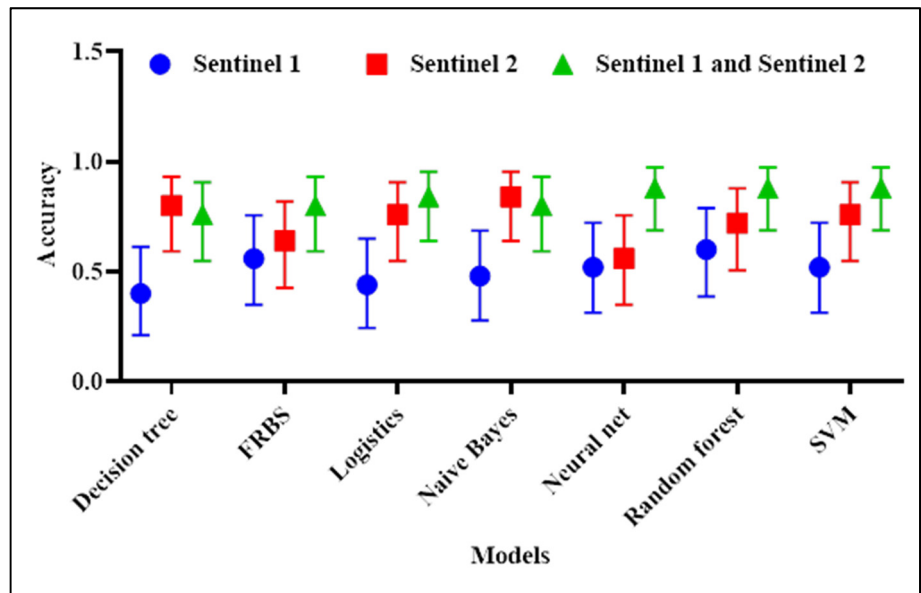


Figure S2. Accuracy of all classification models

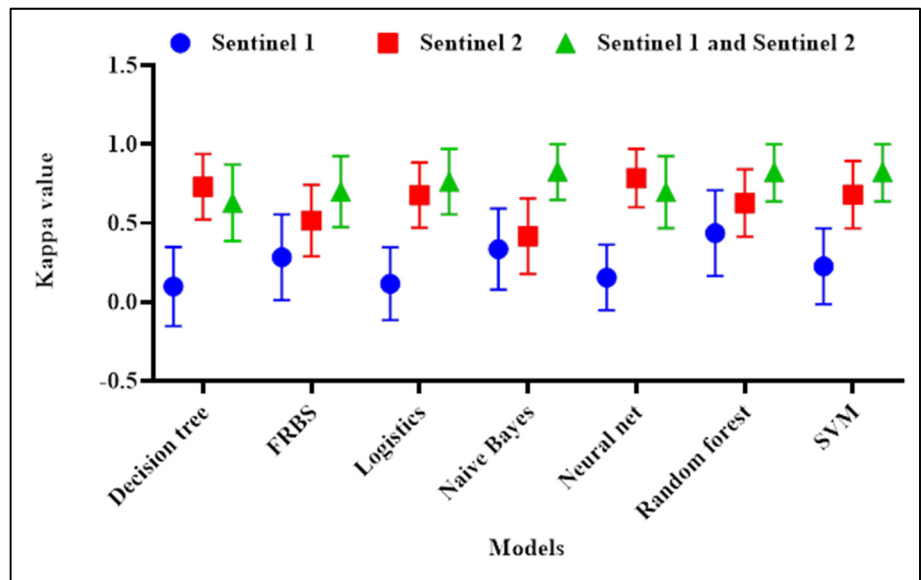


Figure S3. Kappa value of all classification models

Table S2: Pair wise comparisons of model's accuracy for Sentinel-1 data

	Decision tree	FRBS	Logistics	Naïve Bayes	Neural net	Random forest	SVM
Decision tree		0.01	<0.01	0.04	0.03	<0.01	0.03
FRBS			0.02	0.05	0.03	0.05	0.05
Logistics				0.04	0.05	0.01	0.03
Naïve Bayes					0.04	0.04	0.35
Neural net						0.03	0.03
Random forest							0.03
SVM							

**Table S3:** Pair wise comparisons of model's accuracy for Sentinel-2 data

	Decision tree	FRBS	Logistics	Naïve Bayes	Neural net	Random forest	SVM
Decision tree		<0.01	0.04	<0.01	0.03	0.01	0.01
FRBS			<0.01	<0.01	0.01	0.03	0.03
Logistics				<0.01	0.02	0.05	0.29
Naïve Bayes					<0.01	<0.01	<0.01
Neural net						0.01	0.03
Random forest							0.04
SVM							

**Table S4:** Pair wise comparisons of model's accuracy for Sentinel-1 and Sentinel-2 data

	Decision tree	FRBS	Logistics	Naïve Bayes	Neural net	Random forest	SVM
Decision tree		0.01	0.02	0.01	<0.01	<0.01	<0.01
FRBS			0.13	0.05	0.03	0.03	0.04
Logistics				0.05	0.02	0.03	0.03
Naïve Bayes					0.04	0.04	0.03
Neural net						0.18	0.15
Random forest							0.21
SVM							

**Table S5:** Pair wise comparisons of model's kappa value for Sentinel-1 data

	Decision tree	FRBS	Logistics	Naïve Bayes	Neural net	Random forest	SVM
Decision tree		<0.01	0.05	<0.01	0.01	<0.01	<0.01
FRBS			<0.01	0.05	<0.01	<0.01	0.02
Logistics				<0.01	0.07	<0.01	<0.01
Naïve Bayes					<0.01	<0.01	<0.01
Neural net						<0.01	<0.01
Random forest							<0.01
SVM							

**Table S6:** Pair wise comparisons of model's kappa value for Sentinel-2 data

	Decision tree	FRBS	Logistics	Naïve Bayes	Neural net	Random forest	SVM
Decision tree		<0.01	<0.01	<0.01	0.03	<0.01	<0.01
FRBS			<0.01	<0.01	<0.01	<0.01	<0.01
Logistics				<0.01	<0.01	0.04	0.13
Naïve Bayes					<0.01	<0.01	<0.01
Neural net						<0.01	0.01
Random forest							0.02
SVM							

**Table S7:** Pair wise comparisons of model's kappa value for Sentinel-1 and Sentinel-2 data

	Decision tree	FRBS	Logistics	Naïve Bayes	Neural net	Random forest	SVM
Decision tree		0.02	<0.01	<0.01	<0.01	<0.01	<0.01
FRBS			0.04	<0.01	0.08	<0.01	<0.01
Logistics				0.03	0.02	0.01	0.01
Naïve Bayes					<0.01	0.09	0.07
Neural net						0.03	0.03
Random forest							0.12
SVM							

**Table S8:** Pair wise comparisons of data for based on decision tree model's accuracy

	Sentinel 1	Sentinel 2	Sentinel 1 and Sentinel 2
Sentinel 1		<0.01	<0.01
Sentinel 2			<0.01
Sentinel 1 and Sentinel 2			<0.01

**Table S9:** Pair wise comparisons of data based on FRBS model's accuracy

	Sentinel 1	Sentinel 2	Sentinel 1 and Sentinel 2
Sentinel 1		<0.01	<0.01
Sentinel 2			<0.01
Sentinel 1 and Sentinel 2			<0.01

**Table S10:** Pair wise comparisons of data based on Logistic tree model's accuracy

	Sentinel 1	Sentinel 2	Sentinel 1 and Sentinel 2
Sentinel 1		<0.01	<0.01
Sentinel 2			<0.01
Sentinel 1 and Sentinel 2			<0.01

**Table S11:** Pair wise comparisons of data based on naïve bayes model's accuracy

	Sentinel 1	Sentinel 2	Sentinel 1 and Sentinel 2
Sentinel 1		<0.01	<0.01
Sentinel 2			<0.01
Sentinel 1 and Sentinel 2			<0.01

**Table S12:** Pair wise comparisons of data based on neural net model's accuracy

	Sentinel 1	Sentinel 2	Sentinel 1 and Sentinel 2
Sentinel 1		<0.01	<0.01
Sentinel 2			<0.01
Sentinel 1 and Sentinel 2			<0.01

**Table S13:** Pair wise comparisons of data based on random forest model's accuracy

	Sentinel 1	Sentinel 2	Sentinel 1 and Sentinel 2
Sentinel 1		<0.01	<0.01
Sentinel 2			<0.01
Sentinel 1 and Sentinel 2			<0.01

**Table S14:** Pair wise comparisons of data based on SVM model's accuracy

	Sentinel 1	Sentinel 2	Sentinel 1 and Sentinel 2
Sentinel 1		<0.01	<0.01
Sentinel 2			<0.01
Sentinel 1 and Sentinel 2			<0.01

**Table S15:** Pair wise comparisons of data for based on decision tree model's kappa value

	Sentinel 1	Sentinel 2	Sentinel 1 and Sentinel 2
Sentinel 1		<0.01	<0.01
Sentinel 2			<0.01
Sentinel 1 and Sentinel 2			<0.01

**Table S16:** Pair wise comparisons of data based on FRBS model's kappa value

	Sentinel 1	Sentinel 2	Sentinel 1 and Sentinel 2
Sentinel 1		<0.01	<0.01
Sentinel 2			<0.01
Sentinel 1 and Sentinel 2			<0.01

**Table S17:** Pair wise comparisons of data based on Logistic tree model's kappa value

	Sentinel 1	Sentinel 2	Sentinel 1 and Sentinel 2
Sentinel 1		<0.01	<0.01
Sentinel 2			<0.01
Sentinel 1 and Sentinel 2			<0.01

**Table S18:** Pair wise comparisons of data based on naïve bayes model's kappa value

	Sentinel 1	Sentinel 2	Sentinel 1 and Sentinel 2
Sentinel 1		<0.01	<0.01
Sentinel 2			<0.01
Sentinel 1 and Sentinel 2			<0.01

**Table S19:** Pair wise comparisons of data based on neural net model's kappa value

	Sentinel 1	Sentinel 2	Sentinel 1 and Sentinel 2
Sentinel 1		<0.01	<0.01
Sentinel 2			<0.01
Sentinel 1 and Sentinel 2			<0.01

**Table S20:** Pair wise comparisons of data based on random forest model's kappa value

	Sentinel 1	Sentinel 2	Sentinel 1 and Sentinel 2
Sentinel 1		<0.01	<0.01
Sentinel 2			<0.01

Sentinel 1 and Sentinel 2	<0.01
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**Table S21:** Pair wise comparisons of data based on SVM model's kappa value

	Sentinel 1	Sentinel 2	Sentinel 1 and Sentinel 2
Sentinel 1		<0.01	<0.01
Sentinel 2			<0.01
Sentinel 1 and Sentinel 2			<0.01