

AI in Agriculture: Predicting Crop Yield

By Adi Awasthi



Why AI in Agriculture Matters?

① Rising Food Demand

- Global population is growing.
- Farmers must produce more with fewer resources.

② Climate Change Challenges

- Unpredictable weather affects crop health and yield.
- AI helps adapt farming to changing conditions.

③ Smarter Decisions

- AI analyzes soil, weather, and crop data.
- Farmers get accurate predictions to plan better.

④ Resource Efficiency

- AI reduces waste by optimizing water, fertilizer, and pesticide use.

Data Preprocessing

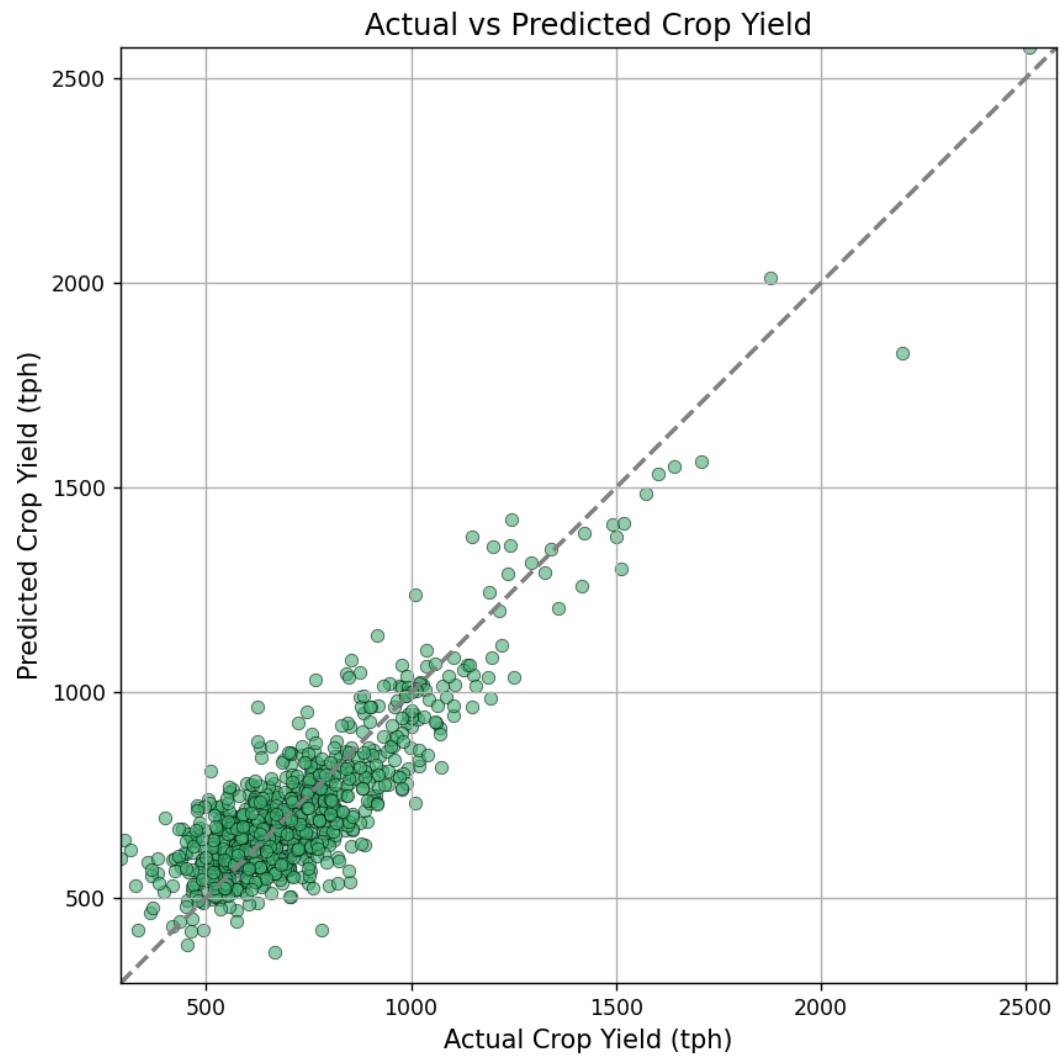
- ◆ Handling Missing Values
 - Removed incomplete rows using df.dropna
 - Ensures clean input for model training
- ◆ Feature Scaling (To prevent unwanted stuff to interfere)
 - Applied StandardScaler to normalize feature ranges
 - Prevents bias from large-scale features like rainfall or temperature
- ◆ Label Encoding (For Machine to understand)
 - Converted crop type labels into numeric form using LabelEncoder
 - Required for classification models like logistic regression
- ◆ Train-Test Split
 - Used train_test_split with 80% training and 20% testing
 - Ensures fair evaluation and avoids overfitting

Soilcolor	Ph	K	P	N	Zn	S	QV2M-W	QV2M-S	QV2M-S	QV2M-A	T2M_MA	T2M_MA	T2M_MA	T2M_MA	T2M_MIN	T2M_MIN	T2M_MIN	T2M_MIN	PRECTO	PRECTO	PRECTO	PRECTO	WD10M	GWETTC	CLOUD_	WS2M_FPS	label	crop_yield_tph
Yellowish	5.81	738.23	5.401	0.23	2.976	13.816	7.9933	10.457	11.963	9.6833	26.853	28.527	23.06	22.273	5.39	9.89	10.417	5.6933	2.0733	5.27	12.303	5.27	3.44	0.73	56.57	6.24	77.03 Barley	1000.1
Yellowish	5.43	606.38	10.478	0.23	3.077	16.421	7.9933	10.457	11.963	9.6833	26.853	28.527	23.06	22.273	5.39	9.89	10.417	5.6933	2.0733	5.27	12.303	5.27	3.44	0.73	56.57	6.24	77.03 Barley	858.6
brown	5.41	386.58	6.847	0.23	6.611	16.557	7.9933	10.457	11.963	9.6833	26.853	28.527	23.06	22.273	5.39	9.89	10.417	5.6933	2.0733	5.27	12.303	5.27	3.44	0.73	56.57	6.24	77.03 Barley	780.27
red	5.65	207.09	3.418	0.23	0.4602	16.075	7.9933	10.457	11.963	9.6833	26.853	28.527	23.06	22.273	5.39	9.89	10.417	5.6933	2.0733	5.27	12.303	5.27	3.44	0.73	56.57	6.24	77.03 Barley	732.55
red	5.27	317.36	39.282	0.23	2.743	12.558	7.9933	10.457	11.963	9.6833	26.853	28.527	23.06	22.273	5.39	9.89	10.417	5.6933	2.0733	5.27	12.303	5.27	3.44	0.73	56.57	6.24	77.03 Barley	695.85
brown	5.06	148.44	8.48	0.23	4.511	17.755	7.9933	10.457	11.963	9.6833	26.853	28.527	23.06	22.273	5.39	9.89	10.417	5.6933	2.0733	5.27	12.303	5.27	3.44	0.73	56.57	6.24	77.03 Barley	530.07
red	5.57	303.53	2.147	0.23	1.418	11.203	7.9933	10.457	11.963	9.6833	26.853	28.527	23.06	22.273	5.39	9.89	10.417	5.6933	2.0733	5.27	12.303	5.27	3.44	0.73	56.57	6.24	77.03 Barley	794.59
brown	5.2	380.6	30.3	0.23	1.772	13.985	7.9933	10.457	11.963	9.6833	26.853	28.527	23.06	22.273	5.39	9.89	10.417	5.6933	2.0733	5.27	12.303	5.27	3.44	0.73	56.57	6.24	77.03 Barley	824.59
red	5.34	401.06	6.382	0.23	2.433	13.069	7.9933	10.457	11.963	9.6833	26.853	28.527	23.06	22.273	5.39	9.89	10.417	5.6933	2.0733	5.27	12.303	5.27	3.44	0.73	56.57	6.24	77.03 Barley	668.85
gray	5.95	226.95	27.577	0.23	0.4519	17.067	7.9933	10.457	11.963	9.6833	26.853	28.527	23.06	22.273	5.39	9.89	10.417	5.6933	2.0733	5.27	12.303	5.27	3.44	0.73	56.57	6.24	77.03 Barley	696.4
red	5.47	217.87	0.8389	0.23	0.7233	11.88	7.9933	10.457	11.963	9.6833	26.853	28.527	23.06	22.273	5.39	9.89	10.417	5.6933	2.0733	5.27	12.303	5.27	3.44	0.73	56.57	6.24	77.03 Barley	528.98
brown	6.43	417.19	46.842	0.23	1.17	15.386	7.9933	10.457	11.963	9.6833	26.853	28.527	23.06	22.273	5.39	9.89	10.417	5.6933	2.0733	5.27	12.303	5.27	3.44	0.73	56.57	6.24	77.03 Barley	762.51
red	6.06	149.36	1.505	0.23	0.7547	11.35	7.9933	10.457	11.963	9.6833	26.853	28.527	23.06	22.273	5.39	9.89	10.417	5.6933	2.0733	5.27	12.303	5.27	3.44	0.73	56.57	6.24	77.03 Barley	553.52
brown	5.6	423.77	3.822	0.23	2.093	12.197	7.9933	10.457	11.963	9.6833	26.853	28.527	23.06	22.273	5.39	9.89	10.417	5.6933	2.0733	5.27	12.303	5.27	3.44	0.73	56.57	6.24	77.03 Barley	534.14
brown	6.03	351.52	66.314	0.23	1.157	17.559	7.9933	10.457	11.963	9.6833	26.853	28.527	23.06	22.273	5.39	9.89	10.417	5.6933	2.0733	5.27	12.303	5.27	3.44	0.73	56.57	6.24	77.03 Barley	630.96
gray	5.25	164.48	2.601	0.23	3.62	10.133	7.9933	10.457	11.963	9.6833	26.853	28.527	23.06	22.273	5.39	9.89	10.417	5.6933	2.0733	5.27	12.303	5.27	3.44	0.73	56.57	6.24	77.03 Barley	483.73
brown	6.17	77.385	6.166	0.23	0.942	10.85	7.9933	10.457	11.963	9.6833	26.853	28.527	23.06	22.273	5.39	9.89	10.417	5.6933	2.0733	5.27	12.303	5.27	3.44	0.73	56.57	6.24	77.03 Barley	386.41
black	6.15	116.77	5.055	0.23	1.831	10.016	7.65	7.7733	10.987	9.7267	9.03	25.147	28.243	23.807	3.4133	6.96	9.98	5.7033	1.17	2.2433	7.52	2.88	81.06	0.69	53.45	6.48	75.83 Barley	532.14
black	5.79	137.39	4.894	0.23	2.773	8.975	7.65	7.7733	10.987	9.7267	9.03	25.147	28.243	23.807	3.4133	6.96	9.98	5.7033	1.17	2.2433	7.52	2.88	81.06	0.69	53.45	6.48	75.83 Barley	421.97
Reddish	5.99	81.482	12.275	0.23	1.082	10.742	7.65	7.7733	10.987	9.7267	9.03	25.147	28.243	23.807	3.4133	6.96	9.98	5.7033	1.17	2.2433	7.52	2.88	81.06	0.69	53.45	6.48	75.83 Barley	349.18
black	5.9	196.73	2.025	0.23	1.705	14.6	7.65	7.7733	10.987	9.7267	9.03	25.147	28.243	23.807	3.4133	6.96	9.98	5.7033	1.17	2.2433	7.52	2.88	81.06	0.69	53.45	6.48	75.83 Barley	704.44
Yellowish	5.65	388.94	0.4125	0.23	1.237	10.498	7.65	7.7733	10.987	9.7267	9.03	25.147	28.243	23.807	3.4133	6.96	9.98	5.7033	1.17	2.2433	7.52	2.88	81.06	0.69	53.45	6.48	75.83 Barley	657.61
brown	5.84	146.31	12.296	0.23	1.414	11.191	7.65	7.7733	10.987	9.7267	9.03	25.147	28.243	23.807	3.4133	6.96	9.98	5.7033	1.17	2.2433	7.52	2.88	81.06	0.69	53.45	6.48	75.83 Barley	542.87
red	5.99	55.789	7.601	0.23	1.355	11.674	7.65	7.7733	10.987	9.7267	9.03	25.147	28.243	23.807	3.4133	6.96	9.98	5.7033	1.17	2.2433	7.52	2.88	81.06	0.69	53.45	6.48	75.83 Barley	323.05
brown	5.8	276	4	0.321	2	9	7.1833	7.65	10.477	9.07	22.33	25.617	23.65	20.617	2.0533	4.8167	8.4333	3.98	2.0733	2.6133	4.8367	3.63	75.69	0.65	0.46	46.1	74.17 Barley	549.52
red	6.3	277.67	80.748	0.23	1.209	11.417	7.65	7.7733	10.987	9.7267	9.03	25.147	28.243	23.807	3.4133	6.96	9.98	5.7033	1.17	2.2433	7.52	2.88	81.06	0.69	53.45	6.48	75.83 Barley	769.26
Reddish	5.93	234.67	6.988	0.23	0.9254	11.54	7.65	7.7733	10.987	9.7267	9.03	25.147	28.243	23.807	3.4133	6.96	9.98	5.7033	1.17	2.2433	7.52	2.88	81.06	0.69	53.45	6.48	75.83 Barley	472.72
brown	6.05	96.094	7.112	0.23	0.9233	11.728	7.65	7.7733	10.987	9.7267	9.03	25.147	28.243	23.807	3.4133	6.96	9.98	5.7033	1.17	2.2433	7.52	2.88	81.06	0.69	53.45	6.48	75.83 Barley	530.07
red	5.63	508.62	3.883	0.23	0.6795	12.999	7.65	7.7733	10.987	9.7267	9.03	25.147	28.243	23.807	3.4133	6.96	9.98	5.7033	1.17	2.2433	7.52	2.88	81.06	0.69	53.45	6.48	75.83 Barley	713.71
brown	5.99	403.94	74.965	0.23	1.985	16.624	7.65	7.7733	10.987	9.7267	9.03	25.147	28.243	23.807	3.4133	6.96	9.98	5.7033	1.17	2.2433	7.52	2.88	81.06	0.69	53.45	6.48	75.83 Barley	814.59
brown	5.9	347	12	0.2526	3.5	11	7.1833	7.65	10.477	9.07	22.33	25.617	23.65	20.617	2.0533	4.8167	8.4333	3.98	2.0733	2.6133	4.8367	3.63	75.69	0.65	0.46	46.1	74.17 Barley	612.73
Dark Bro	5.2	135.7	8.851	0.23	3.177	12.095	7.65	7.7733	10.987	9.7267	9.03	25.147	28.243	23.807	3.4133	6.96	9.98	5.7033	1.17	2.2433	7.52	2.88	81.06	0.69	53.45	6.48	75.83 Barley	708.87
Reddish	6.21	175.79	13.07	0.23	1.443	9.367	7.65	7.7733	10.987	9.7267	9.03	25.147	28.243	23.807	3.4133	6.96	9.98	5.7033	1.17	2.2433	7.52	2.88	81.06	0.69	53.45	6.48	75.83 Barley	554.24
brown	5.57	71.766	8.048	0.23	3.137	5.906	7.65	7.7733	10.987	9.7267	9.03	25.147	28.243	23.807	3.4133	6.96	9.98	5.7033	1.17	2.2433	7.52	2.88	81.06	0.69	53.45	6.48	75.83 Barley	361.9
brown	6.05	697.63	168.21	0.23	1.814	15.609	7.65	7.7733	10.987	9.7267	9.03	25.147	28.243	23.807	3.4133	6.96	9.98	5.7033	1.17	2.2433	7.52	2.88	81.06	0.69	53.45	6.48	75.83 Barley	1304.7
brown	6.01	285.66	58.65	0.23	1.733	10.517	7.65	7.7733	10.987	9.7267	9.03</																	



Linear Regression – Crop Yield Prediction

- ◆ **Model Purpose**
 - Predicts **continuous crop yield** based on soil and climate inputs
- ◆ **Key Features**
 - Inputs: Ph, N, P, K, Zn, S, seasonal climate variables
 - Output: Estimated crop yield (e.g., tons per hectare)
- ◆ **Evaluation Metrics**
 - **R² Score:** Measures how well the model fits the data
 - **Residuals:** Show prediction errors across samples





Interpretation & Visualization

- ◆ Interpretation
 - Coefficients show how each feature affects yield
 - Positive: increases yield
 - Negative: decreases yield
 - Helps explain model logic to stakeholders
- ◆ Visualization
 - **Scatter Plot:** Actual vs predicted yield
 - **Residual Plot:** Highlights prediction errors
 - **Feature Importance:** Shows which inputs matter most

Thank You