Agricultural Statistics in Practice

Regression Path Analysis

Calculation of Residual

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Residuals

- The residual for each observation is the difference between predicted values of y (dependent variable) and observed values of y

$$Residual = actual\ y\ value - predicted\ y\ value,$$
$$r_i = y_i - \widehat{y}_i$$

- Having a negative residual means that the predicted value is too high, similarly if you have a positive residual it means that the predicted value was too low. The aim of a regression line is to minimise the sum of residuals.

Calculating Residuals

- Knowing that
$$r_i = y_i - \hat{y}_i$$

- and knowing that the regression line has the equation
$$\hat{y}_i = a + bx_i \quad = mx + c$$

- we calculate the residual of an observation as follows
$$r_i = y_i - \hat{y}_i = r_i = y_i - (a + bx_i)$$

Example

- To see how crop sales has increased over a four-year period, sales of ten crops were observed, recorded and then four years later recorded again. Here are their sales:

Crop	Chillies	Potato	Wheat	Rice	Maize	Jowar	Dal	Cucumber	Cabbage	Brinjal
First Test	67	53	68	57	71	74	63	75	66	66
Second Test	46	29	37	44	41	35	41	43	33	36

- What is the residual value?

Solution

- Using our regression line equation we can calculate the predicted value, $\hat{y}$, by simply substituting in our value for x

$$= \hat{y}_i = a + bx_i$$
$$= 23.91 + 0.22x_i$$
$$= 23.91 + 0.22 \times 74$$
$$= 40.19$$

- The residual value is calculated by $r_i = y_i - \hat{y}_i$

$$= 35 - 40.19$$
$$= -5.19$$

Applications in Agricultural Field

- **_Crop Yield:_** The difference between the actual yield of a crop and the predicted yield based on various factors such as fertilizer application, irrigation, and weather conditions.

- **_Livestock Weight:_** The deviation between the observed weight of livestock and the expected weight based on factors like feed quality, breed, and management practices.

- **_Soil Nutrient Levels:_** The variation between the measured nutrient levels in soil samples and the expected nutrient levels based on soil type, fertilization practices, and crop rotation.

- **_Pest Infestation:_** The discrepancy between the observed pest infestation levels in crops and the predicted levels based on factors such as pest control measures, weather patterns, and crop management techniques.

- **_Disease Incidence:_** The difference between the actual occurrence of diseases in plants or animals and the expected occurrence based on factors like vaccination, hygiene practices, and disease prevention strategies.

Thank You