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AGRICULTURAL DATA ANALYSIS

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**RESULTS AND DISCUSSIONS**

1. **Descriptive Statistics**

**Table 1.1: Frequency Distributions**

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Frequency** | **Percentage** |
| **Region** |  |  |
| East | 103 | 20.6 |
| North | 160 | 32 |
| South | 115 | 23 |
| West | 122 | 24.4 |
| Total | 500 | 100 |
| **Soil Type** |  |  |
| Chalky | 71 | 14.2 |
| Clay | 89 | 17.8 |
| Loam | 88 | 17.6 |
| Peaty | 79 | 15.8 |
| Sandy | 83 | 16.6 |
| Silt | 90 | 18 |
| Total | 500 | 100 |
| **Crop** |  |  |
| Barley | 83 | 16.6 |
| Cotton | 89 | 17.8 |
| Maize | 78 | 15.6 |
| Rice | 88 | 17.6 |
| Soybean | 75 | 15 |
| Wheat | 87 | 17.4 |
| Total | 500 | 100 |
| **Fertiliser used?** |  |  |
| True | 246 | 49.2 |
| False | 254 | 50.8 |
| Total | 500 | 100 |
| **Irrigation used?** |  |  |
| True | 257 | 51.4 |
| False | 243 | 48.6 |
| Total | 500 | 100 |
| **Weather Condition** |  |  |
| Cloudy | 173 | 34.6 |
| Rainy | 147 | 29.4 |
| Sunny | 180 | 36 |
| Total | 500 | 100 |

**Table 1.2: Summary Statistics**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***Statistics*** | | | | |
|  | Rainfall(mm) | Temperature (Celsius) | Days to Harvest | Yield per hectare(tonnes) |
| Mean | 542.70 | 27.68 | 105.32 | 4.65 |
| Median | 542.50 | 27.96 | 105.0 | 4.67 |
| Std. Deviation | 262.78 | 7.07 | 26.99 | 1.72 |

**Table 1.2.1**

|  |  |  |  |
| --- | --- | --- | --- |
|  | | Yield per hectare(tonnes) | |
| Mean | Sum |
| Crop | Rice | 4.80 | 422.78 |
| Cotton | 4.55 | 404.67 |
| Wheat | 4.64 | 403.32 |
| Maize | 4.88 | 380.71 |
| Barley | 4.40 | 365.20 |
| Soybean | 4.65 | 348.59 |

A total of 500 observations were analysed. The regional distribution of the data showed that the largest proportion of samples came from the North (32%), followed by the West (24.4%), South (23%), and East (20.6%).

Regarding soil type, silt was the most common (18%), closely followed by clay (17.8%), loam (17.6%), sandy (16.6%), peaty (15.8%), and chalky (14.2%).

Crop distribution was relatively even, with cotton being the most frequently cultivated (17.8%), and soybeans the least (15%). Other major crops included rice (17.6%), barley (16.6%), wheat (17.4%), and maize (15.6%).

Approximately half of the fields used fertiliser (49.2%), while the other half did not (50.8%). Similarly, irrigation was reported in just over half the cases (51.4%), with 48.6% not using irrigation.

Weather conditions during the growing period were categorised as sunny (36%), cloudy (34.6%), or rainy (29.4%).

The average rainfall across all observations was 542.70 mm (SD = 262.78), with a median of 542.50 mm. Mean temperature was 27.68°C (SD = 7.07), and the average time to harvest was 105.32 days (SD = 26.99). The average yield was 4.65 tons per hectare (SD = 1.72), with a median yield of 4.67 tons per hectare.

Rice had the highest yield at 422.78 tonnes with a mean of 4.80. Cotton followed second with a yield of 404.67. Wheat trailed behind at just 403.32. Maize was 380.71, Barley had a yield of 365.20, and finally, Soybean had the lowest at 348.59.

**2.0 Independent Samples T-Test**

The result from an independent sample t-test between Yield per hectare and fertiliser used is presented in Table 2.1.

**Table 2.1**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Independent Samples t-test* | | | | | | | | | |
|  | Fertiliser used? | *N* | *M* | *SD* | *t* | *df* | *p-value* | *d* |  |
| Yield per hectare(tonnes) | True | 246 | 5.35 | 1.51 | 9.78 | 498 | <.001 | 0.88 |  |
| False | 254 | 3.97 | 1.64 |  |  |  |  |  |

An independent samples t-test was conducted to compare yield per hectare with whether fertiliser was used or not. There was a statistically significant difference in yield for fertiliser used (*M* = 5.35, *SD* = 1.51) and fertiliser not used (*M* = 3.97, *SD* = 1.64), *t*(498) = 9.78, *p* = <.001. The effect size, as measured by Cohen’s d, was 0.88, indicating a large effect size (Cohen,1992).

**3.0 Independent Samples T-Test**

The result from an independent sample t-test between Yield per hectare and Irrigation used is presented in Table 3.1.

**Table 3.1**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Independent Samples t-test* | | | | | | | | | |
|  | Irrigation used? | *N* | *M* | *SD* | *t* | *df* | *p-value* | *d* |  |
| Yield per hectare(tonnes) | True | 257 | 5.32 | 1.54 | 9.82 | 498 | <.001 | 0.88 |  |
| False | 243 | 3.94 | 1.62 |  |  |  |  |  |

An independent samples t-test was conducted to compare yield per hectare and whether irrigation was used. There was a statistically significant difference in yield for irrigation used (*M* = 5.32, *SD* = 1.54) and irrigation not used (*M* = 3.94, *SD* = 1.62), *t*(498) = 9.82, *p* = <.001. The effect size, as measured by Cohen’s d, was 0.88, indicating a large effect size (Cohen,1992).

**4.0 Correlation Analysis**

The results from a correlation analysis between Rainfall, Temperature, Days to harvest and yield per hectare are presented in Table 4.1

**Table 4.1**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *Correlations* | | | | | |
|  | | Rainfall (mm) | Temperature (Celsius) | Days to Harvest | Yield per hectare (tonnes) |
| Rainfall (mm) | Pearson Correlation | -- |  |  |  |
| N | 500 |  |  |  |
| Temperature (Celsius) | Pearson Correlation | -.004 | -- |  |  |
| Sig. (2-tailed) | 0.935 |  |  |  |
| N | 500 | 500 |  |  |
| Days to Harvest | Pearson Correlation | .007 | .008 | -- |  |
| Sig. (2-tailed) | .872 | .852 |  |  |
| N | 500 | 500 | 500 |  |
| Yield per hectare (tonnes) | Pearson Correlation | .770\*\* | .074 | .008 | -- |
| Sig. (2-tailed) | <.001 | 0.97 | .864 |  |
| N | 500 | 500 | 500 | 500 |
| \*\*. Correlation is significant at the 0.01 level (2-tailed). | | | | | |

A Pearson correlation analysis was conducted to examine the relationships between rainfall, temperature, days to harvest, and yield per hectare. The results are based on a large sample (N = 500).

Rainfall and yield per hectare were strongly positively correlated (*r* =.77, *p* < .001), indicating that greater rainfall is associated with higher yield. Rainfall and temperature were not significantly correlated (*r* = -.004, *p* = .935). Rainfall and days to harvest were not statistically significant (*r* = .007, *p* = .872).

Temperature was not correlated with yield (*r =*.074, *p* =.097); its correlation with days to harvest was also not statistically significant (*r* =.008, *p* = .852). Days to harvest had a non-statistically significant correlation with yield per hectare (*r =* .008, *p* = .864).

**5.0 Multiple Linear Regression**

The result from a multiple linear regression, which was used to determine the factors influencing crop yield, is presented in Table 5.1

**Table 5.1: Factors influencing crop yield**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***Variables*** | ***Standardised Beta Coefficient*** | ***Standard Error*** | ***t-value*** | ***p-value*** |
| Intercept | 3.240 | 0.258 | 12.563 | <.001\* |
| Rainfall | 0.776 | 0.000 | 36.195 | <.001\* |
| Temperature | 0.096 | 0.005 | 4.457 | <.001\* |
| Days to harvest | 0.011 | 0.001 | 0.532 | 0.595 |
| Fertiliser used? | -0.418 | 0.074 | -19.474 | <.001\* |
| Soil type | 0.027 | 0.022 | 1.274 | 0.297 |
| R2 | 0.773 |  |  |  |
| R2adj | 0.771 |  |  |  |
| F-value | 336.64 |  |  |  |
| Significance F | <.001 |  |  |  |

\* = significant at 0.05

A multiple linear regression analysis was conducted to determine the factors influencing overall crop yield. The independent variables were able to explain 77.1% (R2adj=.771) of the variations in crop yield. Specifically, the positive coefficients of the variable rainfall and temperature imply that an increase in these variables would lead to an increase in crop yield. They were significant at 1%, i.e., they had a significant effect on overall yield. Fertiliser used, which was dummy coded (1= True, 2 = False), had a negative coefficient, indicating that if fertiliser was used, it would lead to an increase in crop yield.

**6.0 Analysis of Variance (ANOVA)**

The results from an ANOVA between yield per hectare and regions are presented in Tables 6.1 and 6.2.

**Table 6.1**

|  |  |  |  |
| --- | --- | --- | --- |
| Descriptive |  |  |  |
| *Regions* | *N* | *Mean* | *SD* |
| East | 103 | 4.93 | 1.55 |
| North | 160 | 4.42 | 1.77 |
| South | 115 | 4.54 | 1.74 |
| West | 122 | 4.82 | 1.75 |
| Total | 500 | 4.65 | 1.72 |

**Table 6.2**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| *ANOVA* | | | | | |  |
| Yield per hectare (tonnes) | | | | | |  |
|  | *Sum of Squares* | *df* | *Mean Square* | *F* | *Sig.* | *η2* |
| Between Groups | 21.401 | 3 | 7.13 | 2.43 | 0.65 | .014 |
| Within Groups | 1457.334 | 496 | 2.94 |  |  |  |
| Total | 1478.734 | 499 |  |  |  |  |

An analysis of variance was conducted to examine the differences in crop yield between various regions. The results were not statistically significant, indicating that there was no difference in yield obtained from the four regions (North, South, East, West). The effect size was very small, indicating low practicality.

**Reference**

Cohen, J. (1992): Quantitative methods in psychology: A power primer. Psychological Bulletin, pp. 155-159.