**Potato and Wheat Yields from Fertilised and Unfertilised Fields**

Name/Date

**Introduction**

A group of farmers is interested in whether a specific fertiliser will increase their annual yield of potatoes and wheat. The fertiliser under investigation is applied to the potato crops grown in a total of 130 different fields, whilst 80 fields growing potatoes are left unfertilised. Similarly, the fertiliser is applied in 90 different fields growing wheat, and 120 other wheat fields are left unfertilised. The yield (in tonnes) of the crop grown in each field is measured and reported.

This analysis investigates whether:

1. There is a difference between the mean yields of potatoes from fields that were fertilised and from fields that were left unfertilised.
2. There is a difference between the mean yields of wheat from fields that were fertilised and from fields that were left unfertilised.

**Exploratory Analysis**

The sample mean potato and wheat yields from fertilised and unfertilised fields are given in Table 1. The sample mean yield of potatoes from fertilised fields is slightly greater than the sample mean yield from unfertilised fields, but both means seem to be approximately equal here. The sample mean yield of wheat from fertilised fields is greater than the sample mean yield of wheat from unfertilised fields.

Table 1: Sample mean yield of potato and wheat yields (in tonnes) from fields which were fertilised and from fields which were unfertilised.

|  |  |  |
| --- | --- | --- |
|  | Fertilised | Unfertilised |
| Potato | 38.75 | 38.60 |
| Wheat | 23.80 | 17.98 |

Histograms of the potato yields from fertilised and unfertilised fields are shown in Figure 1. These suggest that the mean yield of potatoes is approximately equal in fertilised and unfertilised fields and that the standard deviation in these yields is also approximately equal in both fertilised and unfertilised fields.

A graph of a potato yield

Description automatically generated

Figure : Histograms of potato yields (in tonnes) from fields which are fertilised and fields which are unfertilised.

QQ-plots of the potato yields from all fertilised and unfertilised fields are shown in Figure 2. These suggest that both sets of yields approximately follow a normal distribution.

A graph of a potato yield

Description automatically generated

Figure : QQ-plots of potato yields (in tonnes) from fields which are fertilised and fields which are unfertilised.

Histograms of the wheat yields from fertilised and unfertilised fields are shown in Figure 3. These suggest that the mean yield of wheat from fertilised fields is greater than the mean yield of wheat from unfertilised fields. The sample standard deviation of wheat yields from fertilised fields seems to be greater than the sample standard deviation of wheat yields from unfertilised fields.

A graph of wheat yield

Description automatically generated

Figure : Histograms of wheat yields (in tonnes) from fields which are fertilised and fields which are unfertilised.

QQ-plots of the wheat yields from all fertilised and unfertilised fields are shown in Figure 4. These suggest that both sets of yields approximately follow a normal distribution.

A comparison of a graph

Description automatically generated with medium confidence

Figure : QQ-plots of wheat yields (in tonnes) from fields which are fertilised and fields which are unfertilised.

**Statistical Analysis**

Describe the statistical methods and techniques used to analyse the data and detail any assumptions made.

Include any relevant output from the analysis completed (do not include R code used to generate the output) and interpret it in the context of the problem.

**Conclusion**

Provide an answer to the aims of the analysis. Discuss how the formal conclusion compares to the initial impressions from the Exploratory Analysis.

Discuss any limitations in your analysis.