# Legacy effect on a spring barley crop established the year after the cultivation of different grain legumes (sole cropped or as intercrops with spring cereal)

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## Introduction

Intercropping is gaining interest amongst farmers, particularly those practicing organic or agroecological principles.

Intercropping can help maintain crop yields under reduced input conditions through improved resource use efficiency & can help limit yield variation across seasons associated with unusual weather patterns.

Some national Governments are starting to become aware of the use of intercrops, particularly those Governments with policies striving to achieve Net Zero at some point in the future.

Much of the research on intercrops to date has focused on the season the intercrops are grown, but legacy effects on soil & following crops in the rotation are less well known (e.g. Pappa *et al.* 2012).

This poster presents some work from the UK that investigating carry-over spring barley yield the year after a series of sole grain or cereal & grain-legume / cereal intercrops were grown.

## Materials & Methods

A range of grain legumes were established in both 2019 and 2020 in Aberdeenshire, Scotland, UK (Fig 1); plot size 12m x 1.5m; replicated block design (n=4).

- soil - sandy loam; moderate P & K indices; pH ~ 6.0

The same spring crops & seed ratio treatments used each year:

- Barley (var. Westminster) – sole crop or component of intercrop
- Field beans (var. Fuego); Peas (var. Zero 4) & Lupins (var. Iris) - sole crop or intercropped with spring barley @ 40:60 or 60:40 ratio of typical seed rate for each crop species
- Green lentil (var. Anicia) – high and low seed rate both with 20 kg/ha oats as support crop

In 2020 and 2021, pre-crop effects were evaluated using a spring barley crop grown on the previous year's plot areas. At establishment, half of each plot (5m x 1.5m) received no N fertiliser & the other half received 60kg N/ha. P and K were applied across the whole trial area at recommended rate.

Although other data was collected, the focus in this instance is the combine yield of the follow-on spring barley crops, particularly the average yield across both years to indicate consistency of performance across seasons.

***Figure 1:*** *Example of the grain legume and cereal trial plots*

## Results & Discussion

In almost all cases, the addition of 60 kg N / ha resulted in a significant elevation in grain yield of the follow-on spring barley crop compared to the same pre-crop with no N applied and generally had lower variability (smaller error bars) see Fig 2.

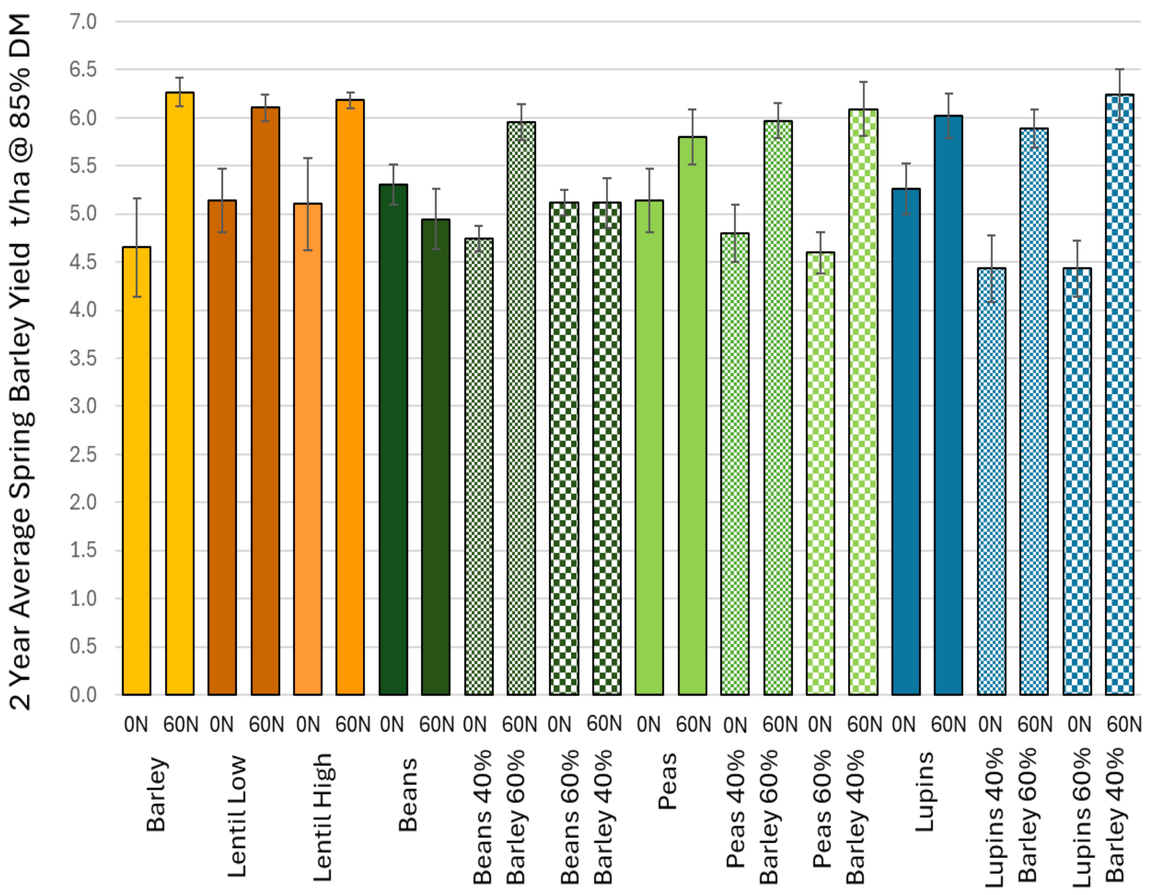


***Figure 2:*** *Average yield of two spring barley crops grown in consecutive years (2020 & 2021) after the same pre-crop treatments, including a spring barley sole crop, & grain legumes grown as sole crops or as intercrops with spring barley (or oats in the case of lentil). These were grown with zero N, or with an application of 60 kg N/ha. Error bars represent standard error of the mean (n=4).*

- ANOVA performed on the spring barley averages from both years for the Zero N treatments indicated significant yield increases ($P \leq 0.001$) compared to the barley pre-crop control (Fig 2).
- The least significant difference (LSD) indicated that any yield above 5t/ha was statistically greater than the control (Fig 2).
- The lentils, sole crop beans and beans intercropped at the higher ratio, sole crop peas and sole crop lupins all achieved an improved legacy yield. The other pre-crop treatments showed no yield increase but may have provided other benefits not highlighted in this paper (Fig 2)

## References

PAPPA VA, REES RM, WALKER RL, BADDELEY JA, WATSON CA. Legumes intercropped with spring barley contribute to increased biomass production and carry-over effects. The Journal of Agricultural Science. 2012;150(5):584-594. doi:10.1017/S0021859611000918

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