Intercrop Legacy

- Following on from a Triticale:Bean intercrop last season
- Looking to see any Legacy effects on a following wheat crop
- Skyfall winter wheat, drilled following a mustard cover
- Wet winter- Unsure if will see any effects from carried over Nitrogen

Intercrop 2020

- After 2 seasons testing **Triticale:Bean** intercrops, we decided to see if other **Cereal:Legume** combinations followed similar trends.
  - Winter experiment testing different cereals with faba bean
    - Barley, wheat and oat
  - Spring experiment testing different legumes with wheat
    - Lupines, Peas and faba bean

Winter Intercrop- (Left)

- 4 treatments for each cereal intercrop + bean sole crop
  - 3 cereals being intercropped
  - 13 treatments/ replication
  - 4 replications
  - 52 plots
  - 4 spare plots of Skyfall
- Intercrop ratio shown as % of sole crop with cereal component always coming first
  - For example, O 25:75=
    - 25% of oat SC seed rate
    - 57% of bean SC seed rate

Treatments
B 25:75
B 50:50
B 75:25
Barley
Beans
O 25:75
O 50:50
O 75:25
Oat
W 25:75
W 50:50
W 75:25
Wheat

	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
G	Skyfall	Skyfall	Skyfall	Skyfall	Beans	W 75:25	W 50:50	Wheat				Pea	B75:25	P25:75	L50:50	
F	B 25:75	O 25:75	B 50:50	Oat	O 50:50	Barley	B 75:25	W 25:75	Wheat	B25:75	Bean	L75:25	P50:50	P75:25	B50:50	L25:75
E	O 75:25	Barley	B 75:25	W 50:50	Beans	B 25:75	W 75:25	B 50:50	Lupin	P50:50	Pea	Wheat	Bean	P25:75	B75:25	L75:25
D	Oat	O 50:50	O 25:75	O 75:25	Wheat	W 25:75	W 75:25	O 25:75	Lupin	B50:50	L25:75	B25:75	L50:50	P75:25	P50:50	Wheat
C	Beans	B 50:50	W 50:50	O 50:50	B 25:75	O 75:25	Barley	Wheat	L25:75	L50:50	P25:75	Bean	B75:25	Pea	Lupin	B25:75
B	Oat	W 25:75	B 75:25	O 50:50	O 75:25	Beans	Barley	W 50:50	L75:25	P75:25	B50:50	L75:25	L25:75	Lupin	Pea	L50:50
A	Oat	B 75:25	B 25:75	O 25:75	Wheat	B 50:50	W 75:25	W 25:75	B25:75	B75:25	Bean	P50:50	B50:50	Wheat	P75:25	P25:75
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8

Spring Intercrop- (Right)

- 4 treatments for each legume intercrop + wheat sole crop
  - 3 cereals being intercropped
  - 13 treatments/ replication
  - 4 replications
  - 52 plots
  - 4 spare plots of Mullica wheat
- Intercrop ratio shown as % of sole crop with cereal component always coming first.
  - For example, L 25:75=
    - 25% of Wheat SC seed rate
    - 57% of Lupin SC seed rate

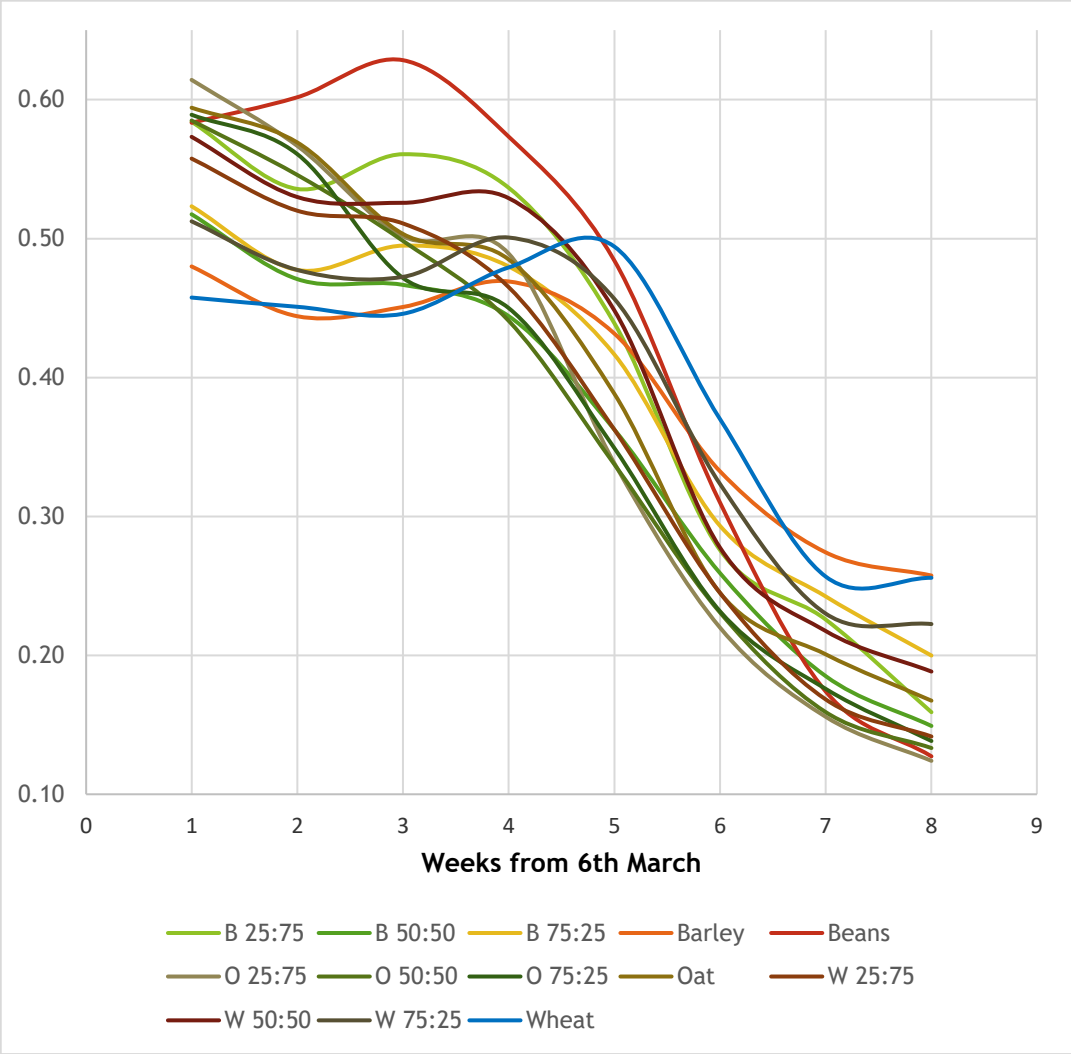
Treatments
B 25:75
B 50:50
B 75:25
Beans
L25:75
L50:50
L75:25
Lupin
P25:75
P50:50
P75:25
Pea
Wheat

	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
G	Skyfall	Skyfall	Skyfall	Skyfall	Beans	W 75:25	W 50:50	Wheat				Pea	B75:25	P25:75	L50:50	
F	B 25:75	O 25:75	B 50:50	Oat	O 50:50	Barley	B 75:25	W 25:75	Wheat	B25:75	Bean	L75:25	P50:50	P75:25	B50:50	L25:75
E	O 75:25	Barley	B 75:25	W 50:50	Beans	B 25:75	W 75:25	B 50:50	Lupin	P50:50	Pea	Wheat	Bean	P25:75	B75:25	L75:25
D	Oat	O 50:50	O 25:75	O 75:25	Wheat	W 25:75	W 75:25	O 25:75	Lupin	B50:50	L25:75	B25:75	L50:50	P75:25	P50:50	Wheat
C	Beans	B 50:50	W 50:50	O 50:50	B 25:75	O 75:25	Barley	Wheat	L25:75	L50:50	P25:75	Bean	B75:25	Pea	Lupin	B25:75
B	Oat	W 25:75	B 75:25	O 50:50	O 75:25	Beans	Barley	W 50:50	L75:25	P75:25	B50:50	L75:25	L25:75	Lupin	Pea	L50:50
A	Oat	B 75:25	B 25:75	O 25:75	Wheat	B 50:50	W 75:25	W 25:75	B25:75	B75:25	Bean	P50:50	B50:50	Wheat	P75:25	P25:75
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8

Winter Intercrop so far…

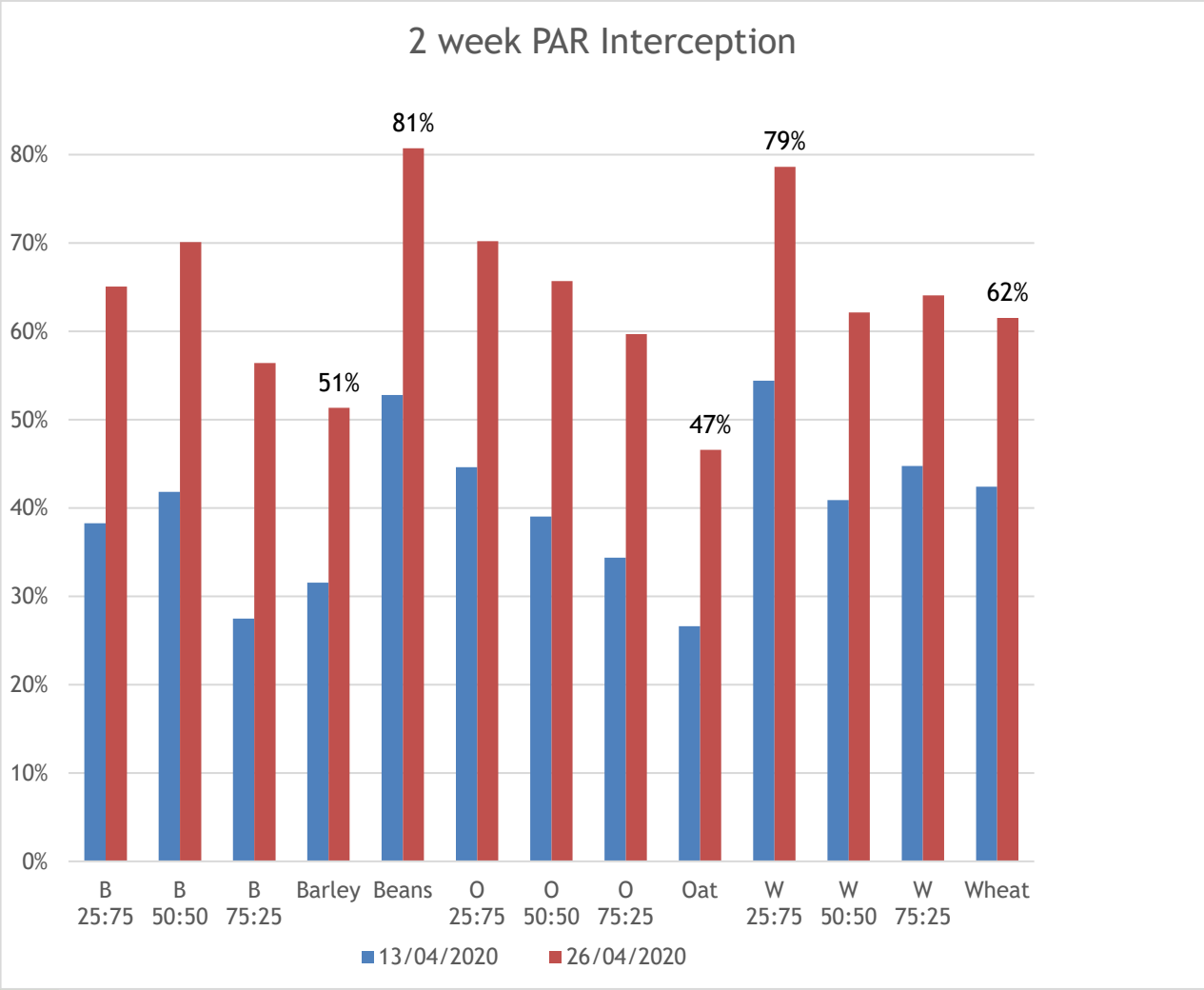
- Drilled 20th November 2019
- Fleeced overwinter
- Unfleeced late Feb
- Green area measured weekly
  - Red:Far Red
- Light Interception measured fortnightly
- Establishment plant counts
- Weed plant counts

Red:Far Red Greenness



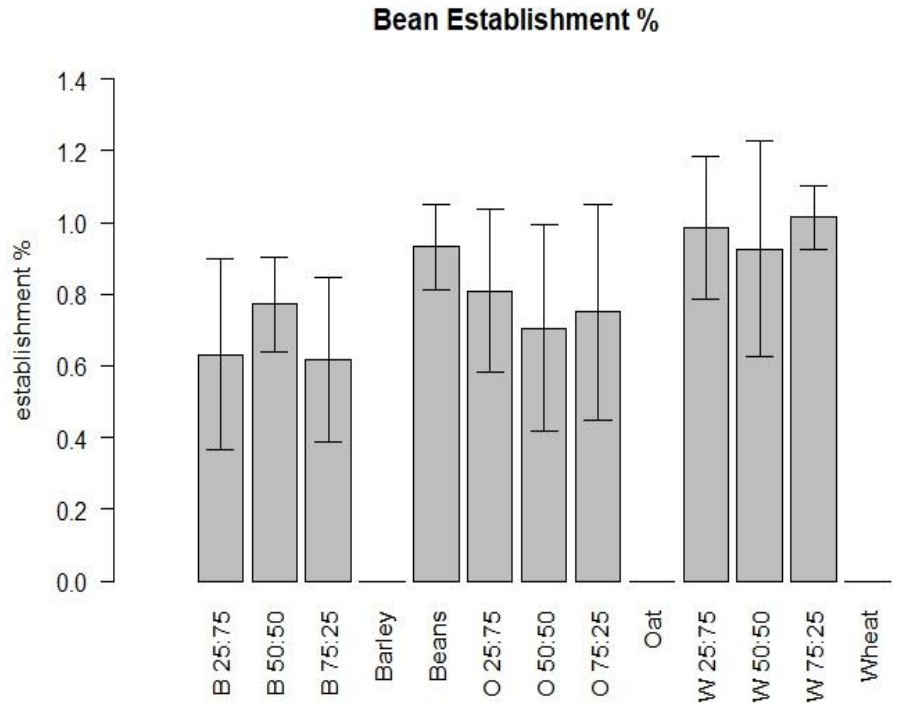
- Beans slow to spread out over the ground, leaving gaps for weeds to establish
- Dry weather at beginning of March cause of variation
  - Rain from week 3 benefitted all treatments
  - “FLATTEN THE CURVE” beginning to happen

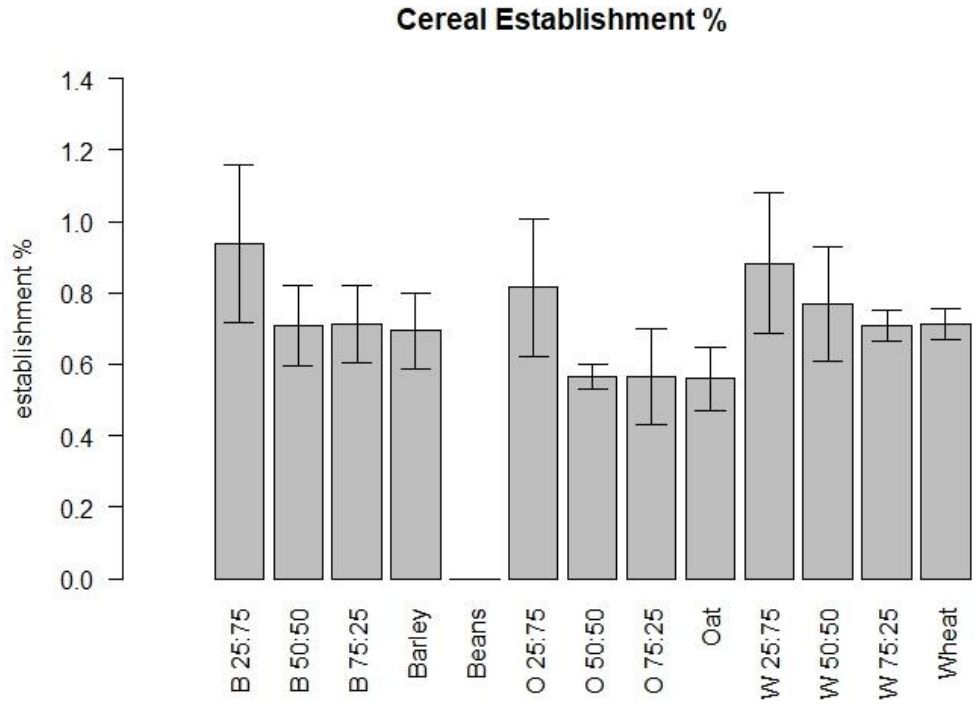
Light Interception



- While beans were slow to form a canopy to begin with, they have started closing fast.
- This could be a problem later for cereals struggling to compete.
- Higher light interception will help reduced weed burden.

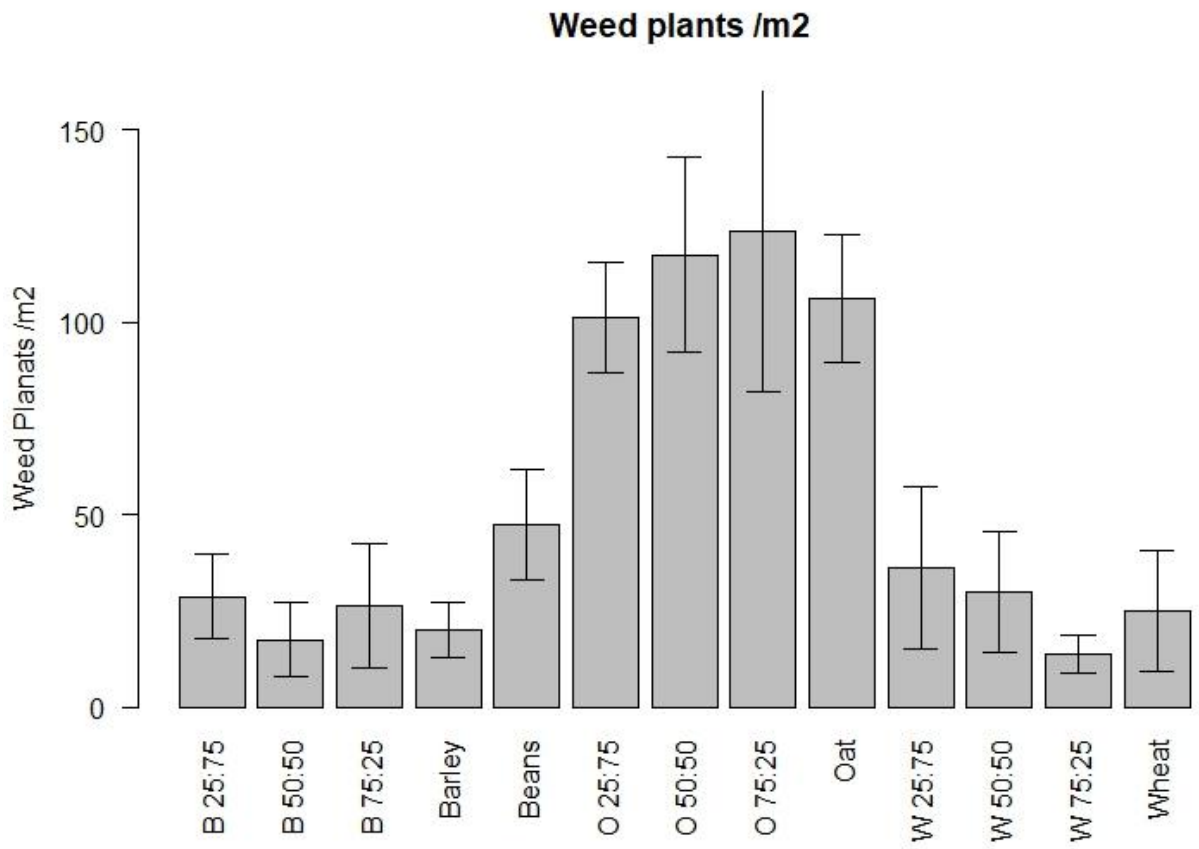
Winter Establishment (2 standard errors)





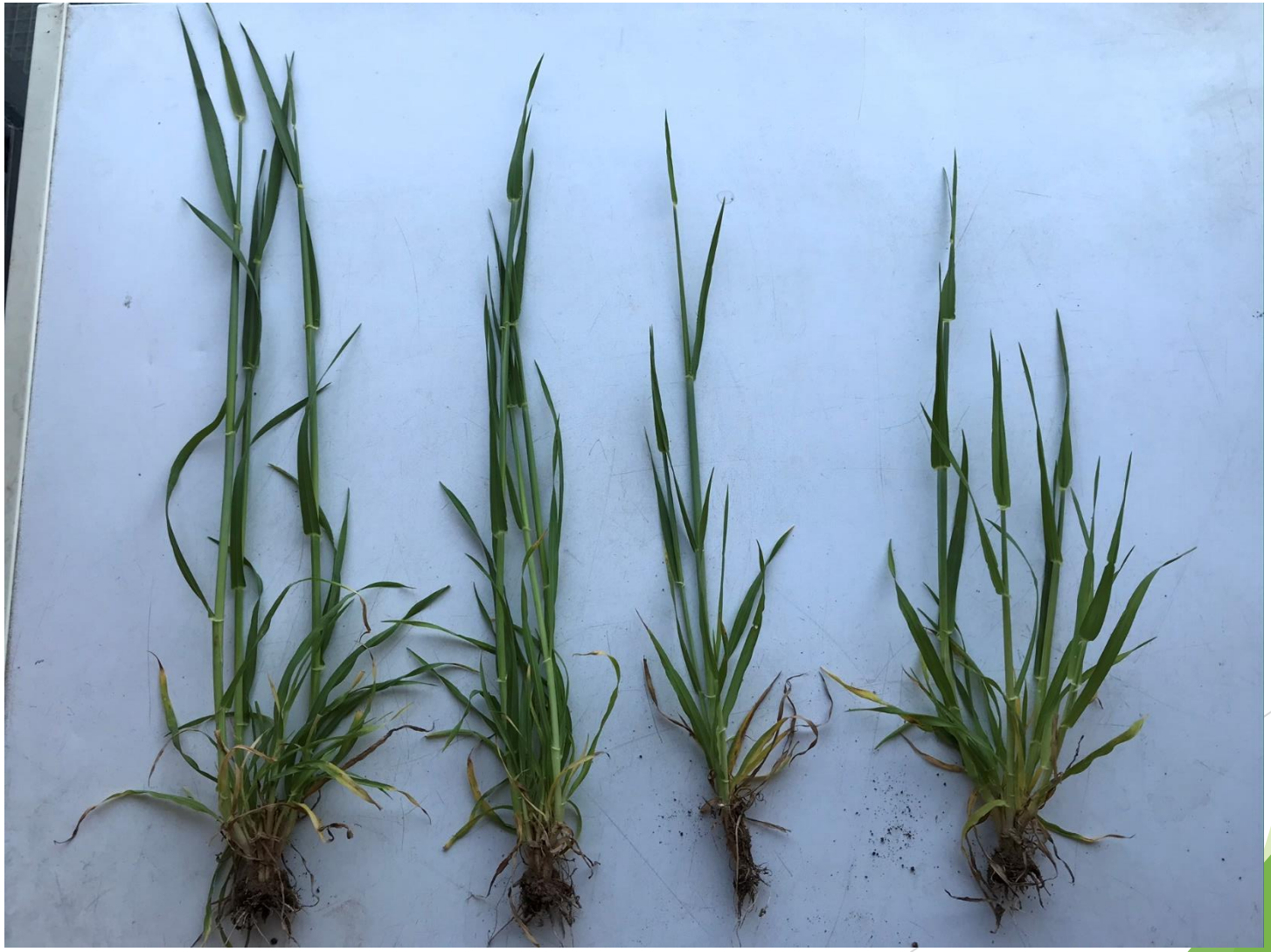
- Consistently raised emergence from 25% cereal 75% legume within the cereal component of intercrop
- Beans established best when intercropped with wheat

Winter weed count (2 standard errors)

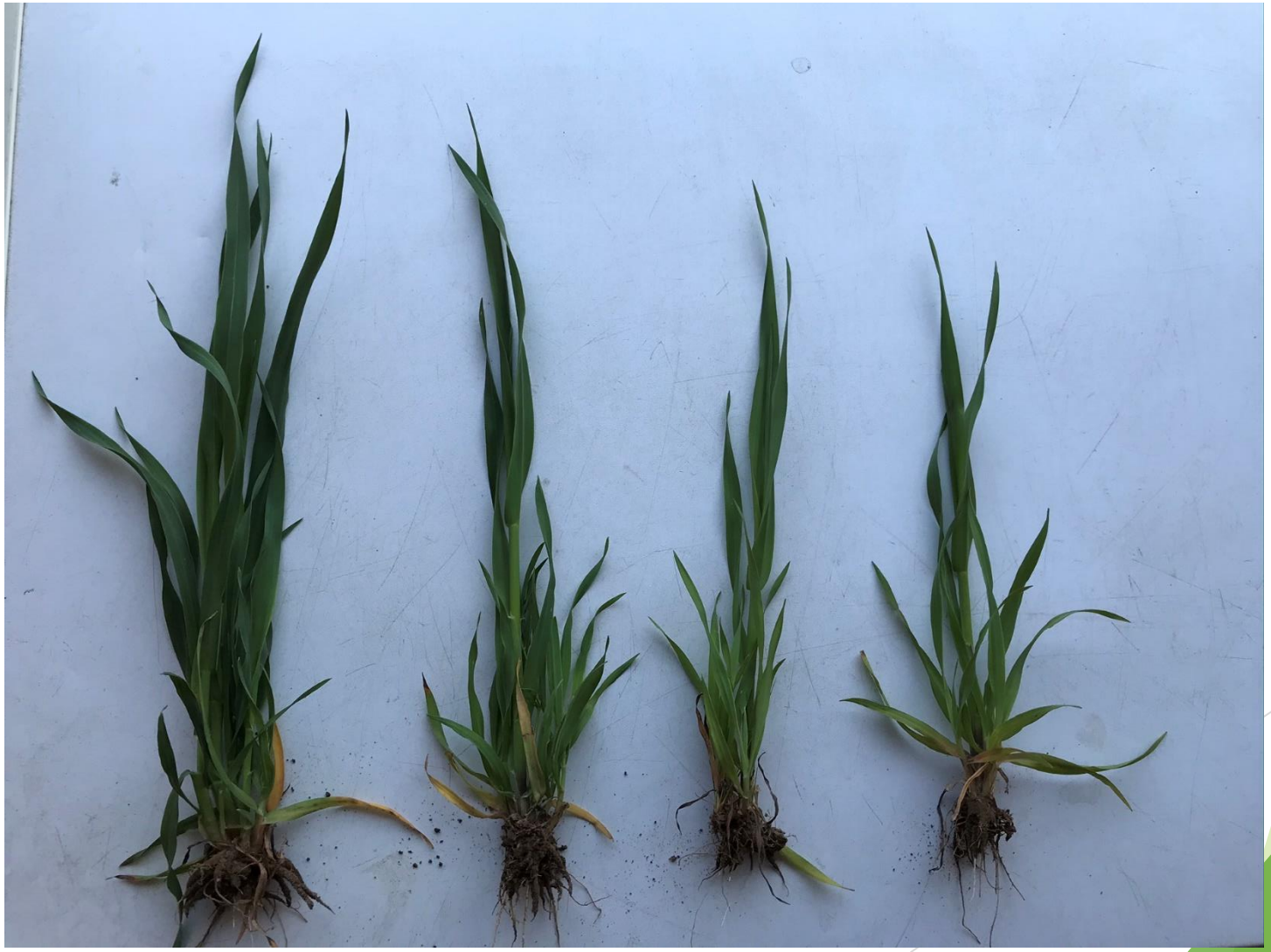


- Oat treatments did not receive a pre-emergence herbicide.
  -Lack of chemistry available
- When pre-emergence herbicide is used, intercropping provides weeding service for bean crops.

Winter Intercrop observations-Barley



Winter Intercrop observations-Oats



Winter Intercrop observations-Wheat

Spring intercrop so far

- Drilled at the beginning of April with pre-emergence herbicide applied then fleeced.
- Fleece removed after 3 weeks, once the crop had emerged.
- Plant counts show roughly 75% establishment- No differences between the different treatments.
- Pre-emergence herbicide effectiveness patchy due to dry surface when applied.
- Weed data premature- no differences seen so far.
- Rabbits appear to enjoy Lupins

Crops Research Unit

Erika Degani : Can novel crop rotations enhance ecosystem services underpinning arable production?

Phd project

Duration of Project: October 2013 - October 2017

Background:

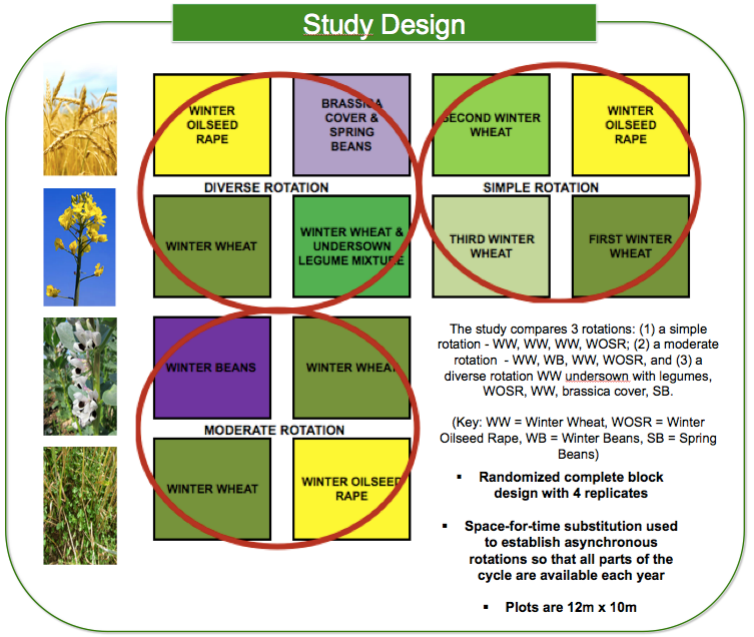
The design of landscapes based on 'ecological intensification' of agriculture, which aims to maintain or enhance agricultural production through the promotion of biodiversity-derived ecosystem services, can potentially enhance food security sustainably. Appropriate management of service-providing organisms underpinning supporting and regulating ecosystem services, can potentially minimize external inputs thus minimizing long-term environmental degradation while maximizing production. Temporal diversity through crop rotations is one approach proposed as a way to ecologically intensify food production and at the same time increase the resilience of production systems. Crop rotation is one of the oldest agronomic techniques and can potentially reduce the spread of pests and diseases as well as economic risks. However, there is a knowledge gap relating to the interactions, including potential trade-offs and/or synergies, between temporal crop diversity and multiple biodiversity-derived ecosystem services. Additionally, the new EU Common Agricultural Policy requires farmers to undertake measures including crop diversification in order to receive subsidies. Therefore it is vital that these interactions are quantified and understood as the optimization of multiple biodiversity-derived ecosystem services can potentially result in more sustainable and resilient agricultural systems.

Specific Work at CRU:

The study compares 3 rotations along a diversity gradient in a randomized complete block design with four replicates, using space-for-time substitution. Pollination service and pollinator abundance are being measured through standardized crop watches and exclusion experiments. Soil services are being assessed through the measurement of key physical, chemical and biological indicators of soil quality.

Supervisors:

Prof. Simon G. Potts, Dr Hannah Jones, Dr Simon Mortimer, Peter Sutton



Intended Outcomes:

This study aims to quantify the contribution of enhanced crop rotations to supporting and regulating ecosystem services. It focuses on pollination and soil fertility, their contribution to productivity and any potential trade offs and/or synergies between them.
plants in the field

Collaborators: LIBERATION, SYNGENTA and BBSRC.