Irrigation Research & Extension Committee

IREC — Griffith Irrigation Discussion Group 2020 Focus Paddock: Winter Cover Cropping Trial

Agriculture Trials with an Agronomic Focus

The aim of this trial, at the IREC field station, was to look at the value and implications of having a winter green manure crop on ground preparation, soil condition and growth of the following summer crop.

Technical Questions

1. Do cover crops prior to a summer crop (cotton) improve soil tilth, improving overall condition?
2. What are the negative effects from the incorporation of a cover crop in the system for land preparation, soil condition and planting?
3. Are there any differences based on the density in which the cover crop is spread on the above?
4. Is there a benefit to the growth of the following cotton crop in terms of soil biology?

Optimising Irrigated Grain

GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION

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Project Manager: Emma Ayliffe **Date Submitted:** April 2021

Irrigation Research & Extension Committee

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1. Summary

The trial at the IREC field station was designed in response to a survey of the members. Three different cover crop densities were established and allowed to grow for three months to provide ground cover and support soil biology while not hindering the preparation of the following summer crop. The cover crop was well established using standard farming practices and tools. The crop was terminated as planned with the paddock pulled into hills for cotton with no issues.

In the following cotton crop, a soil sample was taken from the high density cover crop area, low density cover crop area and compared to soil from an area that was newly developed. This soil was tested from VAM numbers at cut out to look at the colonisation. There was an improvement in the volume and diversity in soil biology where the cover crops where compared to the newly developed comparison field.

Overall it was found that it was easy to establish the cover crop with little extra work and that the preparation for the following cotton crop wasn't hindered by the cover crop. There were no negative effects on the crop. The early season establishment of the cotton was very good, there were no visual difference in the cotton mid season with the VAM results indicating that there was an improvement in soil biology and diversity compared to the newly development bare earth control.

2. Introduction

The IREC Field Station site is used to trial new ideas and tools for the irrigated farming systems. As part of IREC's aim to meet the needs of its members, a survey was sent out to collect the ideas and desires of the paid members. One common theme reoccuring from the surveys, was the incorportation of cover crops into the production system. IREC took this on board and created this cover crop trial as the Griffith Irrigation Discussion Group Focus Paddock- planting a mixed species cover crop, spread at three different densities to look at winter ground cover and the effect on the following crop.

While cover cropping isn't a new concept it is not commonly practiced in modern irrigation systems, with a greater focus on tillage for soil condition rather than cropping.

3. Experimental Details

3.1 Site Details

Location	IREC Field Station
Crop	Cover crop followed by Cotton
Variety	Mixed Species
Soil type	Red Loam
Irrigation type	Flood Furrow
Sowing Date	17/06/2020
Sowing Type	Cover crop spread with super

3.2 Full product details

Cover crop blend – vetch, field peas, canola, oats, barley

Spread with SuPerfect

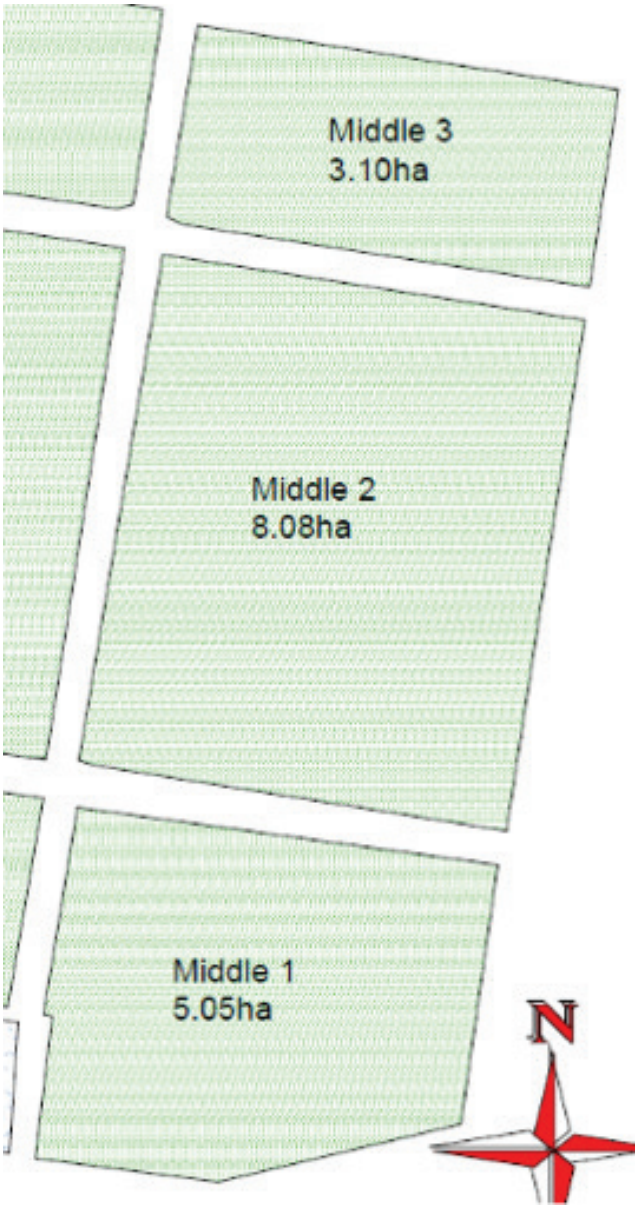
3.3 Treatment Rates

Blend

Product	Kg/ha
SuPerfect	280
Oats	50
Barley	50
Vetch	13
Peas	30
Canola	1

3.5 Application Details

The block was split into 3rds, the western third had the base rate, the centre had a double rate with the eastern third having 3 times the eastern side.



3.6 Trial Design

Design	Strip trial
Replicates	1
Plot size	Approx. 5ha
Buffers	Nil between treatments

3.7 Assessments

NDVI Maps

Soil VAM analysis in following cotton crop.

3.8 Statistical Analysis

Nil

4. Results and Discussion

The trial was spread on the 17th of June and was established by rain.

Zone 1	Zone 2	Zone 3
½ x Base	1 Base Rate	1.5 x Base Rate
SuPerfect 140kg/ha	SuPerfect 280kg/ha	SuPerfect 420kg/ha
Oats 25kg/ha	Oats 50kg/ha	Oats 75kg/ha
Barley 25kg/ha	Barley 50kg/ha	Barley 75kg/ha
Vetch 6.5 kg/ha	Vetch 13 kg/ha	Vetch 19.5 kg/ha
Peas 15kg/ha	Peas 30kg/ha	Peas 45kg/ha

The crop was monitored over the winter for growth.

Figure 1. Base crop 14th August, 2020 with the NDVI from the same timing.

Figure 2 & 3. 21st August left being the thickest sowing rate compared to the right on the lowest spreading rate.

Figure 4. The crop was terminated as a green manure crop at the end of August in preparation for a summer cotton crop.

At termination it was decided to green manure the crop as this allowed the biomass to breakdown faster and be less of an issue for the following summer crop. The block was mulched and then listered, turning the beds into hills. This process was able to provide 80% destruction of the cover crop. Using the same bar, fertilizer was banded. The hill condition was cloddy but due to the root and biomass in the soil the clods were friable. To get into planting conditions the hills were then ring rolled with listers to clean out the furrows, and then rubber tyre rolled.

The comments from the field preparation team were that the root matter in the soil made it very easy to work and get into sowing condition. With the rain events over the winter and the cover crop actively growing it allowed the paddock to be trafficked in a timely manner and in good condition. When the operations started it was borderline too dry as the cover crop had dried down faster then anticipated but with soil type and cover crop the soil was very forgiving. Overall, the benefit of the cover crop far outweighed any operational issues and the following crop was able to establish better than in a long fallow situation.

Figure 5. Left is the cotton emerging, right is the NDVI of the cotton in December.

Post tillage the most persistent species that was left in the field was the oats. These were sprayed post water up of the cotton and while the plant persisted there was no new growth and they actually offered some protection from wind damage compared to other seedlings in the area.

Soil samples were taken from the high biomass and low biomass cover crop areas as well as from a neighboring new development also planted to cotton. These samples were sent to VAMWise to have an analysis on the number and diversity of the spores in the soil. It was tested from group A spores (*Glomus Rhizophagus*), group B spores (*Glomus B sppn.*) and group C spores (*Gigagaspora sppn*. and *scutellospora sppn.*). (Group A primarily cover AMF species required for cotton).

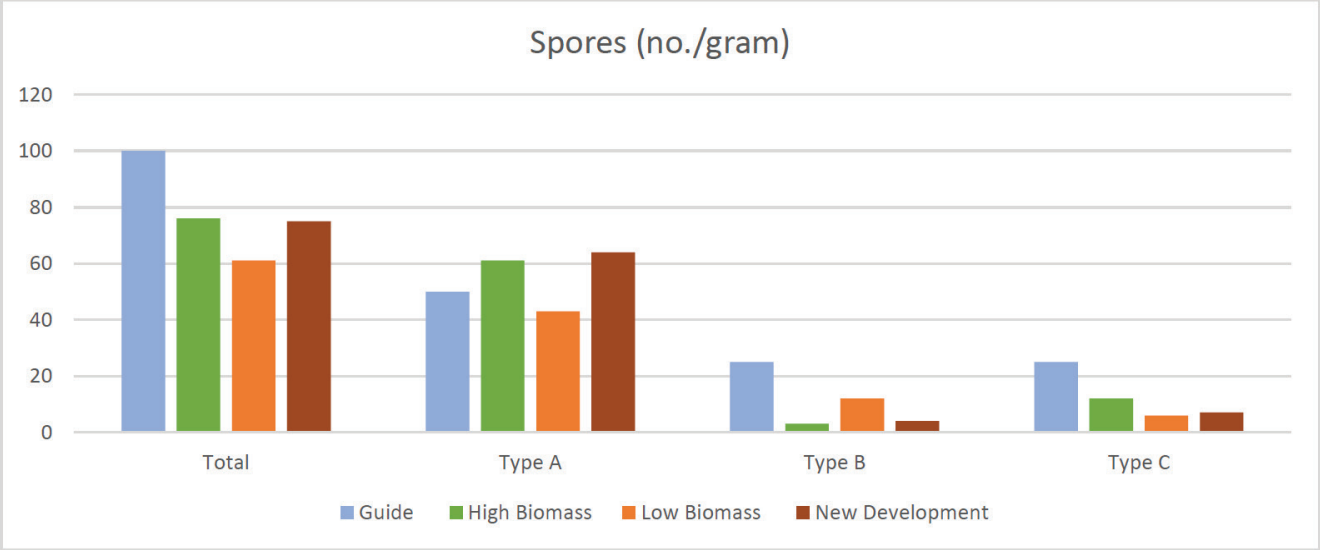


Table One: The total number of spores per gram of soil.

From the soil analysis it can be seen that there was no significant differences or trend between the treatments and the soil biology.

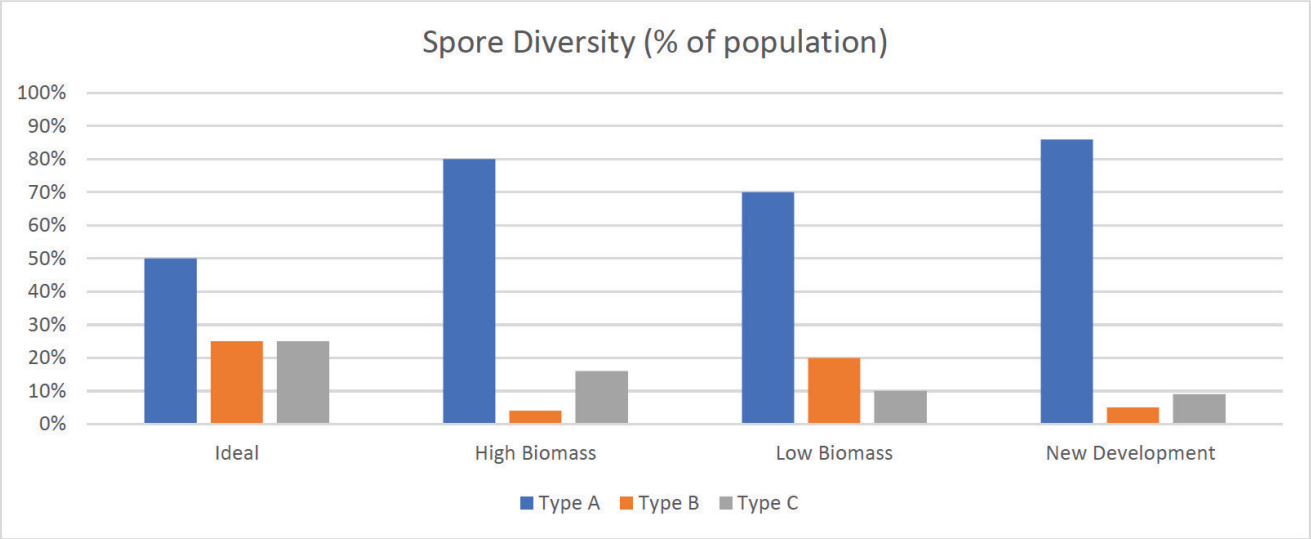


Table 2: Percentage of spore type compared to the ideal for each site.

The newly developed country had the most "out of ratio" spore levels of the samples, with the low biomass having the most in ratio, this is likely due to the very low levels generally in the new development which makes it easier to be in ratio compared to the bigger numbers in the cropped area. The numbers are also highly influenced by mechanical passes and fertiliser but as all blocks had cotton, they were likely exposed to similar fertiliser.

If these tests had been replicated at the start of the season there may have been more stark differences seen.

5. Conclusions

The cover crop project was a success. It was able to be established on rainfall and we were able to get all crop species out of the ground. The establish of the cover crop was simple enough and proved easy to integrate into the current farming methods. Once terminated the crop broke down well and left the soil in incredibly friable condition making a short turn around into cotton easily achievable.

The establishment of the following summer crop proved to be a great success with the crop jumping out of the ground much faster than seen in a long fallow. Soil VAM analysis showed no significant differences between the treatments, although a second test done earlier in the season may have helped to draw this out.

Overall, the double cropping with a green manure cover crop prior to a summer row crop proved a great success. The IREC Field Station manager said he would use green manure cover crops again and on his own property.

Appendix 1 – VAM Results

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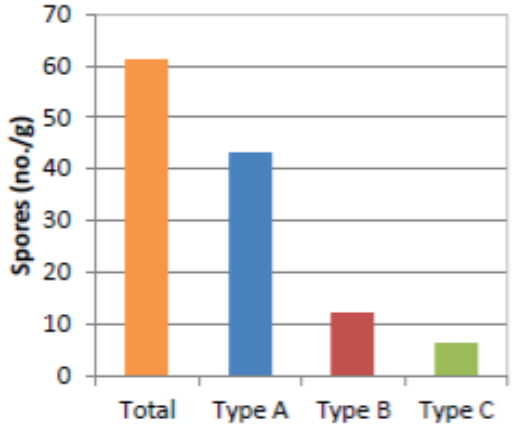
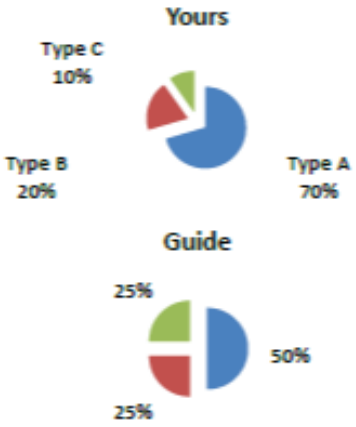
VAM WISE FOR SOILS

Customer name	AgVita Analytical Services	**Date received**	23/02/2021
Client name	Michael Ruffels	**Agent**	AgVita Analytical
Sample name	Summit Ag Irec Low Biomass	**Advisor**	Michael Ruffels
Crop	Not specified	**Authorised by**	
Date sampled		**Analysis no.**	2817-1-VWSS

Spore Numbers



Spore Diversity



	Yours	Guide
Type A spores (no./g)	43.0	50.0
Type B spores (no./g)	12.0	25.0
Type C spores (no./g)	6.0	25.0

	Yours	Guide
Total spores (no./g)	61.0	100.0

Key

Poor | Fair | Good

Comments

The total number of spores was good. Spore diversity was fair. Avoid the use of management practices that reduce VAM populations, such as high fertiliser (particularly P and N) rates, the use of fungicides, bare fallows before planting, previous non-mycorrhizal host crops or excessive tillage. Spore diversity may be increased by increasing the number of different mycorrhizal crops in rotations and decreasing successive rotations of similar crops. Application of VAM inoculum can help to overcome short-term problems.

Explanations

VAM Wise for Soil measures the number of spores of arbuscular mycorrhizal (AM) fungi (VAM) in your sample. Total spores is the total number of all types of spores in your soil. Type A spores belong to Glomus species Group A. Type B spores belong to Glomus species Group B. Type C spores belong to Gigaspora and Scutellospora species. Over time, the diversity of mycorrhizal fungal species (as indicated by spore types) can be reduced by farming practices, particularly monoculture rotations. This can result in populations of mycorrhizal fungi that are less efficient at providing nutrients per unit of plant sugar supplied. A high diversity of VAM species helps to ensure that species of most benefit to a given crop are more likely to be present at any time.

Disclaimer

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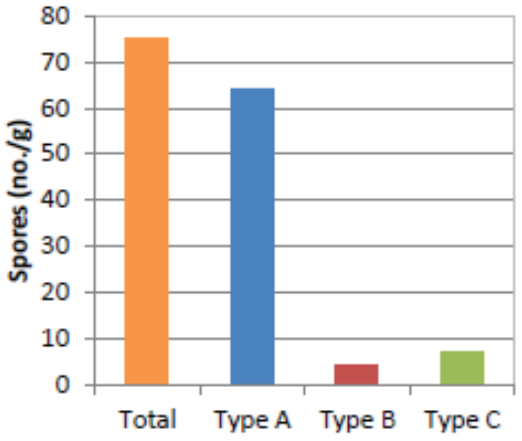
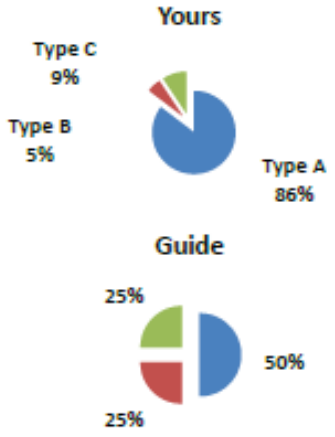
VAM WISE FOR SOILS

Customer name	AgVita Analytical Services	**Date received**	23/02/2021
Client name	Michael Ruffels	**Agent**	AgVita Analytical
Sample name	Summit Ag Irec No Cover	**Advisor**	Michael Ruffels
Crop	Not specified	**Authorised by**	
Date sampled		**Analysis no.**	2817-2-VWSS

Spore Numbers



Spore Diversity



	Yours	Guide
Type A spores (no./g)	64.0	50.0
Type B spores (no./g)	4.0	25.0
Type C spores (no./g)	7.0	25.0

	Yours	Guide
Total spores (no./g)	75.0	100.0

Key

Poor | Fair | Good

Comments

The total number of spores was good. Spore diversity was poor. Avoid the use of management practices that reduce VAM populations, such as high fertiliser (particularly P and N) rates, the use of fungicides, bare fallows before planting, previous non-mycorrhizal host crops or excessive tillage. Spore diversity may be increased by increasing the number of different mycorrhizal crops in rotations and decreasing successive rotations of similar crops. Application of VAM inoculum can help to overcome short-term problems.

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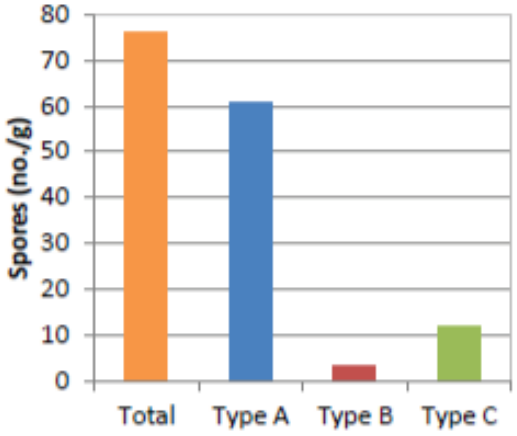
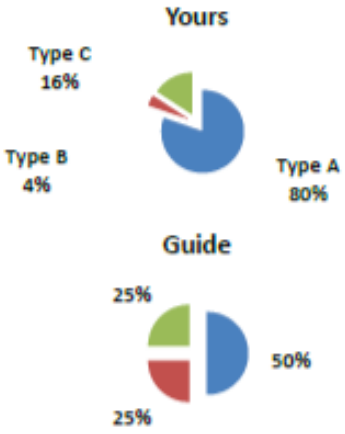
VAM WISE FOR SOILS

Customer name	AgVita Analytical Services	**Date received**	23/02/2021
Client name	Michael Ruffels	**Agent**	AgVita Analytical
Sample name	Summit Ag Irec High Biomass	**Advisor**	Michael Ruffels
Crop	Not specified	**Authorised by**	
Date sampled		**Analysis no.**	2817-3-VWSS

Spore Numbers



Spore Diversity



	Yours	Guide
Type A spores (no./g)	61.0	50.0
Type B spores (no./g)	3.0	25.0
Type C spores (no./g)	12.0	25.0

	Yours	Guide
Total spores (no./g)	76.0	100.0

Key

Poor | Fair | Good

Comments

The total number of spores was good. Spore diversity was poor. Avoid the use of management practices that reduce VAM populations, such as high fertiliser (particularly P and N) rates, the use of fungicides, bare fallows before planting, previous non-mycorrhizal host crops or excessive tillage. Spore diversity may be increased by increasing the number of different mycorrhizal crops in rotations and decreasing successive rotations of similar crops. Application of VAM inoculum can help to overcome short-term problems.

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