Multi-Species Fallow Economics: 2019-2020 Case Study

Herbert growers: Lawrence & Hayden Di Bella

Growers participating in Project Catalyst trials worked with economists from the Department of Agriculture and Fisheries (DAF) to identify costs and benefits of the trials. In this study, Lawrence and Hayden Di Bella and Herbert Cane Productivity Services (HCPSL) trialled a number of legume and multi-species fallows on his farm.

The objective of the trial was to compare the performance of sugarcane following different fallow treatments. Lawrence and Hayden aim to improve their soil health through exploring the possibility of applying less N following a legume or multi-species fallow. To evaluate this opportunity, various legume and multi-species fallows (including a bare fallow) were trialed to compare the yield, sugar and profitability of the subsequent sugarcane crop. The yield, sugar, variable costs and gross margins for the fallow and plant cane for each treatment are compared.

Trial design

The randomised complete bock trial was established with 20 treatments in 2018 (19 legume or multi-species fallow treatments and a single bare fallow treatment). Each treatment included three replicates. Table 1 shows the fallow treatment descriptions while Figure 1 presents a map of the trial layout. Following the fallow, sugarcane was planted on the trial block in 2019 and harvested in 2020. All treatments received 35 kg/ha of nitrogen (N).

Key findings

- There were no significant differences in cane or sugar yield between the treatments ($p>0.05$).
- While there were large differences in gross margin between treatments, these were not statistically significant due to the high variability within treatments ($p>0.05$).

Note: T4 is excluded from the results due to the canola crop failure (likely due to a seasonal timing issue).

Table 1: Description of Fallow treatment

Treatment	Fallow Description
T1	Bare Fallow
T2	Soy Leichardt
T3	Cowpea Ebony
T4	Canola
T5	Jap Millet
T6	Sunn Hemp
T7	Sunflower Greystripe
T8	Sweet Potato
T9	Velvet Bean Dominator
T10	Tropical Mustard
T11	Burgundy Bean
T12	Pigeon Pea
T13	Tillage Raddish
T14	Rice
T15	Soybean Mossman
T16	Mix 1 - Nematode Resistant[1]
T17	Mix 2 - SRA Mix[2]
T18	Mix 3 - High Performer[3]
T19	Mix 4 - Forbes Mix[4]
T20	Mix 5 - Traditional Mix[5]
T21	Soybean Kuranda

[1] Mix 1 – Cowpea (Ebony), Sunn Hemp and Rongai Lablab
[2] Mix 2 – Sunflower, Cowpea (Ebony), Soyabean (Leichardt), Jap Millet, Tropical Mustard, Tillage Raddish
[3] Mix 3 – Soybean (Leichardt), Cowpea (Ebony), Cowpea (Meringa), Sunn Hemp, Rongai Lablab
[4] Mix 4 – Sunn Hemp, Soybean (Leichardt), Pigeon Pea, Cowpea (Ebony), Sunflower, Jap Millet, Tillage Raddish.
[5] Mix 5 – Cowpea (Ebony), Rongai Lablab

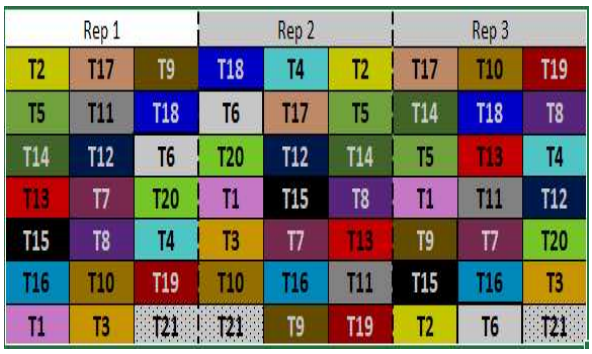

Figure 1: Trial Layout *(source: HCPSL)*

Agronomics

Figure 2 presents the plant cane yield data. Average yields ranged from 95 t/ha to 108 tc/ha (for all treatments) and was highest in the Mix 4 (T19) treatment, but this difference was not significant (p>0.05).

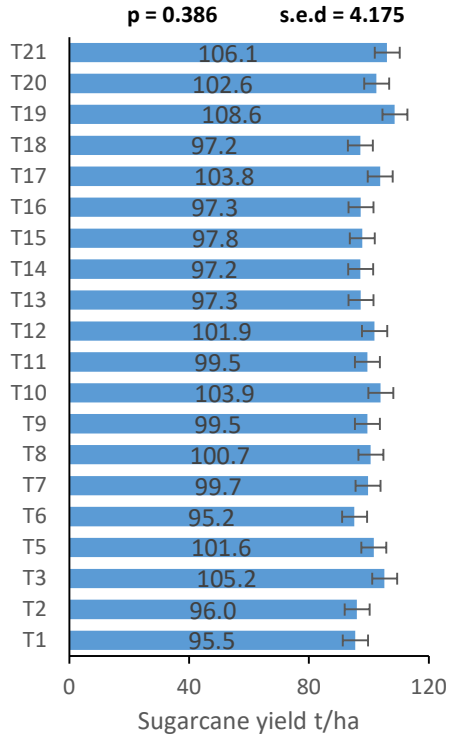

Figure 2: Sugarcane yield results (t/ha)

Figure 3 shows the average CCS for each treatment. The average CCS ranged from 9.7 to 11.6 units. However, there were no statistically significant differences in CCS between treatments.

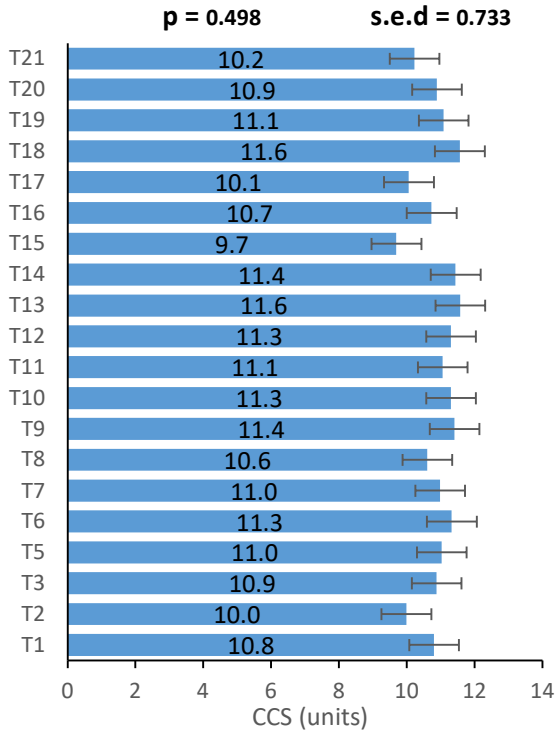

Figure 3: Average mill CCS results (units)

Figure 4 presents the sugar yield from each treatment. Similarly, there were no significant differences in sugar yield between treatments (p>0.05).

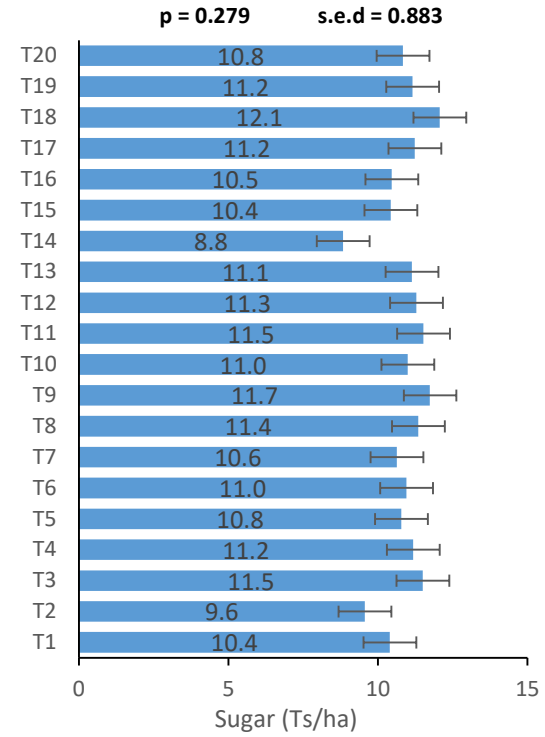

Figure 4: Sugar yield results (Ts/ha)

Costs

Fallow costs are presented in Figure 5. Land preparation and liming costs were the same for all treatments. The Bare Fallow (T1) had no planting or legume costs but incurred higher weeding costs due to two additional herbicide applications required for the fallow period. Except for seed costs, both planting and weed control costs were the same for all fallow crop treatments. The highest seed cost was for the Sunn Hemp (T6) at $326/ha and the lowest was for the Tropical Mustard (T10) at $42/ha.

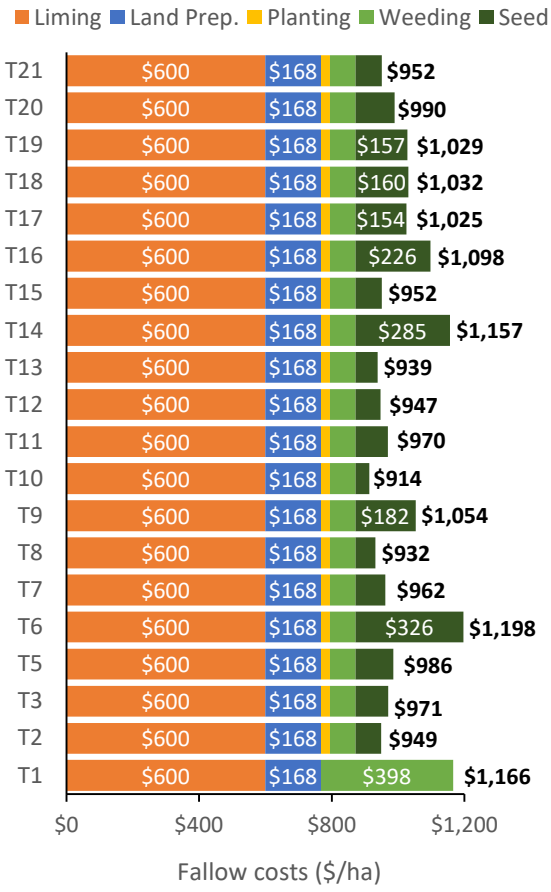

Figure 5: Fallow costs per treatment ($/ha)

The variable costs for the plant cane are presented in Figure 6. The difference in treatment variable costs were due to differences in harvesting costs and levies, both linked to yield variations. All other variable costs were the same between treatments.

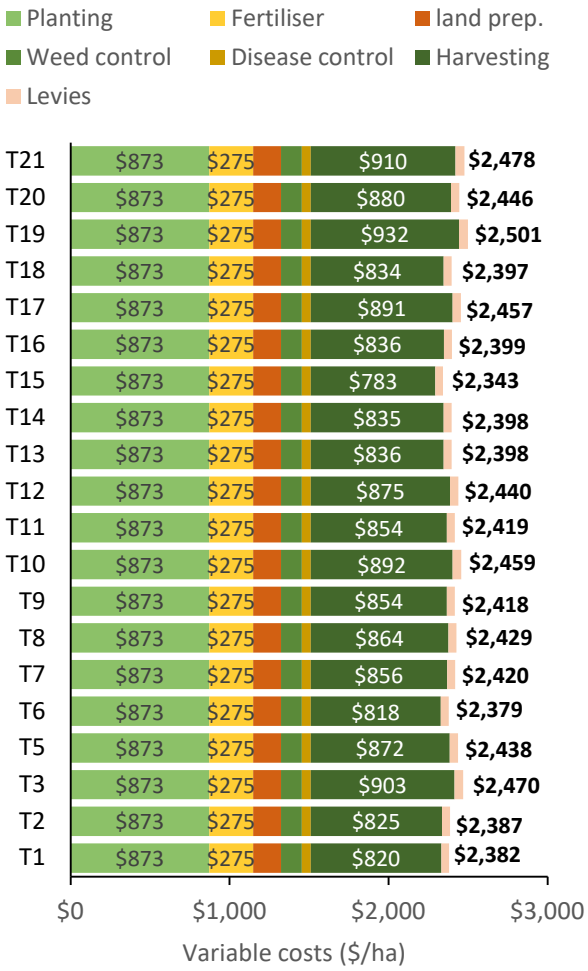

Figure 6: Variable costs per treatment, plant cane ($/ha)

Gross margins

Gross margin results (revenue less variable costs) are presented in Figure 7 for the plant cane. Gross margins varied across treatments with Tropical mustard (T10) having the highest overall gross margin (+$487/ha) and the Soy Leichardt (T2) having the lowest (-$176/ha). However, these differences were not statistically significant ($p>0.05$) and could therefore not be attributed to the various fallow treatments.

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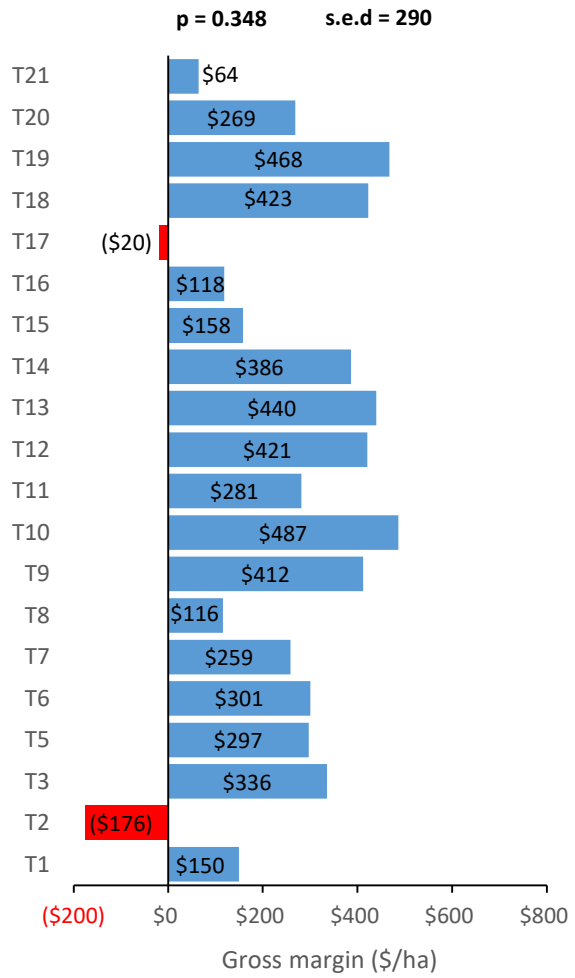

Figure 7: Plant cane gross margin ($/ha)

Conclusion

Lawrence and Hayden wanted to assess both the agronomic and economic performance of sugarcane following different legumes, multi-species crops and a bare fallow.

Differences in average yield, CCS, sugar and gross margins were not statistically significant ($p>0.05$) due to the high variability within treatments. Mean differences could, therefore, not confidently be attributed to the treatment effect.

Benefits from legume and multi-species fallows are expected to improve soil health over the longer-term. Noticeable improvements in sugarcane production and profitability might therefore require a longer trial period to accurately quantify production impacts. This would improve the understanding of fallow treatment impacts on sugarcane production and economics. Utilising a different trial design concept for the randomisation of replicates, such as a spatial design, would improve the layout and better account for variability. More replicates would also be beneficial given the variability in the data.

Note: The trial results are specific to this grower, paddock and prevailing conditions.

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