How do shelterbelts affect soil health and pasture production?

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Background

- Shelterbelts provide vegetative barriers to protect pasture and animals during extreme climatic events.
- They can attract and host beneficial insects and improve soil health.
- The benefits of shelterbelts should not be assumed and extrapolated across locations.
- Soil, plant, and animal properties, as well as agricultural management practices, differ significantly across locations.
- Differences in these factors can impact the effectiveness of shelterbelts and their potential to increase farm productivity.

Background

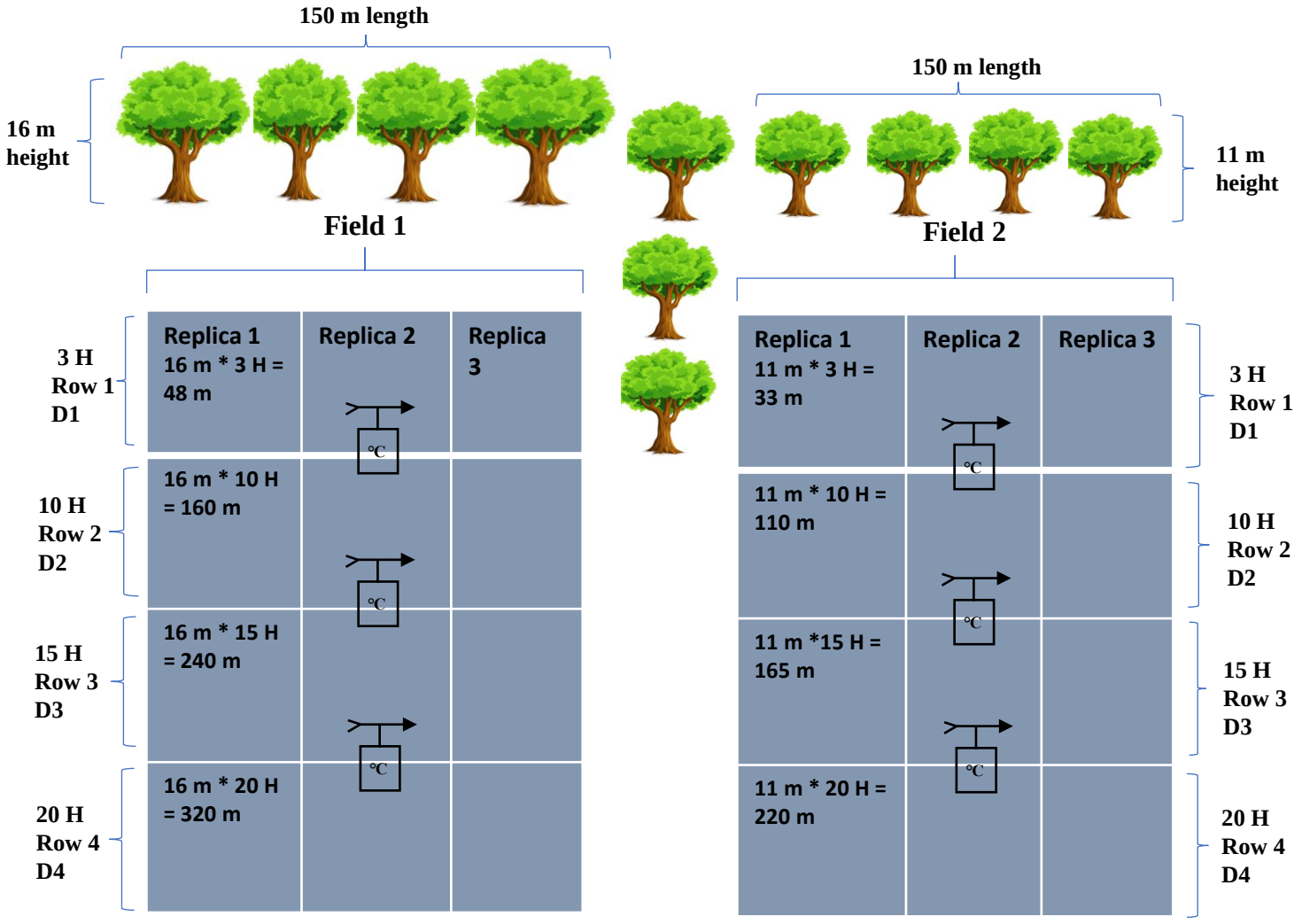
- Literature review noted that further research is required to assess how the type of shelterbelt interacts with different forage and animal classes.
- It is important to note that a large proportion of the Australian literature found was in the form of technical report, which in most cases is not peer-reviewed; therefore, it is difficult to determine the quality of these technical report results.
- The effects of shelterbelts on pasture growth are complex and **local** research is needed to confirm the benefits of using shelterbelt.

Paddock history

Year	Forages
2016	Wheat
2017	Canola
2021	Ryegrass

Paddock Location

Diagram of studied area



D1: Distance one to the shelterbelt
D2: Distance two to the shelterbelt
D3: Distance three to the shelterbelt
D4: Distance four to the shelterbelt

Shelterbelts

Field 1 – Shelterbelt 16 meters height

Field 2 – Shelterbelt 11 meters height

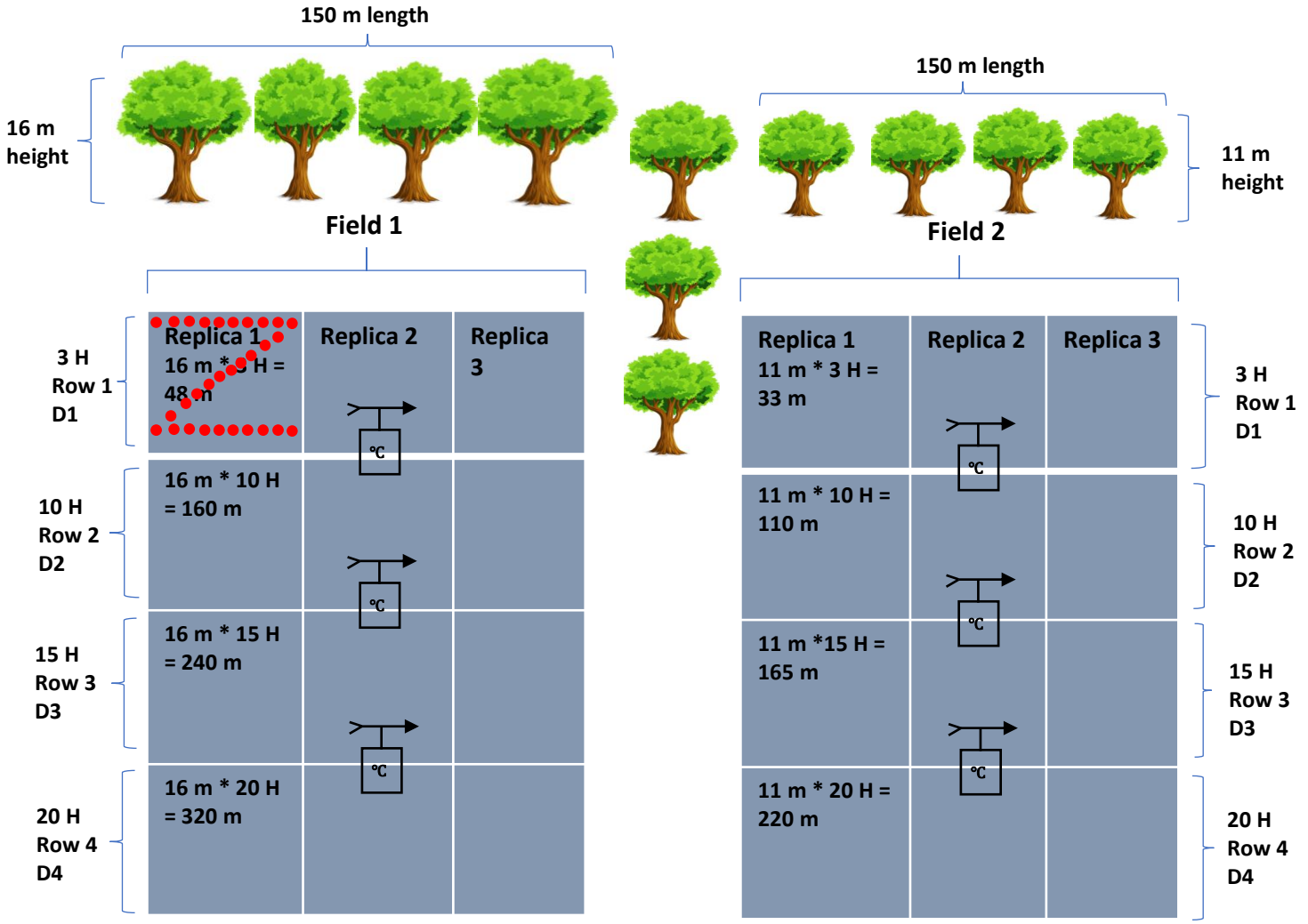
Method

- Soil in this paddock is typical red soil region.
- This project has two trials that fell into Spring (Sep-Oct) and Summer (Nov-Dec).
- The temperature in Spring were ranging from 13.6℃ to 21.1 ℃, and average at 17.6 ℃.
- The maximum wind speeds were from 1 m/s to 10.6 m/s.
- In the Spring trial, the soil samples were collected after sheep completed grazing out the paddock on 17th Sep.

Method (the Spring trial)

- The soil sampled in each block in “Z” shape, total 30 times collection were performed in each block.
- Then measure the pasture height by using rising plate meter in the paddock with sample method with soil sampling and set at day 0.
- The weather station were located at boundary of 3H,10H and 15H, to record the wind and temperature in different distance.
- The weather data were collected at day 3, 10, 15,16,18,21,25.
- Hay sample were measured height and cut at the heading stage for quality test at the day 39.

Diagram of studied area



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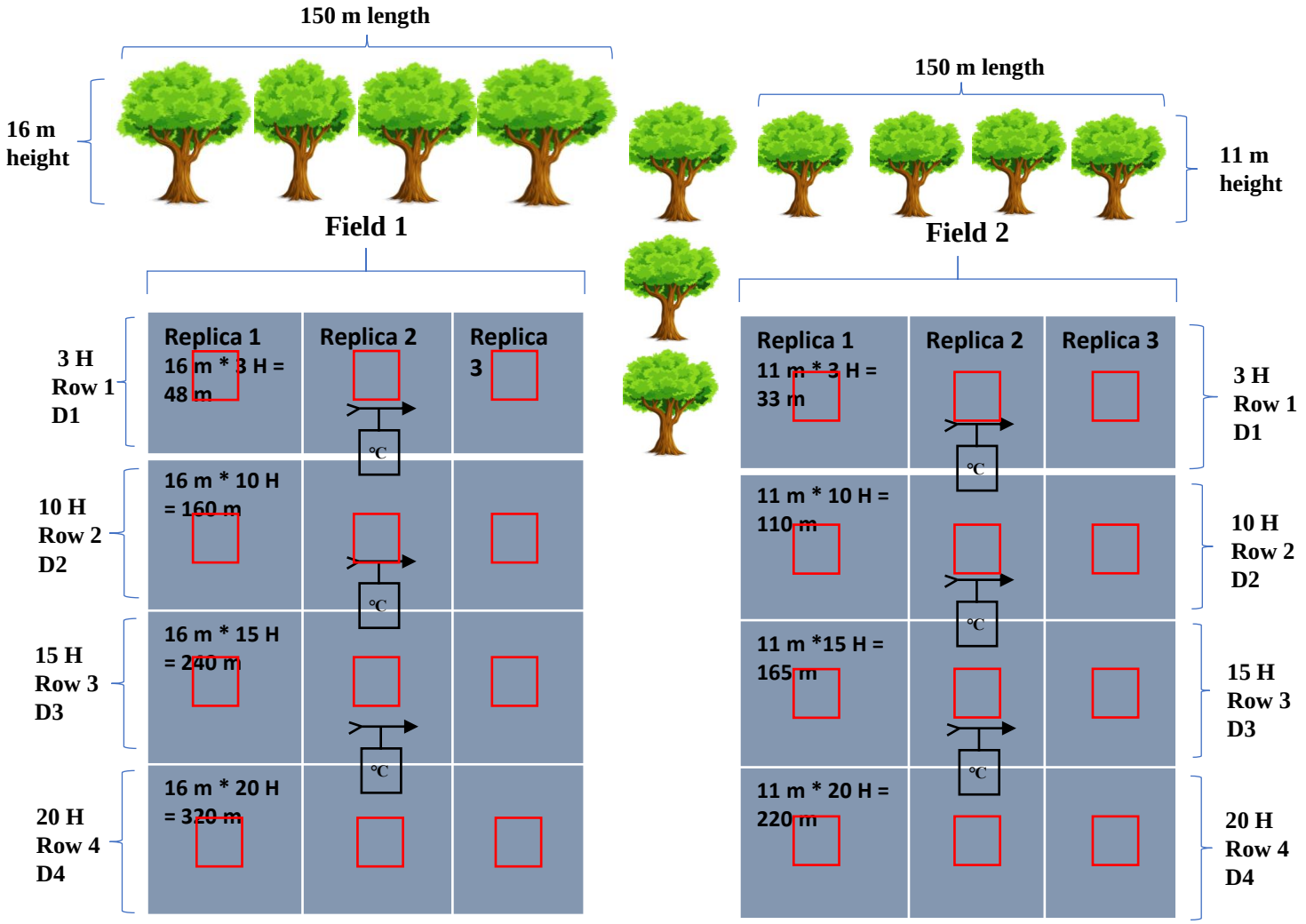
Method (the Summer trial)

- Mowing were applied in summer trial in each block for around 4 sqm.
- Soil sampling were collected in the 4 sqm in “Z” shape with small soil sampler and 30 samples were collected in each block.
- Regrowth cages (1 sqm) were install in the central of mowing areas (day 0).
- The weather station were located at boundary of 3H,10H and 15H, to record the wind and temperature in different distance.
- The weather data were collected at day 10,15,16,18,21,25.
- And hay cut were performed at the day 39.

Diagram of studied area



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Spring Results overview

Table 1. The effects of Distance and Tree high on regrowth DM yield, pasture quality and nutrient yield during 39 days in Spring.

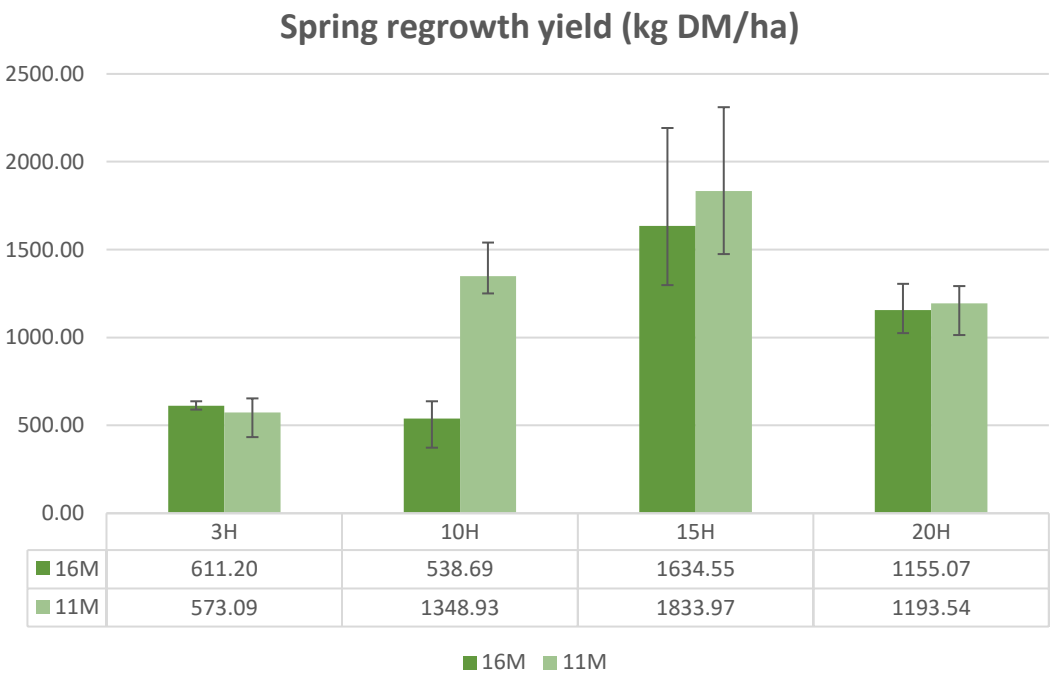
	Treatment									P-value		
	11M				16M							
Item	3H	10H	15H	20H	3H	10H	15H	20H	SEM	Distance	Tree high	Distance × Tree high
Spring regrowth DM yield (kg DM/ha)	573.1^{D}	1348.9^{BC}	1834.0^{A}	1193.5^{BC}	611.2^{D}	538.7^{D}	1634.6^{AB}	1155.1^{C}	106.36	0.000	0.029	0.045
Spring CP (%DM)	7.1^{A}	5.9^{C}	6.5^{ABC}	6.1^{BC}	5.9^{C}	6.6^{AB}	6.2^{BC}	6.1^{BC}	0.10	0.430	0.194	0.005
Spring CP yield (kg /ha)	40.0	79.6	119.4	72.9	35.9	35.4	101.0	70.0	6.68	0.000	0.021	0.153
Spring ME (MJ/kg DM)	10.0	9.7	9.9	9.7	10.4	11.6	11.7	10.1	0.20	0.118	0.001	0.092
Spring ME yield (MJ/ha)	5731.0	13084.3	18156.6	11577.0	6356.48	6248.9	19,124.8	11,666.5	1,244.4	0.000	0.369	0.152

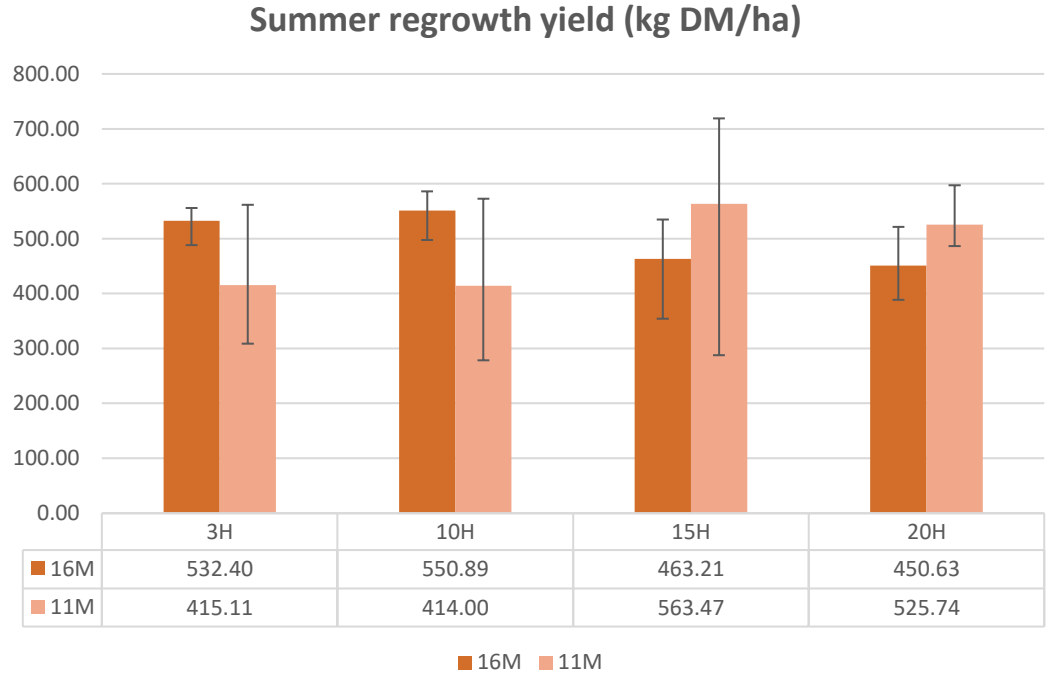
Summer Results overview

Table 2. The effects of Distance and Tree high on regrowth DM yield, pasture quality and nutrient yield during 39 days in Summer.

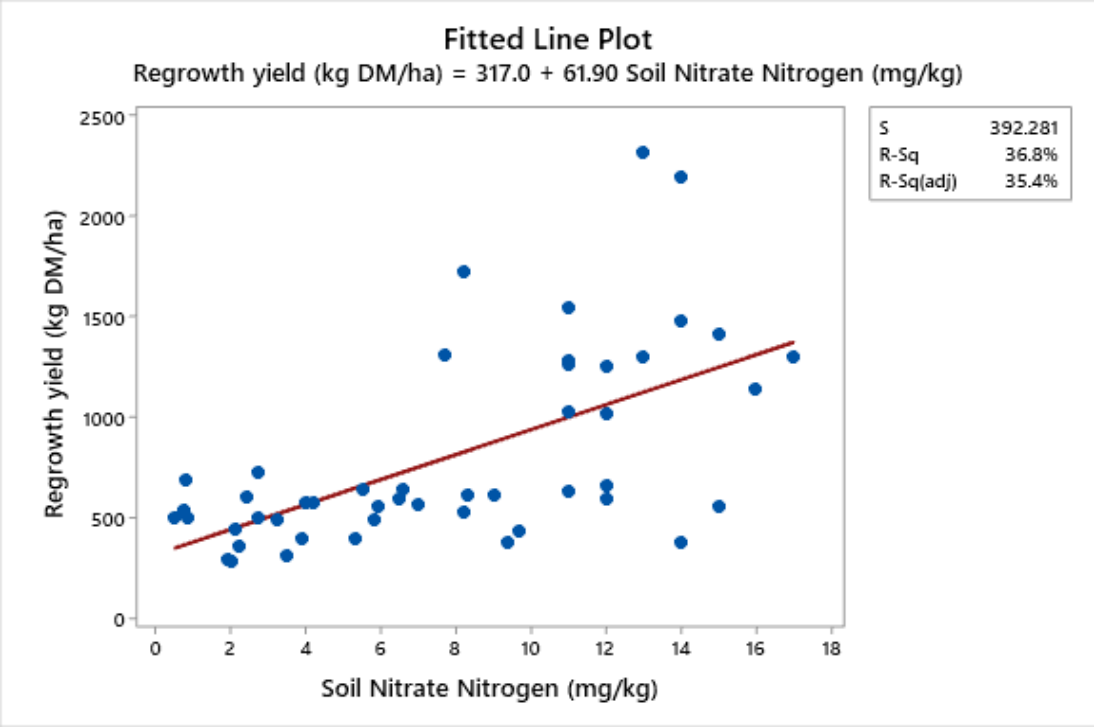
	Treatment									P-value		
	11M				16M							
Item	3H	10H	15H	20H	3H	10H	15H	20H	SEM	Distance	Tree high	Distance × Tree high
Summer DM yield (kg DM/ha)	415.1	414.0	563.5	525.7	532.4	550.9	463.2	450.6	23.83	0.948	0.696	0.233
Summer CP content (%DM)	11.8	9.7	9.8	10.4	9.6	8.1	7.6	8.5	0.33	0.037	0.001	0.966
Summer CP yield (kg DM/ha)	49.7	40.7	55.9	55.5	50.9	44.7	34.6	37.8	2.90	0.830	0.166	0.338
Summer ME content (MJ/kg DM)	9.3	8.6	9.8	9.9	10.0	9.4	9.8	9.6	0.12	0.035	0.102	0.177
Summer ME yield (MJ/ha)	3,860.4	3,560.4	5,522.3	5,204.4	5,324.0	5,178.5	4,539.4	4,325.8	2.66	0.806	0.625	0.174

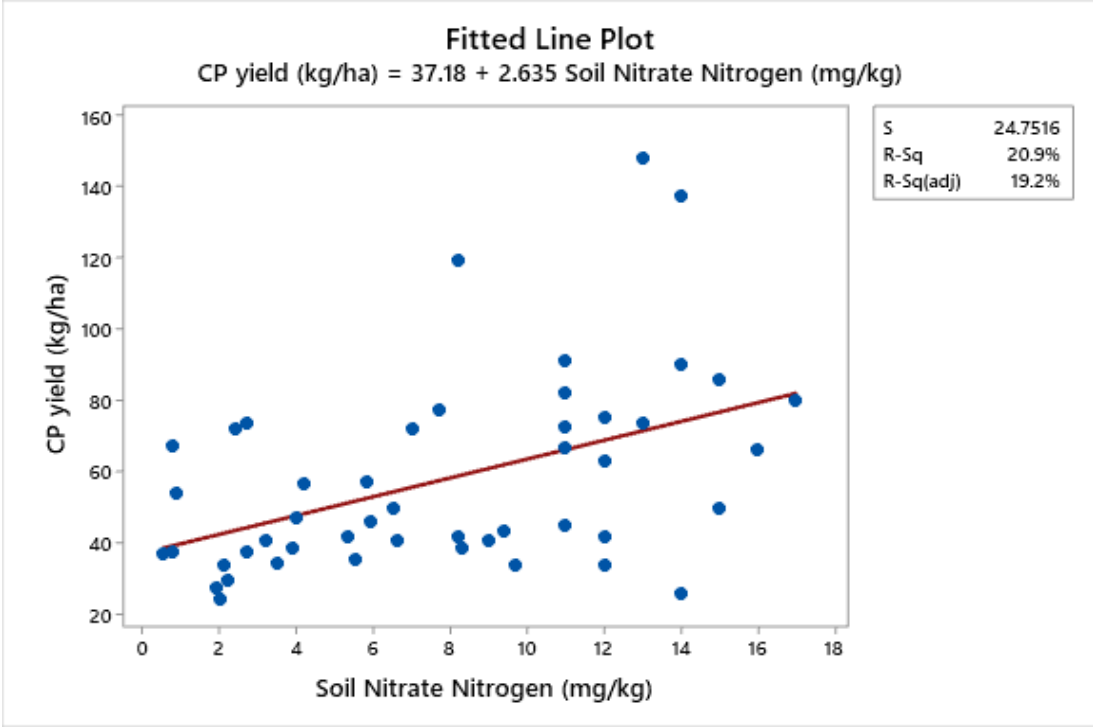
Regrowth yield Results





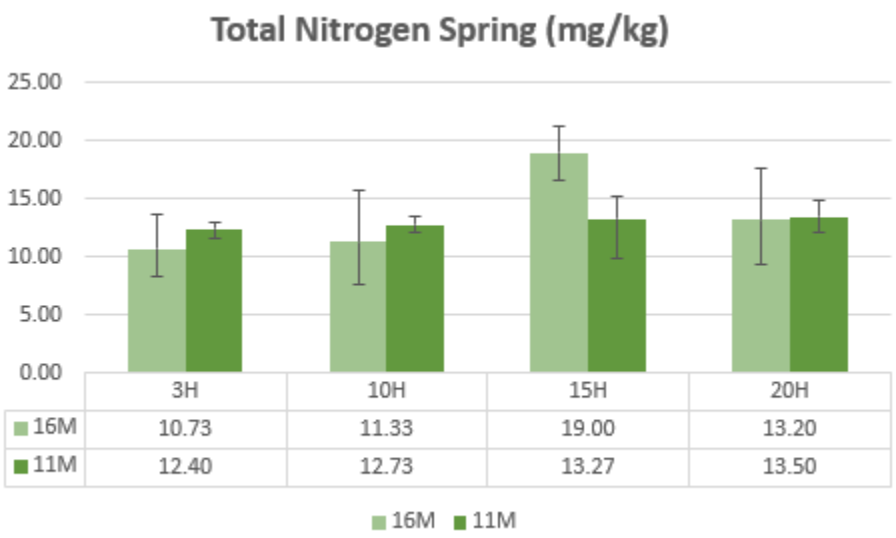
Regression on nitrate nitrogen and regrowth yield/ CP yield for 39 days



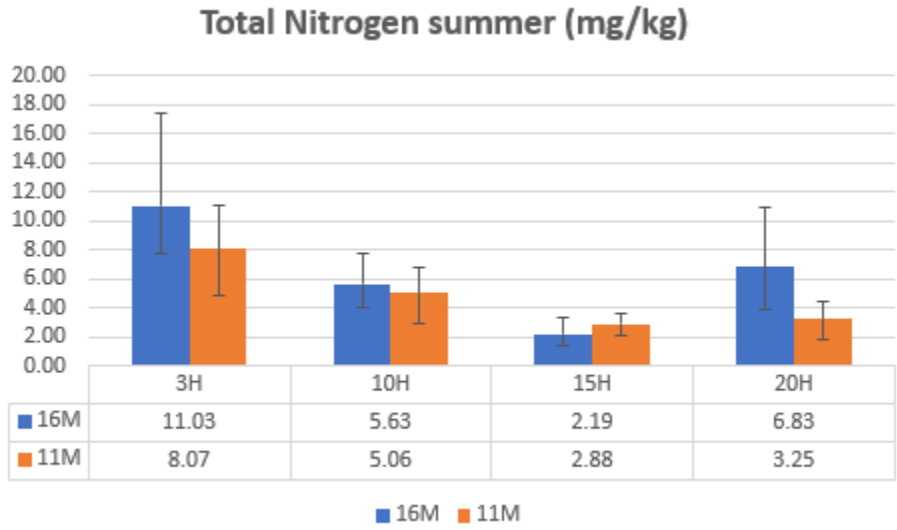


Nitrate nitrogen content in the soil can be a good indicator for the regrowth yield and CP yield during two 39 day-trials.

Nitrogen Distribution Along the Shelterbelt in different seasons



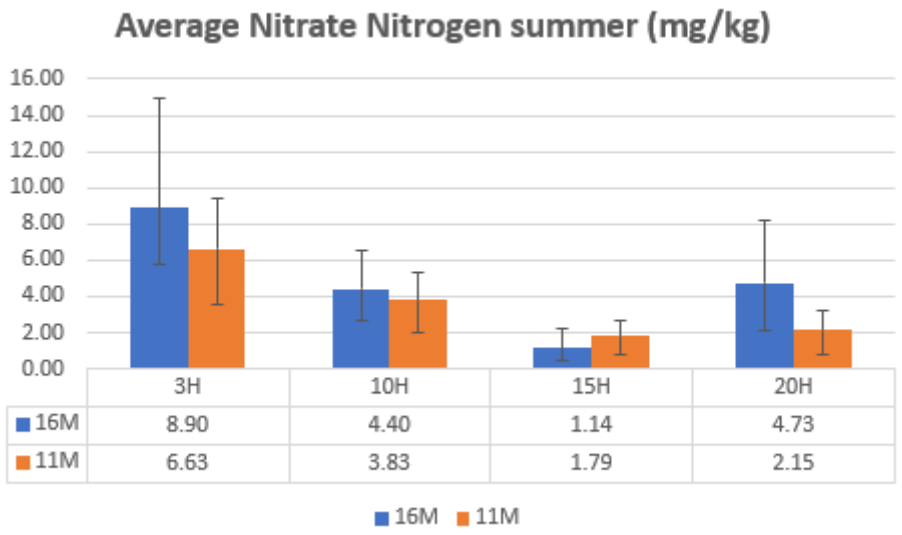
	3H	10H	15H	20H
16M	10.73	11.33	19.00	13.20
11M	12.40	12.73	13.27	13.50

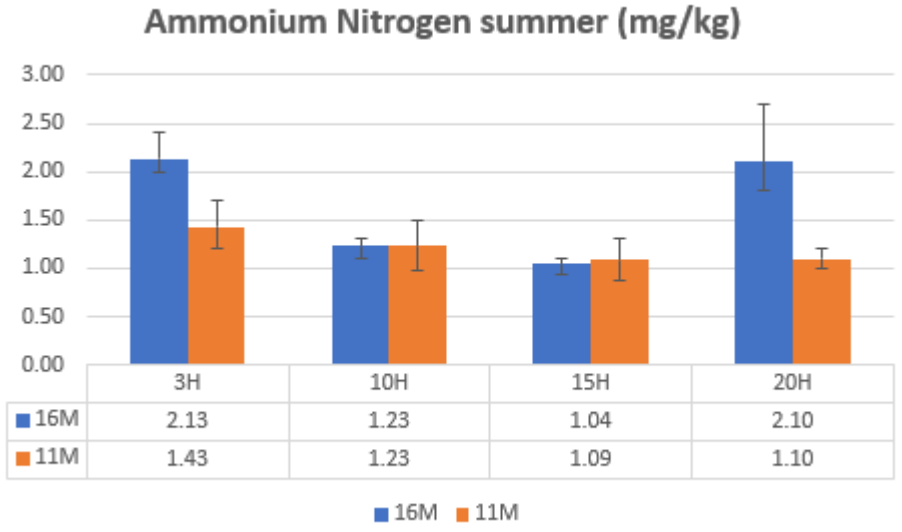


	3H	10H	15H	20H
16M	11.03	5.63	2.19	6.83
11M	8.07	5.06	2.88	3.25

Summer total nitrogen (soil) distribution may show the stock camping near the shelterbelt during the 39 day-trials.

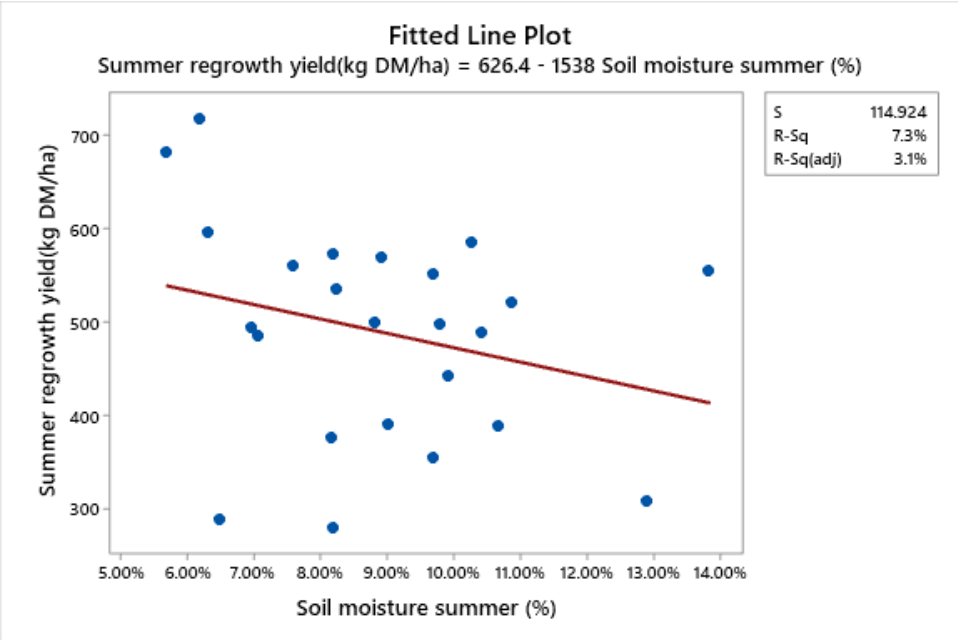
Ammonium Distribution vs. Nitrate Nitrogen Distribution Along the Shelterbelt

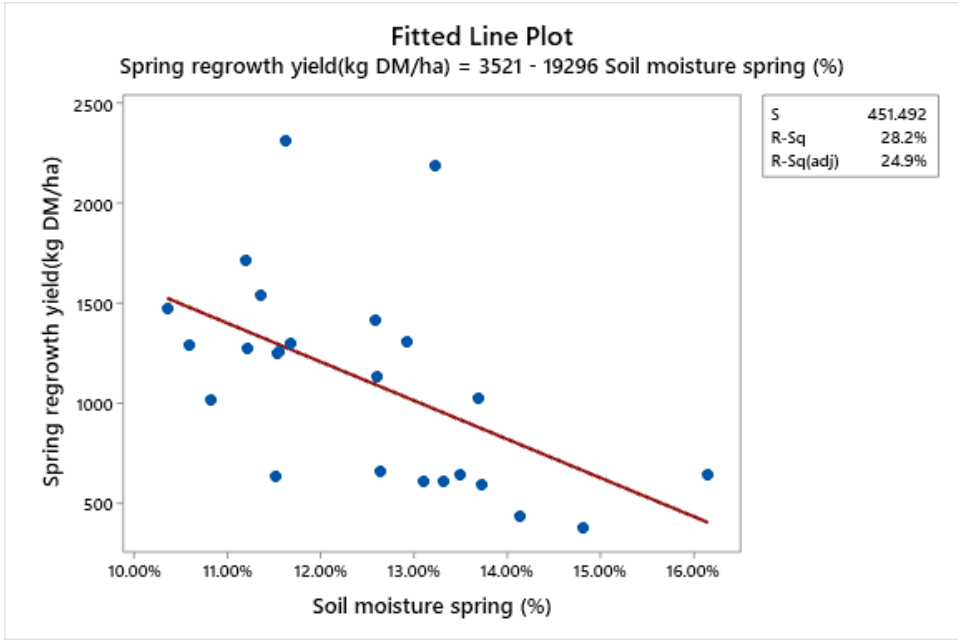




Summer ammonium nitrogen distribution further provide the evidence that the stock camping near the shelterbelt during the 39 day-trials.

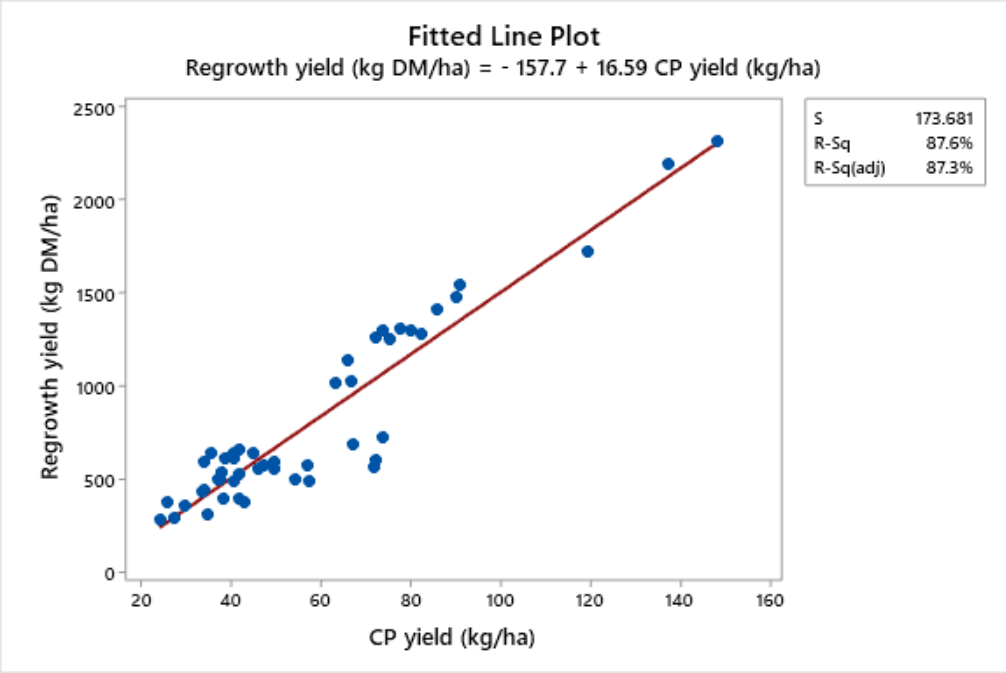
Regression between soil moisture and regrowth yield in two seasons for 39 days

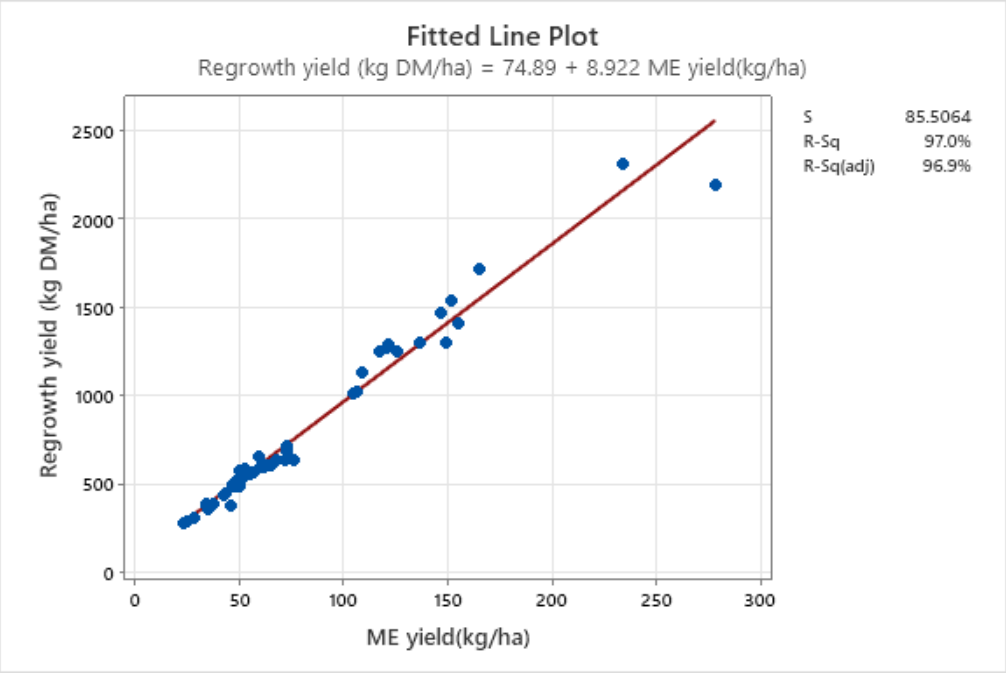




Soil moisture is not a good indicator to show the yield, because the moisture is one day sample rather than multiple days soil samples. Therefore, it can not show the accumulative effects of soil moisture on pasture regrowth.

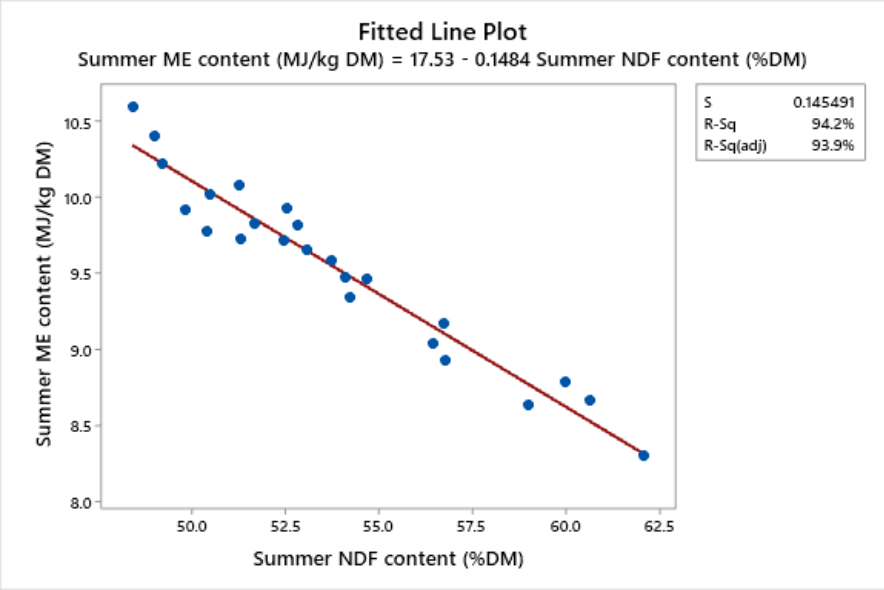
Regression between regrowth yield and CP, ME yield

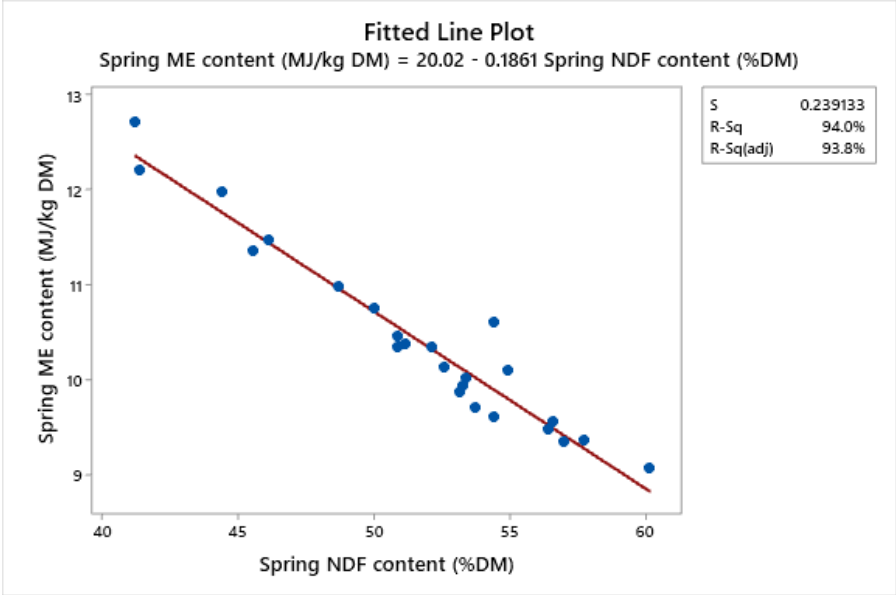




Regrowth yields are positively correlative with CP, and ME yields, which indicated that increasing the regrowth yield before the heading stage can increase the CP, and ME production in the paddock.

Regression between ME content and NDF content





Both spring (0.1484) and summer trials (0.1861) indicated the ME content will decrease linearly with the increasing NDF content in similar rate.

Thank you

Q & A