Effect of Black Medic (*Medicago lupulina*) and Nitrogen Fertilizer on Crop Yield and Soil Nitrogen

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Why Black Medic?

• Legume
  – Contribute Nitrogen (N) to cropping system

• Self Seeding
  – You do not have to seed each year

• Limited amount of growth in first 60 days
Potential Problems with Black Medic?

- Self Seeding
  - Builds up a large seed bank
  - May never be able to remove after introduction
- Growth after 60 days may hurt weak non-competitive crops
- Uses water
- Weed control more complicated
Experiment

• Medic and non-Medic Blocks

• Flax - Wheat - Oat Rotation

• Three levels of N, 20, 60 and 100% of recommended N (applied + residual)
  – Flax 110 kg ha$^{-1}$
  – Oats 100 kg ha$^{-1}$
  – Wheat 135 kg ha$^{-1}$
Experiment

• Statistical Analysis
  – PROC MIXED procedure of SAS
  – replicate and year as random effects
  – medic treatment, crop, and N fertilizer rate as a fixed effects
  – Residual variance heterogeneity among years also was modeled
Black Medic Biomass

![Graph showing the relationship between Biomass (Kg ha\(^{-1}\)) and Nitrogen Fertilizer (% of Recommended). The graph indicates a downward trend as the percentage of recommended fertilization increases.](graph.png)
Black Medic Biomass

Biomass (Kg ha-1)

Nitrogen Fertilizer (% of Recommended)

- Flax
- Oat
- Wheat

The graph shows the biomass of Black Medic for different nitrogen fertilizer percentages. Flax has the highest biomass, followed by Wheat, with Oat having the lowest biomass among the three.
Black Medic Biomass

Flax - Medic

- 20
- 60
- 100
Grain Yield: Medic and N Fertilizer

Grain Yield (kg ha\(^{-1}\))

Nitrogen Fertilizer (% of Recommended)
Grain Yield

Oats - Medic

Oats - No medic

0 2 4 6 8 10

20 60 100

0 2 4 6 8 10

20 60 100
Total Grain N: Crop and N Fertilizer

Grain N Yield (N kg ha\(^{-1}\))

Nitrogen Fertilizer (% of Recommended)

- medic
- nomed
Applied N Fertilizer over Duration of Study

Applied N Fertilizer (kg ha\(^{-1}\))
Grain N Removed over Duration of Study

![Bar graph showing grain N removed over the duration of study for different crops and medic treatments.](image-url)
Change in N Due to Fertilizer Addition and Grain Removal

Grain N Removed (kg ha⁻¹)

-500 -400 -300 -200 -100 0 100 200 300 400 500

Medic Non Medic

Oat Wheat

20 60 100 20 60 100

-200 -100 0 100 200 300 400 500

-400 -300 -200 -100 0 100 200 300 400 500
Fall Residual Soil N (NO$_3$)
Fall Residual Soil N (NO₃ 30-60cm)
Fall Residual Soil N (NO$_3$)
Grain P Removed over Duration of Study

- **Grain P Removed (kg ha⁻¹)**

**Oat**
- 20
- 60
- 100

**Wheat**
- 20
- 60
- 100

**Legend**
- Green: Medic
- Red: Non Medic
Fall Residual Soil P (0-60cm)

Soil Residual P (kg ha\(^{-1}\) in 0-60cm) vs Percentage of Recommended Nitrogen.

- Green line: medic
- Blue line: nomed
Fall Residual Soil P

P Supply Rate (μg cm\(^{-2}\))

Percentage of Recommended Nitrogen
Conclusions

• Applied N had larger effects than medic

• Medic tended to increase yield and quality at low N rates

• N fertilizer suppressed the growth of medic

• Medic is suited for low N farming systems and organic farming systems