Potential of forage brassicas for use in pasture-based livestock systems

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INTRODUCTION

- Brassicas (*Brassica* sp.) are cool-season annual forages that can be grazed or harvested in as little as 45 days after planting (Hall and Jung, 2008; de Ruiter et al., 2009)
- Brassicas provide forage during the 'summer forage slump' and during the fall, resulting in up to 3 additional months of grazing annually (Hall and Jung, 2008)
- Brassicas contain a group of phytochemicals (glucosinolates) that can decrease palatability, decrease animal gains, and cause copper and iodine deficiencies in livestock
- Brassicas have been linked to reductions in enteric methane emissions in ruminants (Reid et al., 1994; Dillard et al., 2017)
- Little information regarding yield, nutritive quality, or glucosinolate concentration of new forage brassica varieties is available for livestock producers

Objective:

- Determine yield, nutritive quality, and glucosinolate concentration of 3 brassica varieties compared with annual ryegrass grown during the fall grazing season in central Pennsylvania

METHODS

- Field plot study conducted at the Pennsylvania State University Russell Larson Agricultural Research Farm, Rock Springs, PA
- Forage Treatments (n = 4):
  - 'KB Supreme' Annual Ryegrass (**ARG**)
  - 'Inspiration' Canola (**CAN**)
  - 'Barisca' Forage Rapeseed (**RAP**)
  - 'Appin' Forage Turnip (**TUR**)
- Three random forage samples (4 cm stubble height) were taken biweekly during Oct. and Nov. of 2015 and 2016
- Forage samples were composited within plot and sent to Dairy One Laboratories (Ithaca, NY) for wet chemistry analysis
- Glucosinolates were determined using the methods of Dillard et al. (2017)
- PROC GLIMMIX of SAS (SAS Inc., Carey, NC) was used for statistical analysis
- Significance was declared at $P < 0.05$ and trends at $0.05 < P < 0.10$

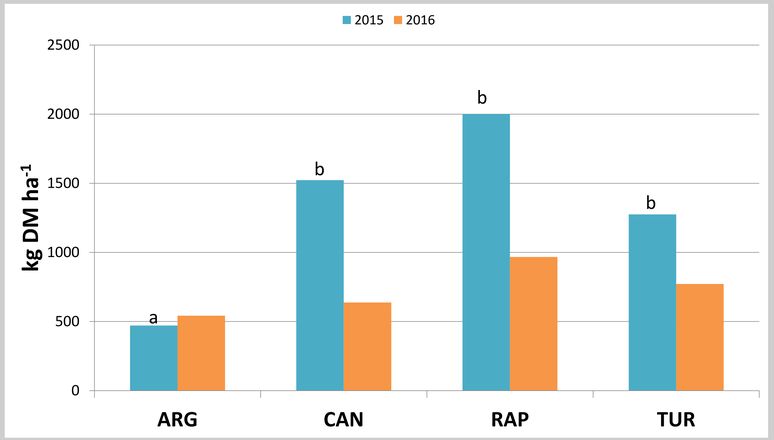

Figure 1. Accumulated forage biomass (75 days after planting; kg DM/ha) of annual ryegrass (ARG), canola (CAN), forage rapeseed (RAP), and forage turnip (TUR) during Fall 2015 and 2016. Within a year, means without a common superscript differ ($P < 0.05$).

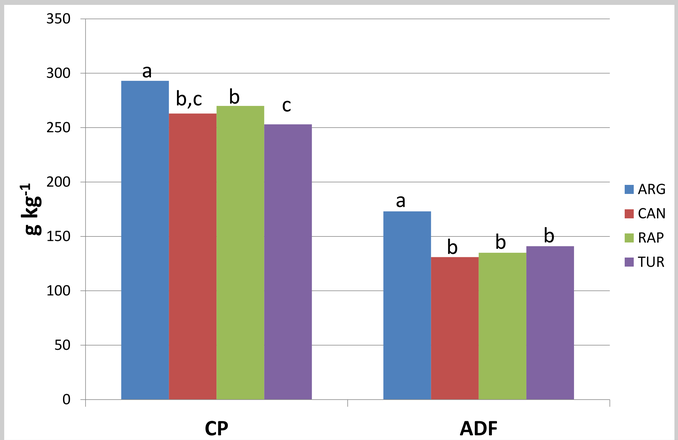

Figure 2. Crude protein (CP) and acid detergent fiber (ADF) of annual ryegrass (ARG), canola (CAN), forage rapeseed (RAP), and forage turnip (TUR) during Fall 2015 and 2016. Within a variable, means without a common superscript differ ($P < 0.05$).

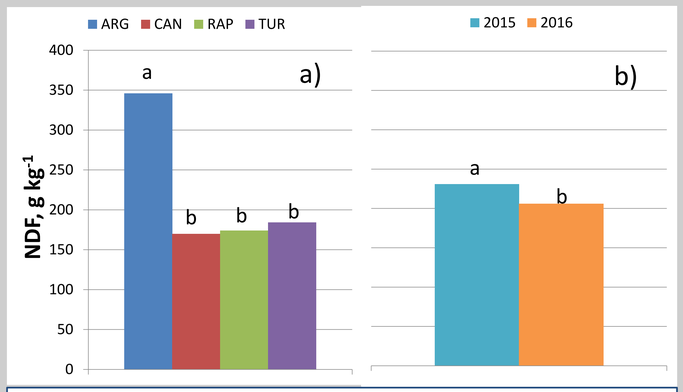

Figure 3. a) Neutral detergent fiber (NDF) of annual ryegrass (ARG), canola (CAN), forage rapeseed (RAP), and forage turnip (TUR) during Fall 2015 and 2016. b) Average NDF of forage grown during 2015 and 2016. Within a variable, means without a common superscript differ ($P < 0.05$).

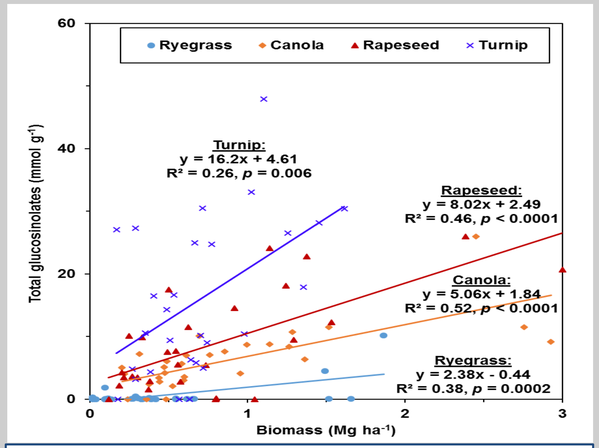

Figure 4. Relationship between total glucosinolate concentration and forage biomass during Fall 2015 and 2016.

RESULTS

- Weather
  - 2015- 69 d fall growing season
    - 491 mm total precipitation
    - Mean air temp 14.8°C
  - 2016- 76 d fall growing season
    - 366 mm total precipitation
    - Mean air temp 15.2°C
- Seasonal Biomass (Figure 1)
  - Significant forage × year interaction
    - 2015- Brassicas (RAP, CAN, and TUR) were greater than ARG
    - 2016- No difference among any forages
- CP (Figure 2)
  - ARG had the greatest CP
  - RAP was greater in CP than TUR, with CAN intermediate among brassicas
  - No effect of year
- ADF (Figure 2)
  - ARG was greater in ADF than brassicas
  - No effect of year
- NDF (Figure 3)
  - ARG had greater NDF than brassicas
  - No differences in NDF among brassicas
  - NDF greater in Fall 2015 than Fall 2016
- Total Glucosinolates (Figure 4)
  - Significant year effect among brassicas
    - 2015- TUR > RAP > CAN
    - 2016- TUR > RAP > CAN
- Glucobrassicanapin, glucobrassicin, gluconasturtiin, progoitrin, and gluconapin accounted for 95% of glucosinolates detectable in brassicas (data not shown)

CONCLUSIONS

- During **cool, wet fall** conditions, **brassicas** show potential to **increase forage** biomass by **423%** compared with ARG
- Brassicas are **similar in biomass** to ARG during **warmer, drier fall** conditions
- However, **forage quality** of brassicas and ARG was **not greatly impacted** by meteorological differences between years
- This also resulted in magnitudinal differences in total glucosinolate present in plant tissues
- These data suggest that **both productivity and the presence of anti-quality factors** are largely influenced by **meteorological conditions**

ACKNOWLEDGEMENTS

Funding and support for this project provided by King's AgriSeed, Inc. (Ronks, PA) and NE SARE (Project number: LNE16-352).

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