Trader's Dispatch
MARCH 2017
Vol. XVIII No. 2
P.O. Box 997
Conrad, MT 59425-0997
Phone 406-271-5533 Fax 406-271-5727
website: tradersdispatch.com
E-MAIL: trader@3rivers.net OR tradersdispatch@yahoo.com

Grazing Improves Tillering and Grain Yield of Dual-Purpose Winter Canola

Roger Nkoa Ondoua[1]; Olga S. Walsh[2]; Kefyalew Desta, Steven Fransen[3]

[1]: Nutrient management scientist, Conrad, Montana, rogernkoaondoua@gmail.com
[2]: Assistant Extension Professor, Dept. of Plant, Soil, & Entomological Sciences, University of Idaho
[3]: Associate Crop Professor, Washington State University

Introduction

In the inland Pacific Northwest of the United States (PNW US), of the 1.24 million irrigated acres, about 16% remain in fallow after the main crop has been harvested. Few acres are dedicated to oilseed crops such as canola. Producers are reluctant to convert their land for sole biofuel feedstock canola due to the lower oil yield of canola compared with high value crops such as wheat commonly grown in the region. In the Palouse of Washington, for example, 120 bushel/A wheat is the norm; whereas in Idaho, irrigated winter wheat can be as high as 150 bushels/A Another trend in the region is cheap imports that resulted in dwindling acreage of crops such as green pea. This has significant implications on crop diversity and thus sustainability of agriculture in the region. The conversion of land to biofuel crops in the NWUS requires a reconfiguration of the entire cropping system. Growing canola as a dual-purpose crop (i.e., for both forage and grain) offers a number of economic and environmental benefits: i) contribution to feed supply for livestock in the region; ii) protection against wind and water erosion for most of the year; iii) diversification of rotation systems with the inclusion of a broadleaf crop in small grain-dominated cropping systems; iv) optimization of labor and capital investment due to limited off-season land management (e.g. weed control); v) improvement of soil health due to the rotation of crops of different root systems and canopy architectures; vi) improvement of forage supply during critical periods, and vii) production of a valuable oilseed. To assess the potential of dual-purpose biennial winter canola production in Montana under irrigated conditions, we conducted an experiment at the Montana State University's Northern Agricultural Research Center (NARC) in Havre, MT, The objective was to compare the grain and hay yields of single purpose (grain only) and dual-purpose (hay and grain) winter canola under seven organic and inorganic fertility treatments.

Material and Methods

The experiment was established at the NARC under supplemental irrigation. The experimental design was a split-plot with four repetitions. The main-plot factor was purpose type (2 levels), and the sub-plot factor was fertility treatment (7 levels). Sub-plots, 25 ft wide and 10 ft long, were amended with corresponding treatments (named 1 through 7) of beef manure, compost (municipal wastes), urea, ammonium sulfate as follows: 1 = Control; 2 = 200 lb N/A (beef manure); 3 = 200 lb N/A (compost); 4 = 100 lb N + 40 lb S/ A (urea, (46-0-0) + ammonium sulfate (21-0-0-24)); 5 = 200 lb N + 40 lb S/ A (urea + ammonium sulfate); 6 = 300 lb N + 40 lb S/ A (urea + ammonium sulfate); 7 = 200 lb N/A (manure + compost).

Matured cow manure and compost were applied and incorporated on July 10, 2015 at 3-4 inch depth. A Roundup Ready® HyCLASS® canola hybrid was planted on July 31, 2015 using a Conserva Pak seed drill at a seeding rate of 8.0 lb pure live seeds per acre. On September 11, 2015, all subplots were sampled for their hay value using a 10 ft^2 quadrant positioned randomly at a sampling point. Canola plants were clipped at a height of 3-4 inches at the rosette (26 -27 on BBCH scale) stage. Hay yields were adjusted to 16% moisture. On September 14, 2015, dual-purpose sub-plots, which had been secured with an electrical fence, were grazed by 20 bulls (**Figure 1 a, b, c).** On August 20, 2016, all plots were harvested using a Wintersteiger harvester. All statistical computations were done using the Statistical Analysis System (SAS Institute Inc. 1996). Analysis of variance, pooled over blocks, was performed for four variables: grain yield, hay biomass (dry weight), tiller number, and plant height.

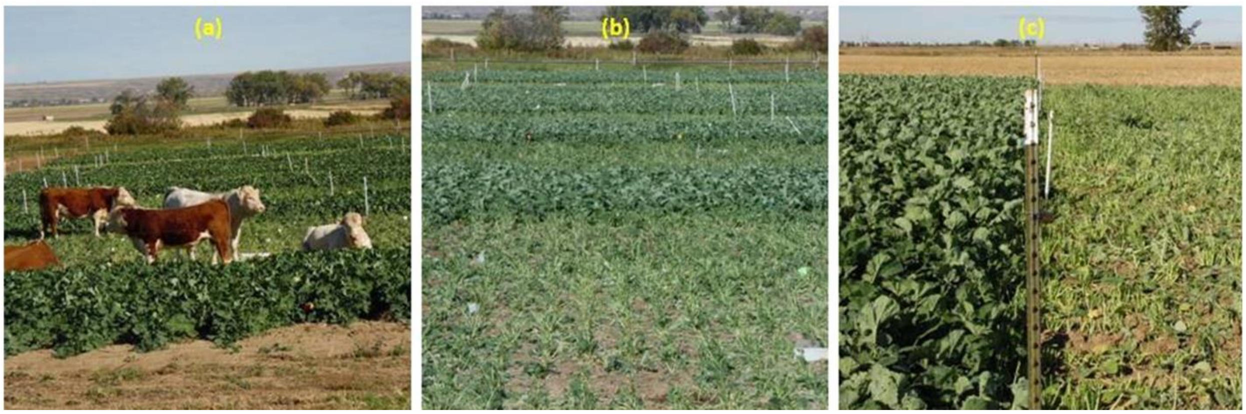

Figure 1. *(a): cows grazing dual-purpose winter canola plots; (b): general view of single and dual-purpose plots after grazing; (c): close-up of non-grazed and grazed plots separated by an electrical fence*

Results and Discussions

Effect of fertility treatments on plant density, canola grain and forage yields.

There were statistical differences between the various fertility treatments. The highest grain yields, irrespective of the purpose, were obtained when canola was fertilized at the rate of 200 lb N/A supplied by cow manure (Treatment 2), and 300 lb N/A and 40 lb S/A supplied by urea and ammonium sulfate (Treatment 6) (**Figure 2**). Fertilizer treatments affected canola forage yield and plant density. Organic amendments and moderate amount of inorganic fertilizers (100 lb N/A produced the highest hay yields and plant density, whereas higher amounts of mineral nitrogen (200 and 300 lb N/ac) resulted in lower plant density (**Figure 3**).

The organic amendments (compost and cow manure) used in this study can be viewed as complex nutrient substrates characterized by differing physical, chemical, and biological properties. The nutrient composition of compost and cow manure depends upon factors such as the nature of feedstock, feed rations and additives, the type of bedding, and the method of manure or compost handling and storage. The cow manure used in this study was richer in terms of macro- and micronutrients than the compost (data not shown). Higher canola grain yields were obtained at higher N and other macronutrient rates. This result can be explained by the relatively high N requirement of the canola crop. To illustrate, a canola (2 t ha^{-1}), wheat (2.7 t ha^{-1}), and corn (6.3 t ha^{-1}) respectively require 62.5, 35.2, and 27.3 kg N ha^{-1} to produce one ton of grain (Wallace, 2001).

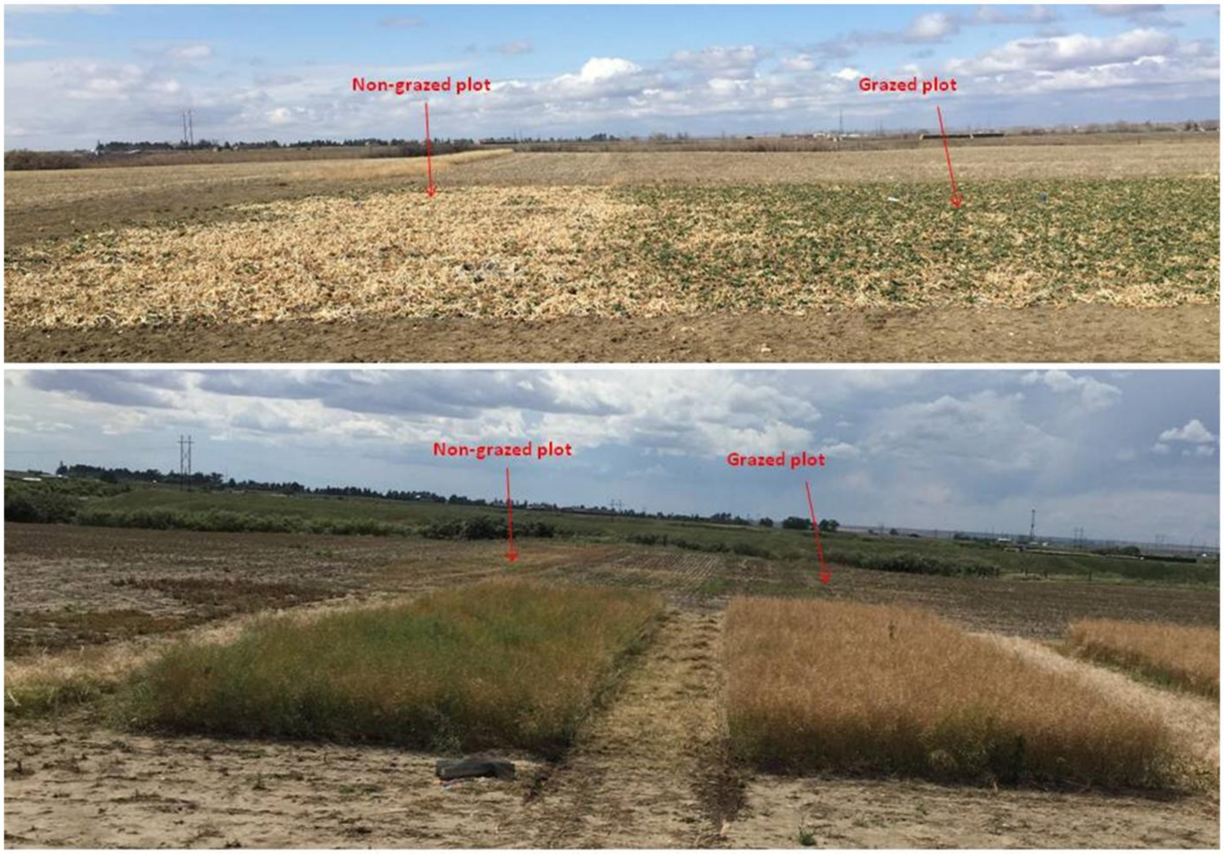

Figure 7. *Difference in ground cover by canola leaf residues in early spring 2015 (Top picture, March 29) and resulting maturity difference on August 20, 2015*

Effect of grazing on winter canola grain yield, tiller number, and plant height.

Grazing canola in the fall significantly increased grain yield by nearly 500 lb/A (**Figure 4**), tiller number by 4 tillers/m^2 (**Figure 5**), and the average plant height by 4 inches (**Figure 6**). This surprising result could be explained by the difference in ground cover at the onset of the spring. Early in the spring, plots that were not grazed (**Figure 7**, top) were covered at approximately 95% by winter-killed leaves, whereas only about 25% percent of the ground was covered on plots that were grazed in the fall. Fall-grazed plots were, therefore, more exposed to sunlight early in the growing season, resulting in higher photosynthetic activity compared to non-grazed plots. This in turn, resulted in a faster growth rate, a higher grain yield, and a shorter maturity cycle as evidenced by the relative advance dryness of grazed-plots on August 20, 2016 (Figure 7, bottom).

Acknowledgments: We thank the USDA/NIFA for funding this work through the Western Sustainable Agriculture Research and Education Program.

References

Wallace, J. (2001). *Guide to organic production of field crops* (French) (2nd ed). Ottawa, Ontario: Canadian Organic Growers Inc.

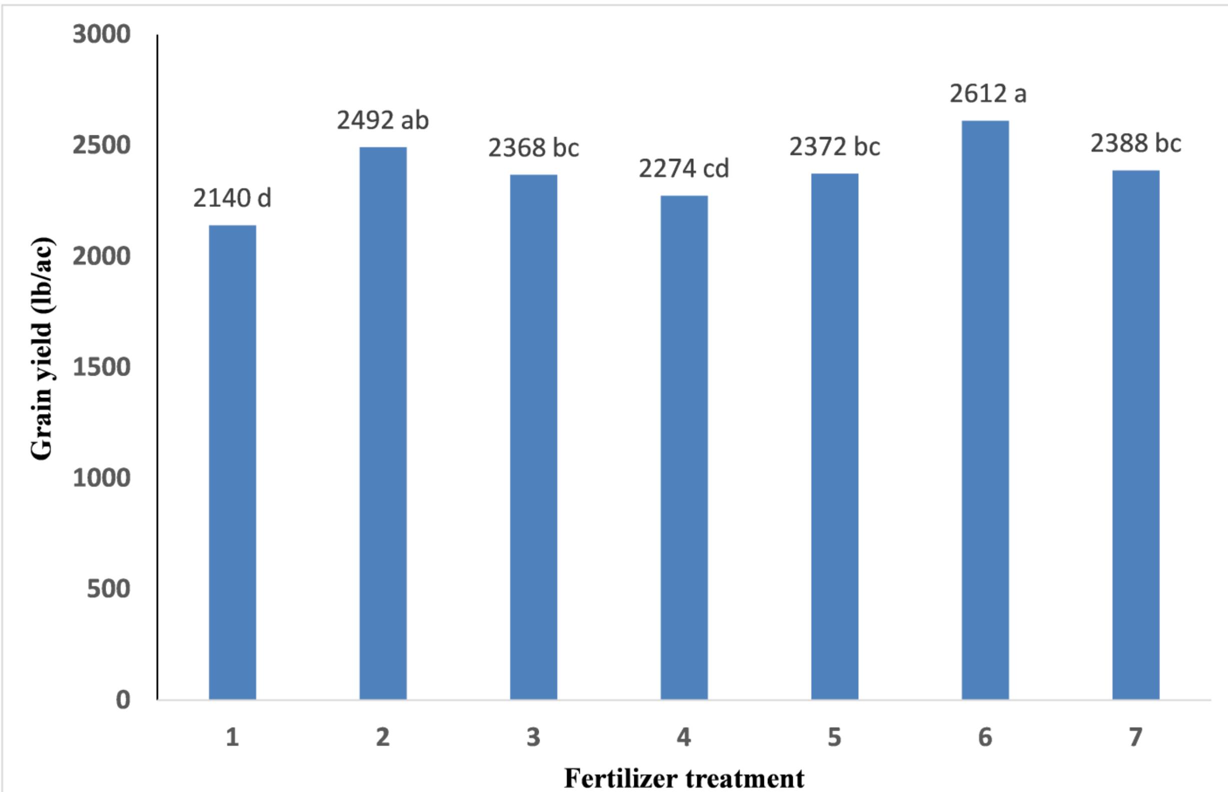

***Figure 2**. Grain yield response of biennial winter canola to fertility treatments. Treatments: **1** = control; **2** = 200 lbs N/ac from cow manure; **3** = 200 lbs N/ac from compost (municipal wastes); **4** = 100 lbs N/ac + 40 lbs S/ac from urea and ammonium sulfate; **5** = 200 lbs N/ac + 40 lbs S/ac from urea and ammonium sulfate; **6** = 300 lbs N/ac + 40 lbs S/ac from urea and ammonium sulfate; **7** = 200 lbs N/ac from cow manure + compost. Treatments followed by the same letter are not statistically different at $\alpha = 5\%$.*

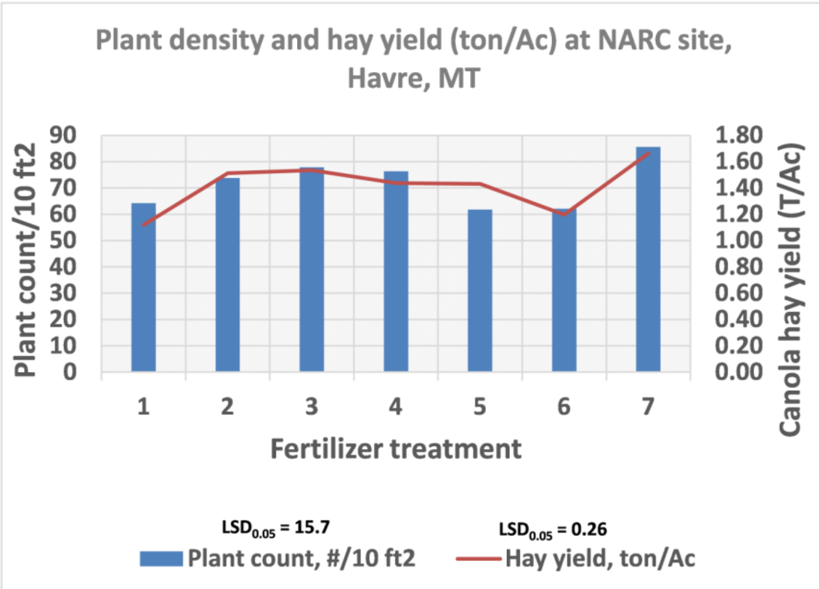

Figure 3. *Hay yield (dry weight) response of biennial winter canola to fertility treatments. Treatments: **1** = control; **2** = 200 lbs N/ac from cow manure; **3** = 200 lbs N/ac from compost (municipal wastes); **4** = 100 lbs N/ac + 40 lbs S/ac from urea and ammonium sulfate; **5** = 200 lbs N/ac + 40 lbs S/ac from urea and ammonium sulfate; **6** = 300 lbs N/ac + 40 lbs S/ac by urea and ammonium sulfate; **7** = 200 lbs N/ac from cow manure + compost*

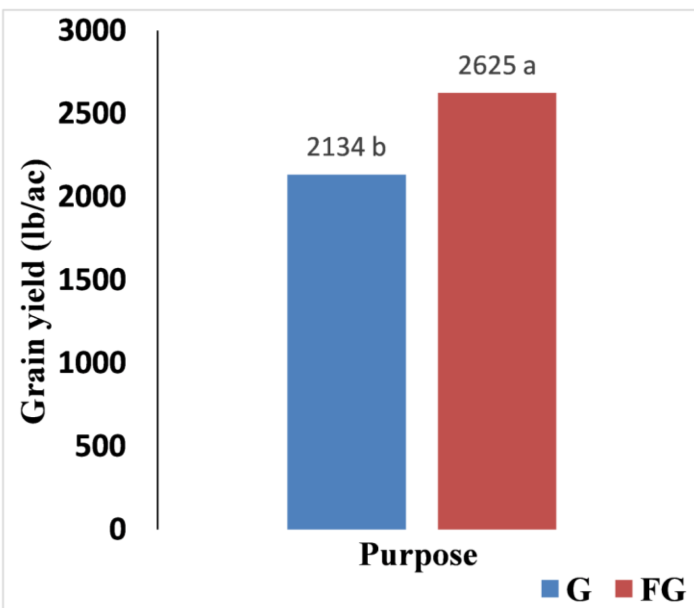

Figure 4. *Grain yield response of biennial winter canola to fall grazing. G = Grain only; FG = Forage + Grain. FG canola plots are those grazed in the fall 2015 by bulls, then harvested in the summer 2016 for grain. Treatments topped by different letters are statistically different at α = 5%.*

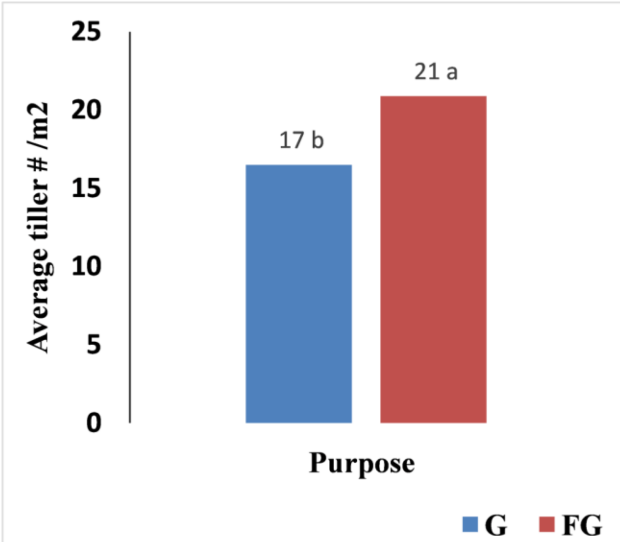

Figure 5. *Tillering response of biennial winter canola to fall grazing. G = Grain only; FG = Forage + Grain. FG canola plots are those grazed in the fall 2015 by bulls, then harvested in the summer 2016 for grain. Treatments topped by different letters are statistically different at α = 5%.*

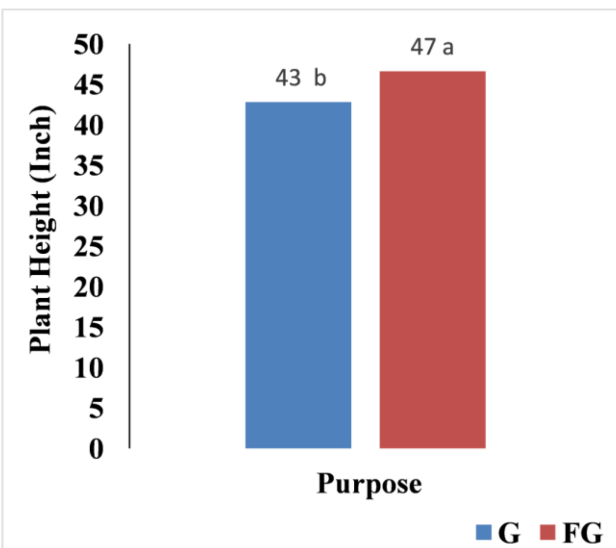

Figure 6. *Plant height response of biennial winter canola to fall grazing. G = Grain only; FG = Forage + Grain. FG canola plots are those grazed in the fall 2015 by bulls, then harvested in the summer 2016 for grain. Treatments topped by different letters are statistically different at α = 5%.*