



COOL-SEASON ANNUALS FOR PASTURE-BASED LIVESTOCK SYSTEMS: REPORT OF ON-FARM TRIAL, ROXBORO, NC, 2016

Forage Notes: #3

ABSTRACT

Forages such as wheat, rye, oats, barley, triticale (collectively known as small grains), and ryegrass can provide nutritious herbage for grazing animals during late fall and spring in North Carolina (NC). An on-farm trial was conducted in Roxboro, NC during the Fall 2015 and Spring 2016. The goal of the trial was two-fold; first, to compare establishment and performance of three cool-season annual forages. Second, to host a field day to train producers on identification, establishment, and management of cool-season annual and perennial forages. This document reports the findings of the trial and provides information on the role and utilization of cool-season annual forages for pasture-based livestock systems.

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FORAGE NOTES: #3

COOL-SEASON ANNUAL FORAGES FOR PASTURE-BASED LIVESTOCK SYSTEMS: REPORT OF 2016 ON-FARM TRIAL IN ROXBORO, NC

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An on-farm research trial and demonstration site was established on Oct. 23rd, 2015 at a farmer's cooperator field near Roxboro, NC. The goals of the trial were two-fold; first, we wanted to evaluate and compare establishment characteristics, dry matter yields, and nutritive value of oats, wheat and triticale. Second, an on-farm Forage Field Day was hosted on April 21st, 2016 to train farmers about establishment, identification, and utilization of annual and perennial cool-season forages. The purpose of this report is to follow up with the attendees of the field day, as well as to provide information to the general public, in terms of the results from the trial using cool-season annual forages for pasture-based livestock systems.



Figure 1. Pictures of the field-day. There were 55 producer-participants.

WHERE DO COOL-SEASON ANNUAL FORAGES FIT IN MY PASTURE-BASED SYSTEM...?

Cool-season annual forages such as wheat, rye, oats, barley, triticale (collectively known as small grains), and ryegrass can provide nutritious forage for grazing animals during late fall and spring in North Carolina (NC). Animal performance (e.g. gains on live-weight, milk production) is often greater during the cool-season compared to the warm-season. Reasons include higher forage nutritive value and reduced heat stress on grazing cattle, which leads to greater forage intake (Dubeux et al., 2016). In addition, these forages can be preserved as hay or silage, allowing flexibility in terms of management options for forage managers. A detailed forage planting guide for NC can be found in extension publication [AG-266](#).

Cool season annual forages can play a strategic role in complementing and improving the quantity and the nutritive value of the forage offered by perennial-based systems. They can also be part of a crop rotation with other warm-season annuals such as pearl millet, sudangrass, corn, or sorghum. Additionally, cool-season annual forages can also be overseeded into existing perennial pastures as a strategy to extend the grazing season into the Fall and Spring, especially for systems that rely on the use of perennial warm-season grasses such as bermudagrass and switchgrass (Aiken, 2014; [Tech. Bulletin 315](#)). This report summarizes information on establishment, development, productivity, and nutritive value results and provides guidelines for utilization.

DETAILS OF THE TRIAL

This was an on-fam replicated trial.

- **Establishment and fertilization:**

The field was mowed for hay (mainly volunteer summer forage such as crabgrass) on 13 Oct. 2015. The hay was baled and removed from the field. Glyphosate (1 qt./ac) was applied on 16 Oct. and planting occurred on 23 Oct. A Great Plains no-till drill was used to plant oats (cv. Cosaque), wheat (cv. Malabar), and triticale (cv. Trical 815) at a rate of 100 lb/ac on a pure-live-seed basis. Planting depth was about 1 ½ inches. The plots were rain-fed. On 4 Sept. 2015, ammonium sulfate fertilizer (21-0-0) was applied at 200 pounds per acre. On 24 March 2016, another fertilizer application occurred (400 lb/acre of 26-0-26). There was no need for herbicide application.



Figure 2. Extension agent examining plots.

Weather data:

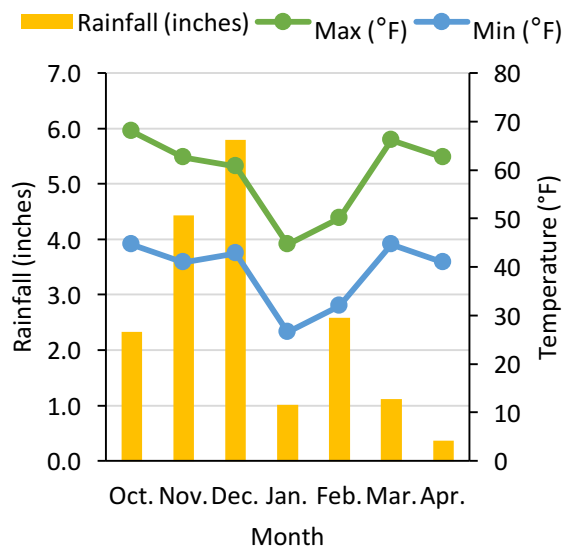


Figure 3. Rainfall and temperature data during the trial

Data collection

Measurements of ground coverage (amount of the ground covered by the desired species), canopy height, tiller counts, and light interception (amount of light intercepted by the canopy) were collected 4 times to characterize forage establishment and development. Measurements were taken every 3 weeks starting on Feb. 1, 2016 (101 days after planting date) and ending April 4, 2016. Dry matter yields were collected twice (on April 4 when forages were at flag leaf ligule visible & boot swollen, Feekes 9 to 10 or Zadoks 39 to 45, and April 29 at fully headed stage, Feekes 10.5 or Zadoks 58; Weiz, 2013) by clipping to 2-inches stubble-height. Samples were analyzed in the laboratory for two measurements of nutritive value (crude protein, CP; and total digestible nutrients, TDN).

Crude protein was estimated based on the concentration of nitrogen in the tissue and TDN represents an estimate of energy which is used when balancing ratios for livestock. For more information and interpretation of laboratory results and forage quality indices please see extension publications [AG-792](#) and [AG-824](#).

RESULTS AND DISCUSSION

Establishment and Development

Data on establishment and development are presented in Figure 4. Ground cover was similar among all small grains. It was greater at early (Feb. 1) and later dates in the growing season. The decline in ground cover could have been a function of increased number of brown tissue that suffered from freeze damage, especially for Oats. This resulted in lower canopy light interception values. Nevertheless, by the last measurement taken on April 4 there was no difference among the smallgrains in either ground coverage or light interception.

There was no difference in tiller counts among small grains. The greater number of tillers was recorded in the last sampling date of April 4. While no statistical effects were detected for the interaction effect of forage x sampling date, it is worth noting the distinct and consistent pattern of increased tillering for oats. This contrasts with both triticale and wheat which declined by mid-March. Oats are not affected by hessian fly.

Canopy height remained below 4 inches until March 10. By the last sampling date of April 4, canopy height for triticale at ~13 inches was higher than for oats and wheat (~10 inches). The rapid increase in canopy height coincides with the period of greater temperatures ranging from 45 to 70°F though mid-March to early-April.

Herbage production

There was no difference in dry matter yield when plots were harvested on April 4 (~2,000 lb/ac; Fig. 5). Canopy height by this date was ~13 inches, and even though, the forage was still mainly in the vegetative stage, an earlier

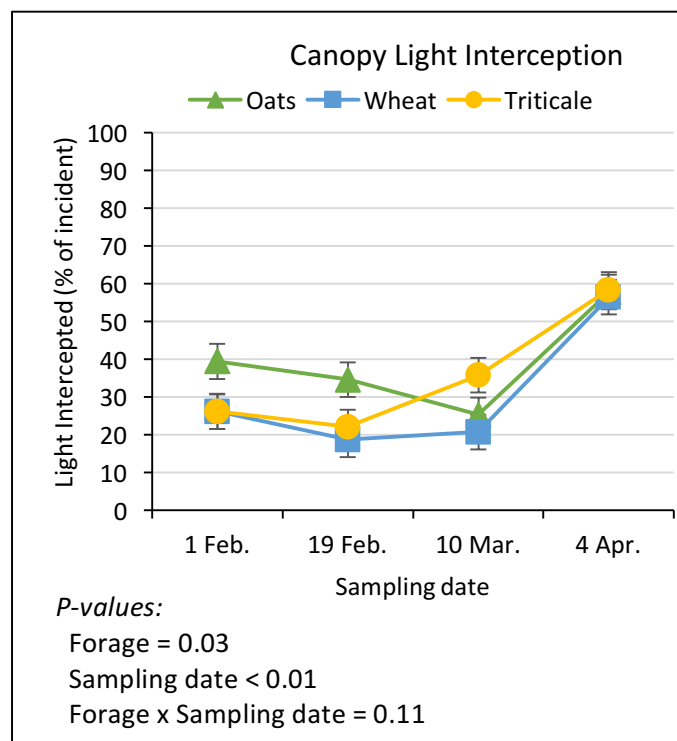
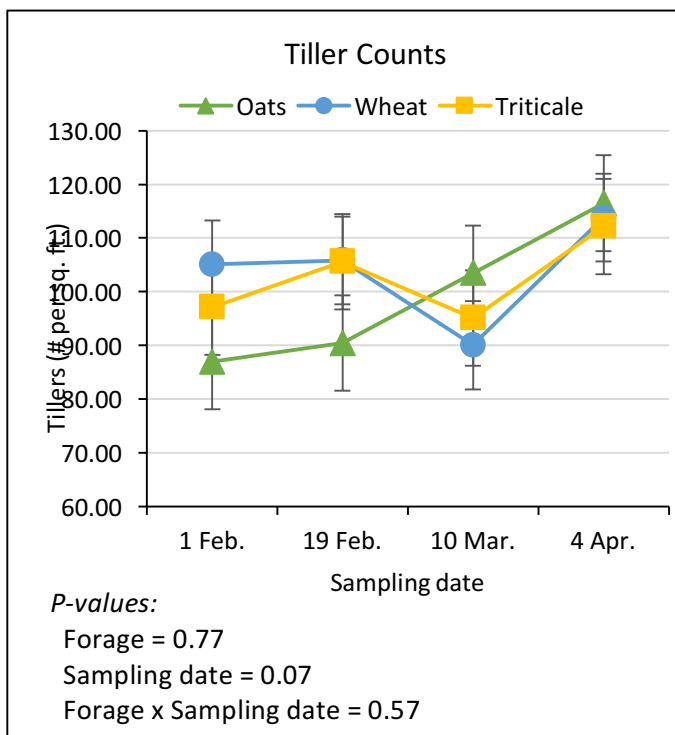
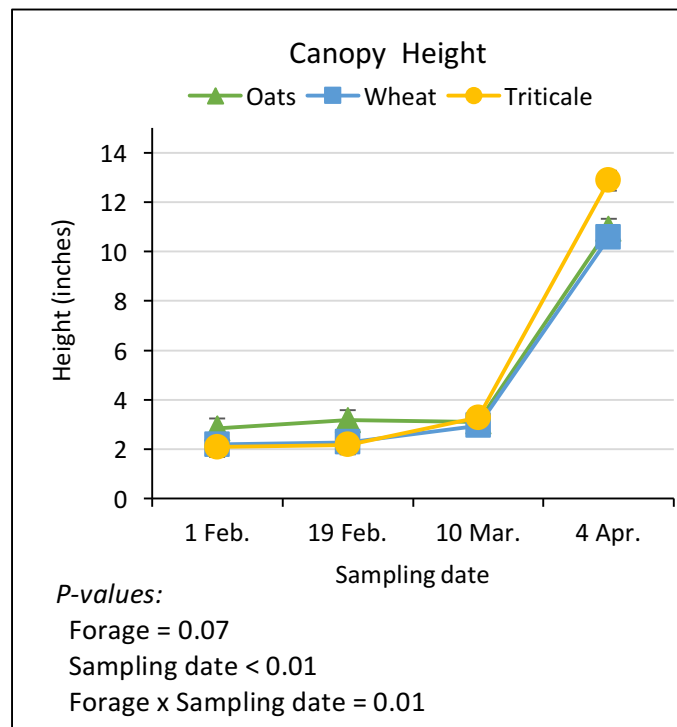
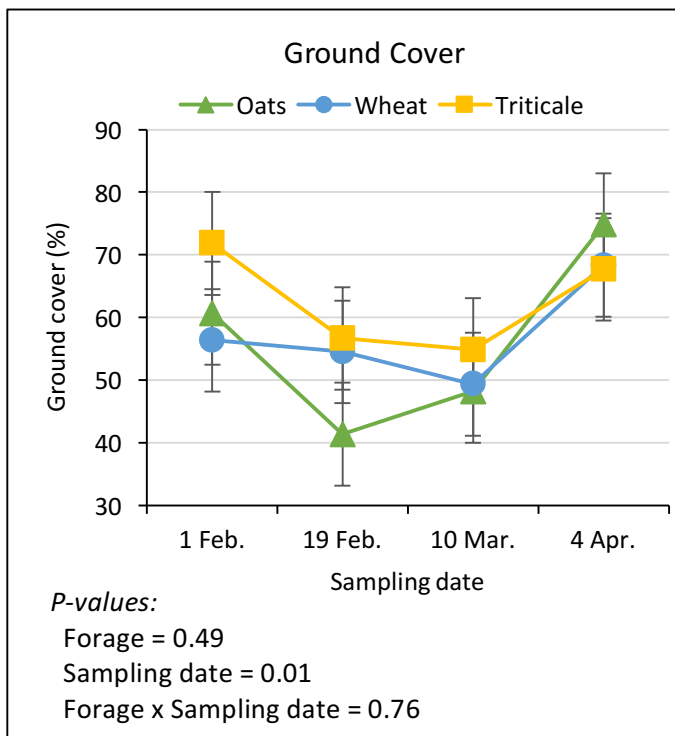


Figure 4. Data collected to describe canopy characteristics

grazing event would have been granted when the canopy was at ~6 inches tall. A key point to remember is that stubble height after defoliation (clipping or grazing) should be between 3-4 inches tall to ensure adequate regrowth and persistence of the forages.

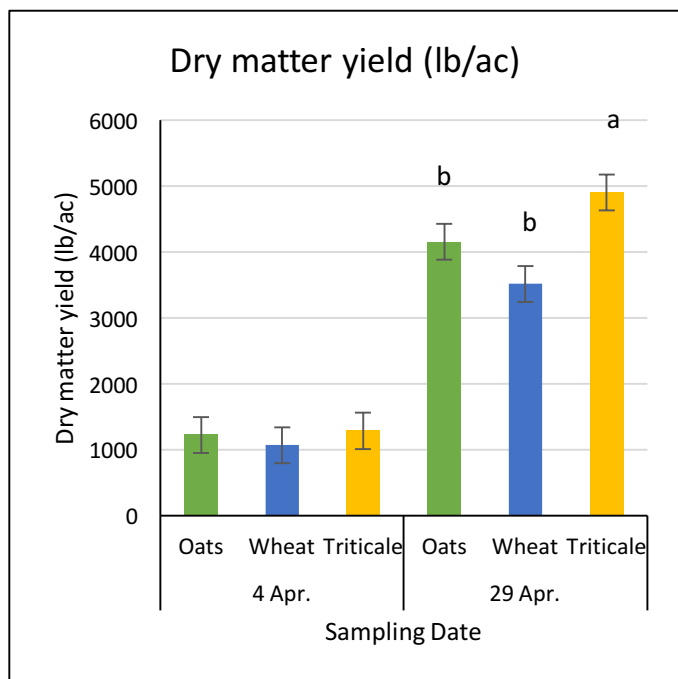


Figure 5. Dry matter yield by date and forage type. Bars followed by different letters, within sampling date, are statistically different.

Dry matter yields measured on April 29 were greater for Triticale and lower and not different between Wheat and Oats (Fig. 5). This clipping event is representative of a situation where the goal is to produce silage (targeting soft dough stage for clipping).

- Nutritive value

Longer growing intervals from planting date (i.e. 29 April vs. 4 April) allowed for greater dry matter yields (Edmisten et al. 1998); nevertheless, the more mature the forage, the lower the nutritive value (as expected). This was the case for both CP and TDN. When forage was harvested in April 4 the CP was greatest in Wheat, followed by lower and no different CP for Triticale and Oats (Fig. 6).

Average CP for April 4 defoliation was 25%. Nevertheless, when forage was harvested on April 29, average CP was 13%, with Triticale being greater than the other two.

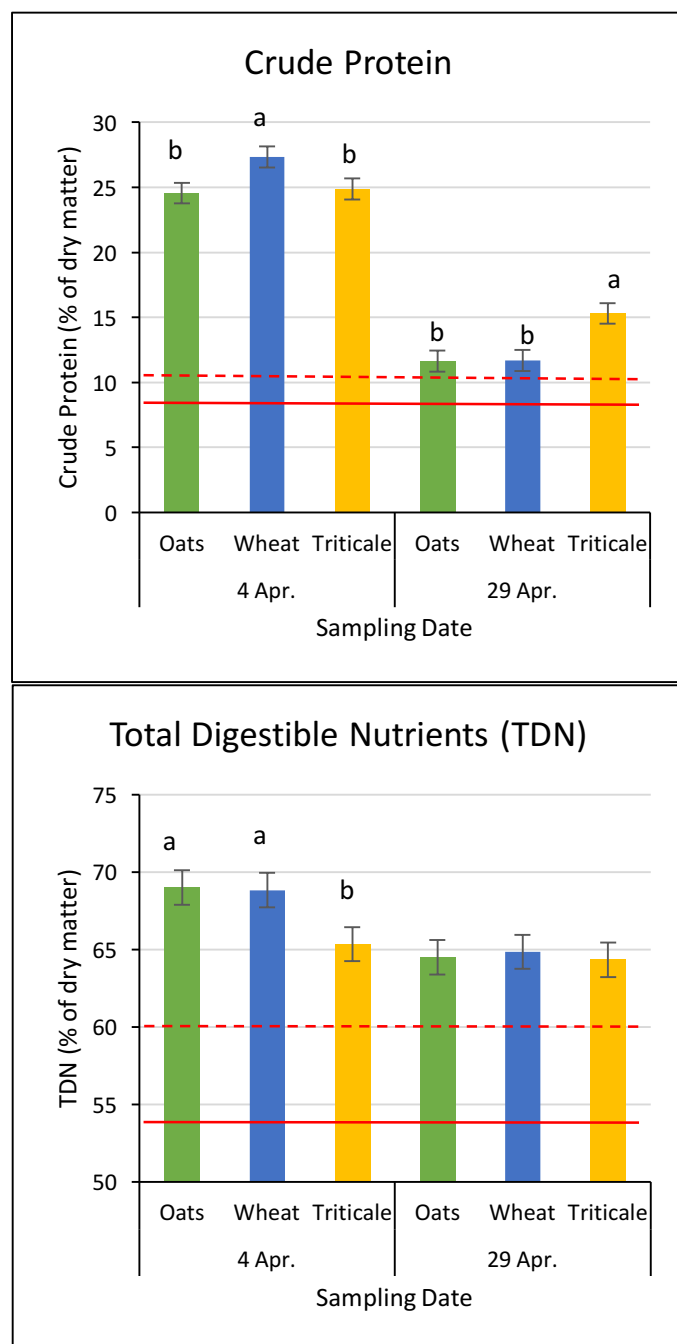


Figure 6. Crude protein (CP) and total digestible nutrients (TDN) values by date and forage type. Bars followed by different letters, within sampling date, are statistically different. Red horizontal lines indicate % CP and TDN requirements in the diet of a dry cow (solid line; CP = 8%, TDN = 54%) and lactating cow (dashed line; CP = 11%, TDN = 60%).

Oats and Wheat had similar and greater TDN compared to Triticale on April 4; however, on April 29 harvest there was no difference among the three forages. The TDN value for Triticale remained constant between the two harvest dates, while there was a change (lower) for Oats and Wheat (Fig. 6).

- **Matching forage nutritive value and livestock requirements**

Let's assume you are off to buy hay and you are given two choices of forage to be purchased: forage from the April 4 cut and forage from the April 29 cut. Which of these two options should you buy to feed to a lactating cow compared to a dry cow during a 90-day period...? This question becomes far more important if you were considering to buy hay for the whole winter.

To answer the previous question one needs to, first, understand the nutrient requirements of the type of livestock. Second, by looking at the nutritive value data you can try to match as close as possible, the supply (by the forage) and the demand (by the animal) of energy, protein, and other mineral requirements. The economics can play a big role in this decision. Biologically, preventing overfeeding or underfeeding is an important strategy to keep healthy-productive animals and also as a strategy for efficient use of resources in the overall system.

The two red lines in Fig. 7 indicate the % CP and TDN needed in the diets of a dry cow (~1,200 lb, last 1/3 of pregnancy; solid line) and a milking cow (~1,200 lb, first 90 days of lactation; dashed line). Both types of hay in this case provide adequate CP and TDN to meet animal requirements for energy and protein.

- **Animal responses under grazing conditions**

In North Florida, Dubeux et al. (2016) conducted an experiment to evaluate forage productivity (e.g. dry matter yield, nutritive value) and animal responses (e.g. average daily gain and gain per acre) of steers grazing three small grain-annual ryegrass mixtures. The mixtures were: rye-ryegrass, oats-ryegrass, and triticale-ryegrass. The results indicated that by the end of the trial there were no differences in animal responses; nevertheless, oat-ryegrass and triticale-ryegrass mixtures displayed a more even distribution of forage throughout the growing season. The rye-ryegrass mixture provided earlier grazing in the growing season and was more consistent across years probably because of greater drought tolerance of rye.

TAKE-HOME MESSAGES

- Cool-season annual forages such as small grains (i.e. oats, wheat, triticale, rye), planted alone or in mixtures with ryegrass, can provide high nutritive value forage to feed livestock.
- The nutritive value of the forage harvested in both sampling dates (stages) in this trial was sufficient (April 29 harvest) and more than sufficient (April 4 harvest) to meet the needs of both of a dry cow and a lactating cow.
- Including cool-season annual forages can have a strategic role in extending the grazing season and complementing the forage provided by perennial forages.
- Results from this experiment and from the literature report similar outcomes in terms of plant responses when choosing/deciding on a specific small grain or ryegrass mixture.

Acknowledgements

We acknowledge the contribution and support of Jay Foushee from Foushee Farms (farmer/cooperator) and Gary Cross, Crops agent for Person and Granville Counties, during the establishment and management of the trial. We are grateful to King's Agriseeds and Camp Chemical for their support with field supplies needed to conduct the trial and to carry out the on-farm field day.

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