

## CHAPTER V

### **SUMMARY AND CONCLUSIONS**

Beef producers in the southeastern USA are being forced to improve production efficiency due to increasing environmental and economic concerns. High quality, productive, and persistent forage systems are needed to allow profitable production at the lowest costs. Alfalfa is a high quality forage that can remain persistent throughout the warmer summer months while tall fescue provides forage during the spring and autumn. Producers could greatly benefit from pasture mixtures of these two well-adapted, productive species. Use of alfalfa-tall fescue mixtures has not been widely accepted in the southeastern USA due to the lack of management recommendations for maintaining alfalfa in the mixture.

This research was conducted to expand on past alfalfa-tall fescue research in Virginia and other states to identify the advantages and limitations of alfalfa-tall fescue mixtures in rotationally stocked pastures. The first experiment was conducted to evaluate the effects of defoliation height and frequency on botanical composition and persistence of alfalfa-tall fescue mixtures. The second experiment was designed to determine the most persistent alfalfa cultivars for planting in mixed stands with tall fescue. The third experiment was conducted to compare livestock performance, forage quality, and productivity of alfalfa-tall fescue mixtures to N-fertilized tall fescue.

Results from the first experiment showed that at certain dates, alfalfa was more competitive in above ground biomass production when defoliated to 3.8 cm as compared to 7.6 or 12.7 cm, and alternatively tall fescue was more competitive when defoliated to 12.7 cm, but there was no defoliation height effect during the majority of either growing season. These results suggest that defoliation height may not be as important for alfalfa-tall fescue mixtures as other legume-grass mixtures such as alfalfa-orchardgrass. A long rest period between defoliation encouraged alfalfa competition in the mixed stands better than a short rest period, which tended to favor tall fescue competition. Both defoliation height and rest period did not have a consistent effect on alfalfa plant persistence, but tall fescue crown size was larger at the 12.7 defoliation height for three sampling dates in 2003.

This thesis identified a number of management considerations that may improve alfalfa persistence and competitiveness in mixture with tall fescue. Alfalfa-tall fescue mixtures could be grazed early in the spring to reduce tall fescue growth and encourage alfalfa competition. Shorter grazing periods and higher stocking rates should also benefit alfalfa by limiting the detrimental effects of regrowth and trampling. A grazing-tolerant alfalfa cultivar should be used in mixtures with tall fescue. Pest management (e.g., potato leafhopper) is also an important factor to consider when managing alfalfa in mixtures. Although more defoliation height and rest period experiments are important, the above considerations should also be included in future alfalfa-tall fescue research.

In the second experiment there was a steady decline in alfalfa persistence across all cultivars. Cultivar recommendations were difficult to make because there were no consistent differences in alfalfa persistence among the twenty cultivars by autumn 2003.

The standard test manual (Bouton and Smith, 1998) also states that there must first be a significant difference between the grazing-tolerant (Alfagraze) and grazing-intolerant (5432) cultivar checks before a test is valid. Since this significant difference did not occur additional grazing seasons will be required.

The series of five cultivar experiments conducted as part of this research identified additional considerations for alfalfa cultivar testing in mixtures with tall fescue. High variability caused by mixed stands may require additional replications. Competition by non-target species such as white clover should be controlled, therefore chemical and/or management control options should be investigated for non-target species. The grazing-tolerant and grazing-intolerant cultivar checks recommended for pure stands may not be valid for mixed stands. Experiments to verify these checks in mixed stands may be needed before further cultivar testing can be conducted. Disease considerations for cultivar choice may be different in mixed stands as compared to pure stands due to microclimate humidity and grass tiller competition. Location may also have an effect on cultivar experiments due to different climatic conditions, topography, soil properties, and competitive species.

Results from the third experiment showed that forage mass was higher for N-fertilized tall fescue than alfalfa-tall fescue mixtures in 2002, but similar for both forage types in 2003. Nitrogen fertilization was able to increase the mass of pure tall fescue over alfalfa-tall fescue under the climatic conditions of 2002. Limited N fertilization may be an option to increase forage mass for alfalfa-tall fescue mixtures. Alfalfa-tall fescue quality was consistently higher than N-fertilized tall fescue in both years, but did not always translate into increased animal gain. Steers grazing N-fertilized tall fescue had

higher ADG for one grazing period in 2002 and steers grazing alfalfa-tall fescue had higher ADG during two grazing periods in 2003 and higher season-long ADG.

Both alfalfa-endophyte-free tall fescue mixtures and N-fertilized endophyte-free tall fescue produced high ADG in steers indicating that either stand type can be recommended for stockers. These results also suggest that endophyte-free tall fescue is similar to alfalfa-tall fescue in productivity and livestock performance, but alfalfa-tall fescue has higher quality. Future livestock research should include alfalfa seeded into endophyte-infected tall fescue stands. This would provide the greatest potential benefit for animal production, but alfalfa persistence may be more difficult to maintain. Modifying management factors such as stocking rate, grazing period, and grazing height would also likely influence animal gain.

Climatic conditions likely had the most influence on alfalfa composition and persistence in all three experiments in 2003. Above average precipitation in 2003 led to a dramatic decline in alfalfa composition and persistence in all alfalfa-tall fescue paddocks. Increased precipitation and moderate temperatures favored tall fescue growth and created waterlogged soils. Similar stand declines occurred in producer fields throughout Virginia in 2003. The consensus was that tall fescue competition and increased root and crown disease due to excess precipitation were the major factors causing alfalfa decline.

In conclusion, defoliation height, rest period, and month all affected alfalfa competition though results were not consistent. Tall fescue is a highly competitive grass, but the improved quality that alfalfa adds to mixed stands supports the value of alfalfa-tall fescue as a desirable pasture mixture. Future research studies on alfalfa-tall fescue

mixtures should include the effects of management, cultivar, climate, endophyte, disease, insect pests, and location.

## VITA

Pepper Monique Raines was born in Christiansburg, Virginia to John and Linda Raines on April 29, 1980. She has one older sister, Erika Raines. She graduated from Christiansburg High School in June 1998 and started Virginia Tech in August 1998. While attending Virginia Tech she became an active member of the Agronomy Club and was elected President of the club for 2001-2002. She conducted a Pratt Animal Nutrition Research Project during her senior year and participated on the Virginia Tech Crops Judging Team. She became a member of Gamma Sigma Delta Honor Society, Golden Key National Honor Society, National Society of Collegiate Scholars, and Phi Kappa Phi Honor Society during her undergraduate years at Virginia Tech. She graduated from Virginia Tech with a B.S. degree in Crop and Soil Environmental Sciences in May 2002. She started her graduate research in forages at Virginia Tech in May 2002. Pepper was a Multicultural Academic Opportunities Program Scholar during her two years of graduate school. She also received the American Forage and Grassland Council Emerging Scientist Award in 2003 for her graduate research. Pepper will be graduating with a M.S. degree in Crop and Soil Environmental Sciences in May 2004. After graduation, she plans to pursue a career in agronomy or natural resource conservation.