Paul Salon
USDA-NRCS
441S. Salina St.
Syracuse, NY 13202
Phone (315) 477-6535
FAX (315) 477-6550
paul.salon@ny.usda.gov

Yield of Eastern Gamagrass with and without Big Bluestem and Switchgrass

Paul Salon

USDA-NRCS, 441 S. Salina St., Syracuse, NY 13202 (315) 477-6535
paul.salon@ny.usda.gov

Abstract
A study was conducted to increase biomass and deter weed encroachment in establishing eastern gamagrass (*Tripsacum dactyloides (L.) L.)* forage planting. Two species mixtures of eastern gamagrass grown on both 15- and 30-inch row spacings with either switchgrass (*Panicum virgatum* L.)or big bluestem (*Andropogon gerardii* Vitman) were compared to eastern gamagrass alone. Biomass measurements were conducted at the first cutting date on the third (2005) and fourth (2006) year after establishment. Eastern gamagrass first cutting yields were reduced when grown with the switchgrass or big bluestem in 2005 and 2006. The switchgrass and big bluestem filled in between and within gamagrass rows and in areas with poor gamagrass population increasing overall yields. Weed encroachment was reduced by the utilization of the two species mixes. Forage quality was not adversely affected with the mixtures.

Keywords: Eastern gamagrass, switchgrass, big bluestem, biomass, forage quality

Introduction

Eastern gamagrass is one of the most palatable and nutritious of the warm season grasses and can be used for hay and pasture. It is typically planted with a corn planter due to its seeding depth requirement. In some instances the gamagrass is double planted to achieve a 15-inch row spacing. In the Northeast these row spacings result in late canopy closure which reduces the optimum capture of sunlight for the crop and allows weeds to become established competing for moisture and sunlight. In some instances due to seed quality, expense and handling requirements a full stand of eastern gamagrass may not be obtained. The use of mixed plantings of big bluestem and switchgrass may help fill in between and within the rows of the eastern gamagrass increasing yields and helping to reduce weed establishment. This study was set up to monitor the competition between switchgrass and big bluestem on eastern gamagrass and to observe if the stand composition will be maintained or will be favored by a particular species.

Materials and Methods:

The plots were located on a farm in Clarion County Pennsylvania near the town of Shippenville (N41.29 lat. W79.46 long.) at an elevation of 1480 ft on a Cookport channery silt loam soil with a 2 – 3% grade. Prior to amendment, soil test results from the Pennsylvania State

University Soil Testing Laboratory indicated the soil pH was 5.8 with optimum phosphorus (16 ppm) and potassium (50 ppm) levels. The field was in hay for over three years prior to the project. In 2002 the field was sprayed with glyphosate in the spring, then chisel plowed to 12 – 14 inches, disked, mechanically summer fallowed, and then planted to oats (*Avena sativa* L.) in late Summer.

In the Spring of 2003 the field was chisel plowed 12 – 14 inch deep, disked and planted to gamagrass with a corn planter at a 1.5 inch depth. The field was cultipacked prior to seeding switchgrass and big bluestem. On 6/1/03 one half of the field (50 ft) was planted to gamagrass in 30-inch rows, the other half was planted in 15-inch rows after recalibrating and double planting. Perpendicular to the gamagrass rows, 18 ft. wide switchgrass and big bluestem treatments were established with a Truax drill across both row spacings by drilling big bluestem in one, and switchgrass in another and leaving an unseeded strip as a control. The resulting 18 x 50 ft plots were replicated four times. The varieties used were 'Pete' eastern gamagrass, 'Cave-In-Rock' switchgrass and 'Niagara' big bluestem. Eastern gamagrass was planted after a 12-week stratification period at a 7 lb/ac bulk rate, the seed test indicated a 48% germination rate. Switchgrass and big bluestem treatments were planted with 4 and 5 lbs/ac bulk seed, respectively. No fertilizer was applied the establishment year. High magnesium lime was applied at 4,500 lbs/ac on 6/27/03. The first year the field was sprayed with 2,4-D in late summer for broadleaf weed control and clipped to 6 inches. There was good establishment of all species. On 4/21/04 of the second year 350 lbs/ac of 10-24-24 fertilizer was applied. There was no harvest or clipping in 2004. On 4/15/05 of the first sampling year a dormant spray of glyphosate was applied at 1 qt/ac.

On 6/23/05 biomass samples were collected by cutting two 2 x 2 foot? squares of switchgrass and big bluestem from each of the switchgrass/gamagrass and big bluestem/gamagrass combination plots. The gamagrass samples were collected from 10 ft of row in the gamagrass 30-inch row treatments and a 5 x 5 ft area for the 15-inch gamagrass row treatments for both the combination and gamagrass control plots. The entire harvested sample was dried in a force air drying oven for dry matter determination. The number of gamagrass plants that made up each sample was recorded. The plots were cut again on 6/20/06 as in 2005 with the addition of plots of big bluestem and switchgrass cut in areas without gamagrass.

An unreplicated forage quality sample for each of the species was analyzed at the Dairy One Forage Testing Laboratory in Ithaca, NY for 2005. The indicators measured were % crude protein (CP), % neutral detergent fiber (NDF), % acid detergent fiber (ADF), % Lignin, % *in vitro* total digestibility for both dry matter (DM) and NDF. The relative forage quality and milk lbs/ton of DM were calculated.

Results and Discussion

In 2005 there was a trend toward increased first cutting gamagrass yields from the plots which were in 15-inch rows (1.33 t/ac) compared to the 30-in rows (0.89 t/ac). Although the drill was recalibrated to maintain the same gamagrass population for the different row spacing treatments. There were on average more plants cut in the same 25 ft^2 area for the 15-inch row plots (13.3) compared to 10.8 plants for the 30-inch row plots. This resulted in the increase yield for the 15-inch row spacing over the 30-inch row spacing in 2005. There was a trend toward lower gamagrass yields from the plots with switchgrass and big bluestem with average yields of 0.62 t/ac compared to gamagrass monocultures at the two row spacings averaging 1.11 t/ac. Switchgrass had the highest yield even when grown with the gamagrass with an average across

both gamagrass row spacings of 1.73 t/ac compared to 0.96 t/ac for big bluestem. This could be due to the increased plant density during the initial establishment of the switchgrass compared to the gamagrass. This may be offset in later years if the individual gamagrass plants continue to increase in size and fill in as expected. The 2005 yield data are summarized in Table 1. Although the biomass is displayed in tons per acre the yields were obtained in portions of the plots with a solid stand of gamagrass and the companion species were obtained in areas directly adjacent to those areas where the gamagrass was cut. This was done to get an indication of the competitive effects of the companion species on the gamagrass in areas with good gamagrass establishment. Therefore the biomass yields are not actual measurements of the overall yield but of the potential yield in areas of good gamagrass establishment.

The average monthly precipitation for the region in 2005 for the months March through June was 4.25 inches below the normal of 15.6 inches. The average monthly temperature for the region in May was 50.8 ^{o}F which was 5.0 ^{o}F below average. In June the average monthly temperature was 67.7 ^{o}F which was 3.4 ^{o}F above average.

The unreplicated forage quality sample was taken in 2005 for each of the species to get an indication of the effect that stage of maturity has on forage quality at the time of harvest. Eastern gamagrass was at the early inflorescence stage and big bluestem and switchgrass were still at the vegetative stage. There was very little difference in forage quality between the species (Table 3.), indicating the forage could be harvested at this stage without big bluestem and switchgrass negatively impacting forage quality. There is an indication from these lab results, the stage of growth of the gamagrass cutting and data from other forage analysis studies, that an earlier harvest, at the boot stage may be expected to improve forage quality of the gamagrass over the other two species. Lab results from a forage quality study in New York (Salon and Cherney 1999) showed eastern gamagrass crude protein of 16.3 % and *in vitro* true digestibility of 79.8 % when cut at the early boot stage. The earlier cutting date would also result in lower yields.

In 2006 (Table 2) there was no significant difference in first cutting gamagrass yields between the 15- and 30-inch gamagrass monoculture row spacing treatments with yields of 1.18 and 1.28 t/ac respectively. The first cutting gamagrass monoculture yield from the 30-inch row spacing increased from 0.89 t/ac in 2005 to 1.28 t/ac in 2006. The plant number was difficult to count due to merging and increased growth of the crowns. There was a significant reduction in yield from the gamagrass component of the switchgrass and big bluestem mixtures with an average of 0.69t/ac compared with an average yield of the gamagrass without the big bluestem and switchgrass of 1.23 t/ac. In 2006 there was a reduction in switchgrass yields compared to 2005. In 2006 when sampled in areas adjacent to the gamagrass at both row spacings the switchgrass averaged 0.78 t/ac. When sampled in areas without gamagrass there were yields of 1.40 t/ac. In 2005 the switchgrass average yield adjacent to the gamagrass at both row spacings was 1.73 t/ac. A reduced amount of perennial weeds (asters (*Aster* spp.), goldenrod (*Solidago* spp.) and milkweed (*Asclepias* spp.)) were observed in the mixed stands compared to the gamagrass monoculture at both gamagrass row spacings (no data presented).

The average monthly precipitation for the region in 2006 for the months March through June was ????? inches below normal. The average monthly temperature for the region in May was 56.0 ^{0}F which was 0.2 ^{o}F degrees above average. In June the average monthly temperature was 64.3^{o}F which was average for the month.

Reference:

Salon P.R. and D.J.R. Cherney. 1999. Eastern gamagrass forage quality as influenced by harvest management, p. 300-306. In: Ritchie, J.C., J.A. Dickerson and C.A. Ritchie (eds.) 2000. Proc. Second Eastern Native Grass Symposium: Baltimore, MD November 17-19, 1999. Published by USDA-Agricultural Research Service, and USDA-Natural Resources Conservation Service, Beltsville, MD. 370 p.

Table 1. Biomass of first cutting of eastern gamagrass at 15- and 30-inch row spacings with and without switchgrass and big bluestem in 2005[1]

Species or mixture[2]	Gamagrass row spacing (in.)	Species	Tons/ac[3]
Gamagrass	15	Gamagrass	1.33 abc
Gamagrass	30	Gamagrass	0.89 bc
Gamagrass/Switchgrass	15	Gamagrass	0.79 c
Gamagrass/Switchgrass	30	Gamagrass	0.50 c
Gamagrass/Big bluestem	15	Gamagrass	0.57 c
Gamagrass/Big bluestem	30	Gamagrass	0.59 c
Switchgrass/Gamagrass	15	Switchgrass	1.77 a
Switchgrass/Gamagrass	30	Switchgrass	1.69 ab
Big bluestem/Gamagrass	15	Big bluestem	0.99 abc
Big bluestem/Gamagrass	30	Big bluestem	0.93 bc
$LSD_{.05}$			0.85

[1] Biomass for one cutting conducted on 6/23/05
[2] The order of the species indicates which species is being measured for biomass
[3]Values with different letters are significantly different by LSD Test at 0.05 level of probability

Table 2. Biomass of first cutting of eastern gamagrass, at 15- and 30-inch row spacings with and without switchgrass and big bluestem in 2006[1]

Species or mixture [2]	Gamagrass row spacing (in.)	Species	Tons/ac[3]
Gamagrass	15	Gamagrass	1.18 ab
Gamagrass	30	Gamagrass	1.28 a
Gamagrass/Switchgrass	15	Gamagrass	0.76 cd
Gamagrass/Switchgrass	30	Gamagrass	0.50 d
Gamagrass/Big bluestem	15	Gamagrass	0.73 cd
Gamagrass/Big bluestem	30	Gamagrass	0.77 cd
Switchgrass/Gamagrass	15	Switchgrass	0.91 bc
Switchgrass/Gamagrass	30	Switchgrass	0.66 cd
Big bluestem/Gamagrass	15	Big bluestem	0.89 c
Big bluestem/Gamagrass	30	Big bluestem	0.76 cd
$LSD_{.05}$			0.27

[1] Biomass for one cutting conducted on 6/20/06
[2] The order of the species indicates which species is being measured for biomass
[3]Values with different letters are significantly different by LSD Test at 0.05 level of probability

Table 3. Forage quality[1] of eastern gamagrass, switchgrass, and big bluestem harvested on 6/23/05

	%CP	%ADF	%NDF	%Lig.	%DM IVTD	%NDF IVTD
Gamagrass	13.2	36.7	69.4	4.8	78	70
Switchgrass	13.3	33.7	63.8	3.5	82	71
Big bluestem	14.5	35.5	67.2	6.1	79	69

[1] % crude protein (CP), % acid detergent fiber (ADF), % neutral detergent fiber (NDF), % Lignin (Lig.), % *invitro* total digestibility (IVTD both dry matter (DM) and NDF.