Bahamas Agricultural Research Training And Development Project

THE PRODUCTIVITY OF MIXED TROPICAL PASTURES GRAZED BY SHEEP OR CATTLE ALONE AND IN COMBINATION

A.R. & R.S. BAHAMAS
FINAL REPORT NO. 45

Final Report No. 45
November, 1977

BAHAMAS AGRICULTURAL
RESEARCH, TRAINING AND
DEVELOPMENT PROJECT

The Productivity of Mixed Tropical Pastures Grazed By Sheep or Cattle Alone and In Combination

T. S. Katsigianis
L. L. Wilson
T. E. Cathopoulis
R. F. Guyton
J. E. Baylor

The Productivity of Mixed Tropical Pastures Grazed By Sheep or Cattle Alone and In Combination

T. S. Katsigianis, L. L. Wilson, T. E. Cathopoulis, R. F. Guyton, and J. E. Baylor

INTRODUCTION

Several investigators at various locations in the United States and in other parts of the world have obtained increases in gains and carrying capacity by grazing sheep and cattle together on the same pastures. These increases realized on many types of pastures are reportedly due to the complimentary nature of the grazing habits of each animal species. For example, although cattle will consume taller growing, more mature grasses, sheep will graze closer to areas where cattle manure and forage on weeds and brush and other pasture plant species not relished by cattle. A combined or "companion" grazing system not only maximized meat production per acre, but often has a beneficial effect on the botanical composition of the pasture.

Combined grazing may not necessarily be beneficial for all pastures. For example, it is expected to work best on extensive types of pastures with several species of plants. On the other hand, high-quality pastures consisting of only one or two species of grasses or legumes, and sprayed regularly to control weeds, may not result in increased productivity when grazed by both sheep and cattle.

The objectives of these investigations were to compare animal performance and pasture productivity from mixed pastures when grazed by sheep or cattle alone and in combination.

PROCEDURES

Three 10.8-acre pastures were disked, fenced and each was subdivided into two equal pasture plots to allow rotational grazing. In October, 1975, 500 pounds of 8-18-8 fertilizer was applied per acre. At the same time, vegetative African stargrass (Cynodon plectostachyus) material was broadcasted and disked. Then a legume mixture consisting of greenleaf desmodium (Desmodium intortum), siratro (Macroptilium atropurpureum) and Tinaroo glycine (Glycine wightii) was seeded with a Brillion seeder. Each legume was seeded at the rate of 2 pounds per acre.

Since the initial stargrass establishment was poor, green panicgrass (Panicum Maximum var. trichoglume) was seeded at the rate of 2.5 pounds per acre with a John Deere grain drill in November, 1975. At this time, each pasture received an additional 500 pounds per acre of 8-18-8 fertilizer. Pasture plots were subsequently fertilized as recommended by on-site agronomy section personnel. The fertilizer applications and dates are presented in Table 1. These pastures were the first crop on new land that was cleared during the Spring of 1974.

Table 1. Fertilizer Application Rates and Dates for Mixed Tropical Legume-Grass Pastures.

Date	Lbs./acre (source)	Lbs./acre (source)	Lbs./acre (source)
May, 1976	40 (8-18-8)	90 (8-18-8)	40 (8-18-8)
July, 1976	-	50 (0-46-0)	35 (0-0-22)
October, 1976	-	50 (0-46-0)	35 (0-0-22)
January, 1977	-	50 (0-20-15)	35 (0-20-15)
April, 1977	-	50 (0-20-15)	35 (0-20-15)
July, 1977	-	50 (0-20-15)	35 (0-20-15)

Investigations were initiated in September, 1976, with addition of livestock to one-half of each 10.8-acre treatment block. Sheep grazed the first treatment (D), while bred, purebred Santa Gertrudis heifers grazed the second treatment (B). Both ewes and heifers grazed the third 10.8-acre block (C). Grazing was conducted on a rotational basis. One-half of each 10.8-acre pasture was grazed for 28 days and rested for the same length of time.

All livestock were weighed at 28-day intervals and animal numbers altered within each treatment at that time. Reserve animals were maintained and added to each plot on a put-and-take basis during times of excess forage production. Alteration of stocking rate was based on animal performance during the previous weigh period and on a visual assessment of pasture quality and quantity.

Calves born to heifers on trial during March and April were weighed in September, 1977, at an average age of 138 days. Lambs born to ewes on trial were weighed and weaned at approximately 90 days of age. Trace mineralized salt, monosodium phosphate and water were available free-choice to all livestock.

Pasture plots were sampled weekly prior to the introduction of animals into the replication to be grazed. Forage from four random strips, 39 inches wide and 10 feet long was cut with a Gravely tractor and sickle bar mower from each field. Gross forage weights were obtained and subsamples were dried at 140°F for one week to determine moisture and dry matter yields. Samples were ground with a Wiley Mill (1 mm screen), composited and shipped to The Pennsylvania State University for chemical analyses. Total yield of dry matter, digestible dry matter, protein per acre and variations in the yield and chemical composition of the pastures for different seasons were obtained.

DRY MATTER, DIGESTIBLE DRY MATTER AND CRUDE PROTEIN YIELDS

The trial was initiated on September 10, 1976. As indicated in the procedures section, pastures were sampled approximately every 28 days when the livestock were rotated. Dry matter production, percent digestibility of the dry matter, and percent crude protein were obtained for each sample. In addition, pounds of crude protein and digestible dry matter per acre were calculated. These results are presented in Table 2.

Although the pastures were initially seeded and fertilized with identical procedures, establishment differed from the onset of the trial. Block B (Cattle) was clearly the best pasture in terms of dry matter production and had a more dominant greenleaf desmodium stand which also resulted in higher digestible dry matter and protein production on this block during the September and October, 1976, periods. All the pastures suffered a setback in January with the occurrence of a frost, the first recorded on Andros, which caused the legumes to lose their leaves. However, as temperatures and rainfall increased, all pasture stands improved. The dry matter production for the duration of the trial reflected the initial patterns with treatment Block B being most productive (9.65 tons/acre) followed by Blocks C (8.62 tons/acre) and D (7.10 tons/acre).

Only minor differences were noted in the digestibility of the dry matter between treatments, with forage in Block D (sheep alone) averaging slightly higher throughout the trial duration. However, total pounds of digestible dry matter reflected the dry matter yield trends. Forage was generally more digestible during the wet season months (May-October) of the year on all plots.

Percent crude protein was consistently higher throughout the trial duration for Block B (17.32%) followed by Blocks C (14.24%) and D (12.98%). The higher protein content of forage in Block B was a reflection of the better stand of legume (chiefly greenleaf desmodium) initially established in that

Table 2. Dry Matter (DM), Estimated Digestibility (Dig. DM) and Protein Production of Mixed Legume-Grass Pastures.

Date	DM, TONS			Dig. DM, %			Dig. DM, Lbs.			Crude Protein, %			Crude Protein, Lbs.		
	3-11 B	3-11 C	3-11 D	3-11 B	3-11 C	3-11 D	3-11 B	3-11 C	3-11 D	3-11 B	3-11 C	3-11 D	3-11 B	3-11 C	3-11 D
Sept. 13, 1976	0.68	0.26	0.31	60.0	54.6	58.7	816	284	364	14.83	8.21	8.05	202	43	50
Oct. 12	0.51	0.58	0.46	51.6	49.6	54.8	526	575	504	17.14	10.73	10.87	175	124	100
Nov. 9*	0.48	0.61	0.44	47.5	47.1	52.9	458	573	461	18.30	11.99	12.23	175	170	106
Dec. 10	0.45	0.64	0.41	43.3	44.6	50.9	390	571	417	19.46	13.25	13.69	175	170	112
Jan. 4, 1977	0.77	0.53	0.31	52.1	54.6	55.4	802	579	343	17.00	17.91	14.15	262	190	88
Jan. 28	0.26	0.26	0.27	42.7	44.4	44.1	222	231	238	10.37	11.24	9.69	54	58	52
Feb. 25	0.76	0.26	0.30	45.5	45.0	45.9	692	234	275	15.84	15.95	11.79	241	83	71
Mar. 25	0.68	0.27	0.31	54.4	69.2	56.9	740	374	353	20.26	13.59	15.68	276	100	97
April 22	0.86	0.56	0.94	55.0	51.6	50.0	946	578	940	21.11	14.87	14.29	363	167	269
May 20	0.55	0.69	0.45	50.0	51.5	52.2	550	711	473	19.85	16.03	15.64	218	221	141
June 17	0.87	0.95	0.54	53.1	51.5	55.0	924	979	594	17.41	17.19	17.00	303	327	184
July 15	1.18	1.41	1.40	40.6	41.9	50.9	959	1182	1425	14.98	12.19	13.78	354	344	386
Aug. 12	1.60	1.60	0.96	46.8	43.8	38.0	1498	1402	730	18.56	16.96	11.88	594	543	228
Avg. 28-Day Period	0.74	0.66	0.55	49.4	49.9	51.2	733	636	548	17.32	14.24	12.98	261	194	145
Total Annual Production	9.65	8.62	7.10	--	--	--	9523	8273	7117	--	--	--	3392	2517	1884

*Samples not taken; values estimated from October 12 and December 10 data.

pasture. Definite seasonal trends in percent crude protein were not observed during this first year after establishment.

ANIMAL MAINTENANCE AND PASTURE CARRYING CAPACITY

Weights and daily gains of the ewes on the two treatments are presented in Table 3. Ewe performance throughout the duration of the trial was satisfactory. Ewes remained in excellent condition and health. Significant weight differences during several periods were related to ewe gestational stages rather than to actual difference in condition. For example, ewes grazing Block D (sheep alone) during the last few months of the trial were all in late gestation stages, while those on Block C (sheep and cattle) were lactating. The average weight of ewes on the two treatments throughout the trial was similar, with ewes on Block D (107.4 lbs.) averaging slightly higher than those on C (101.5 lbs.).

Cattle performed equally as well as ewes (Table 4). During the growing-gestating phase from September to February, gains were satisfactory and comparable between treatments with heifers on Block B (1035 lbs.) averaging only 2 pounds heavier than those on Block C (1033 lbs.) for the entire phase. Similarly, weights during the lactation phase were comparable between treatments with heifers on Block B averaging 1158 lbs. for the entire phase while those on Block C averaged 1116 lbs. Each treatment block contained one non-lactating female. Adjusted calf gains to 165 days were excellent in both treatments, indicating that heifers were producing abundant amounts of milk and that calves had access to large amounts of high-quality forage (Table 4).

Animal units carried on the mixed tropical legume-grass pastures grazed by cattle and sheep alone or in combination are presented in Table 5. Due to

Table 3. Weights and Daily Gains (ADG) of Ewes on Mixed Tropical Legume-Grass Pastures.

Date	3-11C (Sheep & Cattle)		3-11 (Sheep)	
	Wt., lbs. (no. obs.)	ADG, lbs. (no. obs.)	Wt., lbs. (no. obs.)	ADG, lbs. (no. obs.)
September 10, 1976	79.6 (18)		80.8 (33)	
October 8	86.4 (18)	0.25 (18)	88.3 (33)	0.26 (33)
November 5	92.9 (18)	0.23 (18)	93.8 (33)	0.20 (33)
December 3	91.8 (18)	-0.04 (18)	94.7 (33)	0.04 (33)
December 31	92.2 (18)	0.01 (18)	99.4 (33)	0.16 (33)
January 28, 1977	97.3 (18)	0.18 (18)	103.2 (33)	0.14 (33)
February 25	91.3 (16)	-0.16[a] (16)	91.9 (36)	-0.36[b] (36)
March 25	105.4 (9)	0.53 (9)	102.3 (35)	0.37 (35)
April 22	113.8 (9)	0.31 (9)	105.9 (35)	0.13 (35)
May 20	121.3 (8)	0.29 (8)	121.2 (19)	0.39 (19)
June 17	109.8 (8)	-0.41[a] (8)	118.7 (19)	-0.09[b] (19)
July 15	114.5 (8)	0.17 (8)	125.9 (19)	0.26 (19)
August 15	110.6[a] (8)	-0.13 (8)	132.3[b] (19)	0.20 (19)
September 9	114.4 (8)	0.15 (8)	145.7 (19)	0.54 (19)
Average	101.5	0.12	107.4	0.17

[a,b]Means followed by different superscripts were significantly different from each other ($P<.05$)

Table 4. Weights and Daily Gains (ADG) of Heifers on Mixed Tropical Legume-Grass Pastures.[a]

Date	3-11B (Cattle)		3-11C (Sheep & Cattle)	
	Wt., lbs. (no. obs.)	ADG, lbs. (no. obs.)	Wt., lbs. (no. obs.)	ADG, lbs. (no. obs.)
Growing-Gestating:				
September 10, 1976	893 (8)		893 (4)	
October 8	952 (8)	2.10 (8)	952 (4)	2.12 (4)
November 5	1008 (8)	2.00 (8)	1010 (4)	2.05 (4)
December 3	1046 (8)	1.37 (8)	1084 (4)	2.65 (4)
December 31	1108 (8)	2.19 (8)	1080 (4)	-0.13 (4)
January 28, 1977	1134 (8)	0.95[b] (8)	1156 (4)	2.71[c] (4)
February 25	1105 (8)	-0.20[b] (8)	1059 (2)	-2.62[c] (2)
Average	1035	1.40	1033	1.13
Lactating				
March 25	1194 (8)	3.17 (8)	1056 (2)	-0.12 (2)
April 22	1155 (8)	-1.38 (8)	1090 (2)	1.21 (2)
May 20	1168 (8)	0.44 (8)	1097 (2)	0.27 (2)
June 17	1138 (8)	-1.07 (8)	1092 (2)	-0.19 (2)
July 15	1162 (8)	0.86 (8)	1109 (2)	0.62 (2)
August 15	1143 (8)	-0.63[b] (8)	1172 (2)	2.01[c] (2)
September 9	1145 (8)	0.12 (8)	1199 (2)	1.10 (2)
Average	1158	0.22	1116	0.70
Calves				
165-Day Weaning Weight[d]	617 (7)	3.74 (7)	624 (1)	3.78 (1)

[a]Effects due initial weight differences were statistically removed.
[b,c]Means within the same trait followed by different superscripts are significantly different from each other ($P<.05$).
[d]Adjusted for sex of calf and age of dam.

differences in the forage productivity of the treatment pastures (Table 2), the effects of mixed or single species grazing on pasture carrying capacity were difficult to assess. Pasture B (cattle alone) maintained the greatest average number of animal units (0.81 A.U./acre) throughout the trial duration, but also produced the greatest amount of dry matter (9.17 tons/acre). Pasture D (sheep alone) carried the least average number (0.50 A.U./acre) of animal units throughout the trial and produced the lowest amount of dry matter (7.10 tons/acre). However, pasture C (cattle and sheep) carried essentially the same number of animal units (0.80 A.U./acre) as the B block grazed by cattle alone, but produced 1.03 tons of dry matter per acre less. These data indicate that although the total forage production from the block grazed by cattle and sheep in combination was lower than that from the block grazed by cattle alone, greater efficiency of forage utilization was achieved permitting both pastures to carry a similar number of animal units throughout the trial duration.

BEEF AND LAMB PRODUCTION

Actual production of beef and lamb from the three treatment groups are presented in Table 6. On both a total pounds (3576 lbs.) and per acre (331.1 lbs./acre) basis, ewes grazed alone weaned the greatest pounds of liveweight product. Furthermore, this productivity was realized on the treatment block D (sheep alone) that had the lowest dry matter yield per acre and carried the fewest average number of animal units. Cattle grazed alone actually weaned 275 pounds of beef per acre. Although the actual productivity of the cattle was lower than the ewes, all cows were first-calf heifers and therefore, use of manure females would result in a 50 to 60 pound increase in this figure. However, this productivity was achieved on pastures that produced 2.55 tons more dry matter per acre than those grazed by sheep alone (Table 2). In addition, the

Table 5. Animal Units Carried on Mixed Tropical Legume - Grass Pastures.

Date	Animal Units[a] Per Acre		
	3-11B (Cattle)	3-11C (Cattle & Sheep)	3-11D (Sheep)
September 10, 1976	.59	.79	.49
October 8	.59	.83	.52
November 5	.59	.91	.60
December 3	.72	1.02	.65
December 31	.72	1.04	.67
January 28, 1977	.72	.98	.61
February 25	.72	.81	.62
March 25	.74	.79	.58
April 22	.83	.86	.65
May 20	.88	.56	.35
June 17	1.00	.67	.35
July 15	1.04	.69	.36
August 15	1.07	.69	.35
September 9	1.10	.60	.26
Average, 28-Day Period	0.81	0.80	0.50

[a]Animal Unit Equivalents: Mature cow, maintenance and gestation, 1.00
Mature cow with calf, birth to 3 months, 1.25
Mature cow with calf, 3 months to weaning, 1.40
Bulls, 1.25
Ewe, 0.14
Lamb, 0.07

Table 6. Annual Production of Beef and Lamb from Mixed Legume-Grass Pastures.

Pasture	Total Lbs.	Lbs./Acre
3-11B (10.8 Acres):		
Beef	2970	275.0
3-11C (10.8 Acres):		
Beef	572	52.9
Lamb	1799	166.6
Beef & Lamb	2371	219.5
3-11D (10.8 Acres):		
Lamb	3576	331.1

trial was terminated when the calves averaged 138 days of age, rather than the conventional weaning age of approximately 7 months of age. Weaning at an age of 7 months should have added approximately 35% to the pounds of calf produced per acre. Therefore, under these conditions, the amount of animal product produced per acre should have been more comparable across the three treatments. Cows and ewes in combination on block C produced an actual 219.5 pounds of beef and lamb per acre. This figure excludes one calf which died prior to weaning. Assuming two calves weaned from mature cows, the liveweight produce weaned per acre should have exceeded the cattle grazing alone group. Furthermore, this productivity was achieved on pastures that produced 1.03 tons of dry matter per acre less than those grazed by the cattle alone.

SUMMARY AND CONCLUSIONS

The productivity of sheep and cattle grazing mixed tropical legume-grass pastures alone or in combination was excellent. However, major differences in the forage stands between treatment blocks prevented examination of true differences in productivity due to species grazing regime. Based on these limited observations, combined grazing of sheep and cattle resulted in more efficient forage utilization than when cattle were grazed alone. However, the ratio of sheep to cattle was lower than that usually used in companion grazing trials. Sheep grazed alone produced the greatest actual pounds of liveweight product per acre during the 364-day trial period. Future grazing systems at BARTAD should combine the use of both cattle and sheep for maximum efficiency.