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COMPARISON OF TRANSVALA, STARGRASS AND BIGALTA PASTURES FOR GROWING BEEF CATTLE

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INTRODUCTION:

Productive Bahamian livestock enterprises will depend largely on the establishment, maintenance, and persistency characteristics of pastures. Numerous grass species are available and many have been tested in small plot trials. However, the cattle must be evaluated through controlled grazing trials before final recommendations can be made. Information from controlled grazing trails is useful in developing livestock forage programs in a particular environment, and for specific types and goals of animals in mixed livestock enterprises. Pasture output in the form of animal performance and pasture carrying capacity should give reliable estimates of the productivity of a particular grass pasture species in such programs. It should also be realized that different types of animals (i.e., mature animals requiring a maintenance nutritional program and growing-finishing animals requiring a higher quality forage) will require different forage management programs and probably different plant species and mixtures. The present trial was conducted with growing-finishing yearling cattle, although some of the information resulting will have relevance to the mature beef cow. Therefore, the objectives of this trial were to compare three vegetatively propagated grass pastures under grazing conditions for yield, seasonal carrying capacity, and beef production per acre.

PROCEDURES: Four replications, each consisting of three, 1-acre plots (total of 12 acres) were disked and fenced. The land was initially cleared in 1973, then prepared and seeded to sudangrass and sorghum in April, 1974. In July, 1975, the experimental pastures were planted for this trial. Transvala digitgrass (*Digitaria decumbens*), African stargrass (*Cynodon plectostachyus*) or bigalta Hemarthria (USDA PI299995; *Hermarthria altissima*) were established within each replicate. The experimental plot layout is diagrammed in Figure 1. Vegetative material for each of the three species was obtained from nursery stock available on site and established in the pasture plots during July, 1975. African stargrass and Transvala digitgrass were broadcasted and disked in, whereas bigalta was planted in 30-inch rows with a Bermuda King Sprigger.

At planting, 400 pounds of 8-18-8 fertilizer was applied per acre. Thereafter, pasture plots were fertilized as recommended by on-site agronomy section personnel. The fertilizer applications and dates during the trial are shown in Table 1. Sulfur-coated urea was selected as the nitrogen source because supplies were on hand and it had showed promising results in a previous fertility trial due to slower nitrogen release.

Prior to initiation of the grazing trial, pastures were clipped as necessary to control weeds. During the trial, the plots were sprayed once for weed control using a mixture of 2, 4-D and dicambra. The plots were also clipped two times to remove ungrazed herbage and to control weeds.

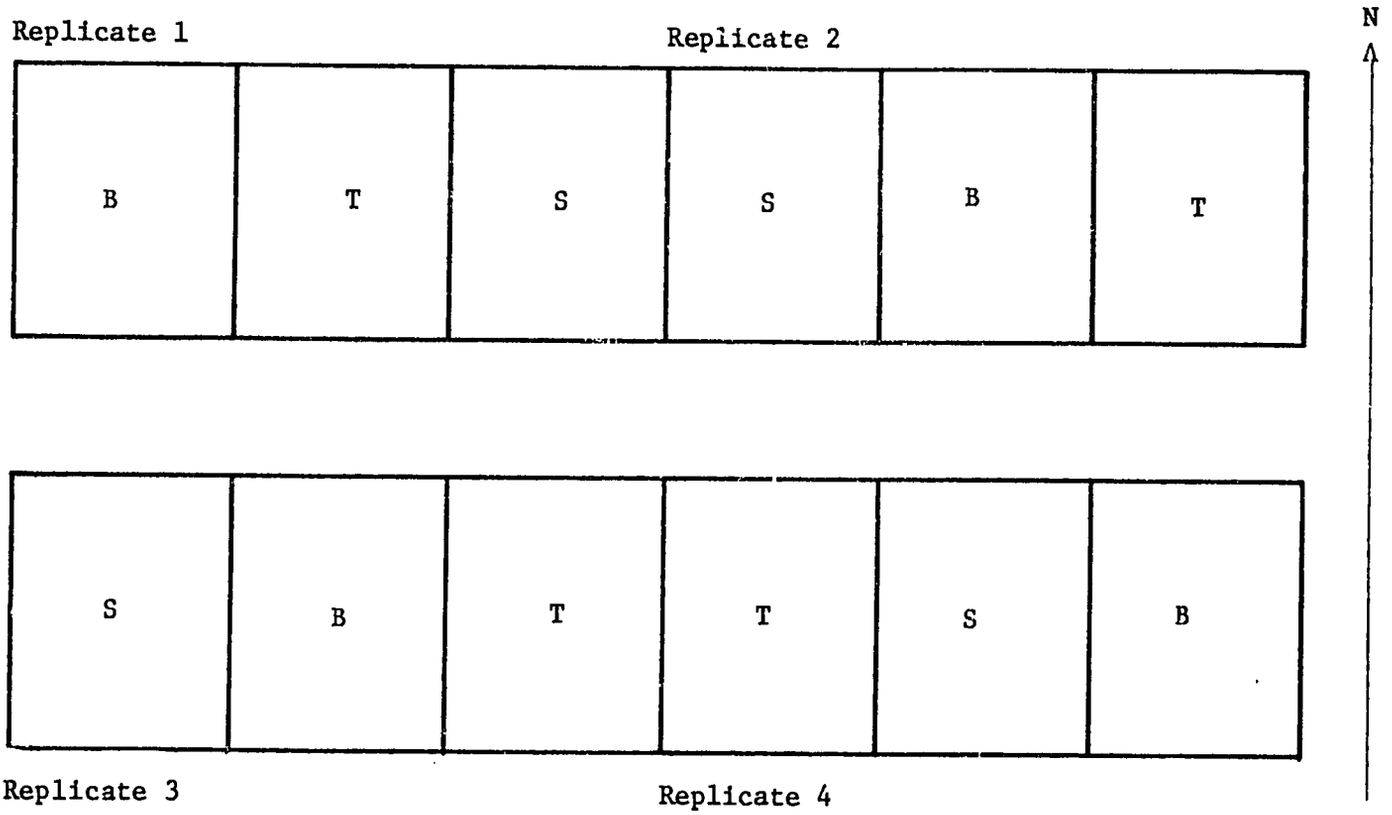

Figure 1. Experimental pasture plot layout (T = Transvala digitgrass; S = African stargrass; B = Bigalta).

Table 1. Fertilizer Application Rates and Dates for Comparison of Transvala, Stargrass and Bigalta Pastures.

Topdress:	Nitrogen Pounds/acre	Phosphorus Pounds/acre (source)	Potassium Pounds/acre (source)
Oct. 1975	50 (SCU)[a]	50 (0-46-0)	25 (0-0-22)
Jan. 1976	50 (SCU)	50 (0-46-0)	25 (0-0-22)
Apr. 1976	50 (SCU)	50 (0-46-0)	25 (0-0-22)
July 1976	50 (SCU)	50 (0-46-0)	25 (0-0-22)
Oct. 1976	50 (SCU)	50 (0-46-0)	25 (0-0-22)
Jan. 1977	50 (SCU)	50 (0-20-15)	25 (0-20-15)
Apr. 1977	50 (SCU)	50 (0-20-15)	25 (0-20-15)
July 1977	50 (AS)[b]	50 (0-20-15)	25 (0-20-15)

[a]Sulfur-Coated Urea

[b]Ammonium Sulfate

Investigations were initiated in March, 1976, with the addition of five yearling, purebred Santa Gertrudis heifers to each plot within the first replicate. Average initial weight of the heifers was 442 pounds. Prior to assignment to this trial the heifers had been in drylot receiving silage and limited green chop and supplemental hay. Grazing was conducted on rotational basis. Each plot was grazed for 7 days and rested for 21 days. Cattle were weighed at 28-day intervals and reserve animals allotted within each treatment at this 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 primarily on a visual assessment of pasture quality and quantity prior to grazing and to a lesser extent on animal performance during the previous 28-day trial. Trace mineral salt, monosodium phosphate and water were available to the livestock at all times.

Plots were sampled weekly prior to the introduction of animals into the pasture species replication to be grazed. Forage from four random strips, 38 inches wide and 10 feet long was cut with a Gravely tractor and sickle bar mower from each 1-acre field. Gross forage weights were obtained and sub-samples were dried at 140°F for 1 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.

Within each pasture plant species, four weekly samples were combined into one monthly sample before chemical analysis. Total yields of dry matter, percent digestibility of dry matter and crude protein percent were determined, and pounds of digestible dry matter and crude protein produced per acre were calculated. In some cases, pasture samples had been destroyed in a dryer fire and production and composition were estimated for those missing dates based on averages of other results from the same pastures within the same season.

The heifers were removed from trial on March 14, 1977, and replaced on the trial with yearling purebred Santa Gertrudis steers. Initial assignment consisted of two steers on the Transvala, six steers on the stargrass and five steers on the bigalta. The steer phase was terminated on July 4, 1977. However, pasture sampling was terminated when the heifers were removed from the trial in March, 1977.

RESULTS AND DISCUSSION: The trial was initiated on March 15, 1976. As indicated in the procedure section, pastures were sampled approximately every week when the cattle were rotated. Weekly samples were combined into monthly samples with dry matter production, precent digestibility of the dry matter, and crude protein percentage were obtained. In addition, pounds of crude protein and digestible dry matter per acre were calculated. These results are presented in Table 2. Annual dry matter production per acre was 6.37, 9.88 and 10.40 tons for Transvala, stargrass and bigalta, respectively. Transvala dry matter production was significantly ($P < .05$) less than the other two species.

The dry matter production of Transvala was apparently affected less by season or amount of rainfall than was the dry matter production of the other two grasses. Low density populations of the twolined spittle bug were first observed in the Transvala pastures in June, 1976, and although populations were never considered excessively high, the insect did contribute to the lower yields of this grass. The highest yield of dry matter from the bigalta was in the

Table 2. Dry Matter (DM), Estimated Digestibility and Protein Production of Transvala (T), Stargrass (S) and Bigalta (B) Pastures.

Item	DM, Tons			Dig. DM, %			Dig. DM, Lbs.			Crude Protein, %			Crude Protein, Lbs.		
	T	S	B	T	S	B	T	S	B	T	S	B	T	S	B
Mar. 15	0.67	0.60	0.56	51.4	55.9	62.6	689	671	701	9.07	7.34	6.56	121.5	88.1	73.5
Apr. 12	0.47	0.43	0.65	49.7[a]	67.9	59.6	467	584	775	8.48[a]	5.53	5.02	79.7	47.6	65.3
May 10	0.43	0.58	0.65	48.0	45.8	55.1	413	431	716	7.88	7.23	5.89	67.8	83.9	76.6
June 7	0.61	0.78	0.72	52.8	48.0	56.4	644	749	812	6.66	7.05	4.80	81.3	110.0	69.1
July 5	0.45	0.77	1.07	55.3	48.1	45.2	498	741	967	8.64	8.16	3.83	77.8	125.7	82.0
Aug. 2	0.56	0.81	1.10	49.9	52.9	50.6	559	857	1113	7.68	9.88	6.36	86.0	160.1	139.9
Aug. 30	0.75	0.99	1.00	64.4	55.9	63.6	966	1107	1272	14.23	9.68	5.89	213.5	191.7	117.8
Sept. 27	0.54	0.95	1.14	60.3	51.9	57.6	651	986	1313	11.38	10.08	5.48	122.9	191.5	124.9
Oct. 25	0.40	0.81	0.89	59.2	52.0	59.2	474	842	1054	12.06	8.60	6.47	96.5	139.3	115.2
Nov. 22	0.33	0.82	0.81	47.1	51.1	59.4	311	838	962	12.69	12.17	9.76	83.8	199.6	158.1
Dec. 20	0.46	0.97	0.94	39.6[a]	49.2[a]	55.9[a]	364	935	1051	11.84	10.98	8.68	108.9	213.0	163.2
Jan. 17	0.37	0.64	0.33	32.0	45.2	52.4	237	579	346	10.98	9.78	7.59	81.3	125.2	50.1
Feb. 14	0.38	0.76	0.48	39.8	37.5	50.9	303	570	489	12.86	9.37	8.12	97.7	142.4	78.0
Average	0.49	0.76	0.80	50.0	50.8	56.0	505.8	768.5	890.1	10.34	8.91	6.50	101.4	139.9	101.0
Total Annual Production per acre	6.37	9.88	10.4				6575	9991	11,571				1318	1819	1314

[a]Values were missing and estimated by calculating average of the two values taken before and after the missing value.

July 5 through September 27 sampling dates. Maximum production of stargrass was during August and September, although the second highest monthly yield was obtained on December 20.

Season also appeared to have an effect on percent digestibility of the dry matter, with the lowest values for Transvala and stargrass obtained in January and February. Averages during the entire trial for Transvala, stargrass and bigalta were 50.0, 50.8, and 56.0 percent, respectively. Generally the highest percentages of dry matter digestibility for Transvala occured in August-September; for stargrass, April, 1976 and August-September, 1976 and April-June, 1976 for bigalta. However, a dry matter digestibility value of 59.4%, the second highest percentage of any analysis, was obtained for bigalta on November 22, 1976.

Pounds of digestible dry matter produced per acre for each sampling date is also presented in Table 2. During the entire trial, averages for Transvala, stargrass and bigalta were 6,575, 9,991 and 11,571 pounds per acre, respectively. Maximum production for Transvala, stargrass and bigalta were observed in late August which would be expected considering the relative amount of rainfall during and prior to this period.

Percent crude protein during the entire trial averaged 10.34, 8.91 and 6.50 percent for Transvala, stargrass and bigalta, respectively. Peak protein content for Transvala was from August through February (11.0 to 12.9%); highest percent crude protein for stargrass was generally during the same period (9.4 to 12.2%), and November through February for bigalta (8.1% to 9.8%). However, bigalta was considerably lower (usually 2%) than the other two grasses at practically every sampling date. Both digestible dry matter and crude protein content for bigalta, as compared with Transvala and stargrass, are in agreement with values obtained in small plot studies at BARTAD (see Final Report #22, "Performance of Several Perennial Grasses Propagated Vegetatively at the BARTAD Project, North Andros Island, Bahamas".)

Pounds of crude protein, a result of both the dry matter yield and percent crude protein, totalled 1,318, 1,819, and 1,314, per 12-month period for Transvala, stargrass, and bigalta, respectively. The highest amount for Transvala occured in the August 30 sampling, with the highest for stargrass being on the August 2 and November 22 sampling dates. Peak crude protein production for Bigalta occured in the November, 1976, sampling date.

It should be mentioned that the percent crude protein in bigalta during the period from March 15, 1976 through August 30, 1976, was less than the National Research Council recommendations for growing-finishing steers and heifers, and in fact was borderline compared to the protein needs for mature non-lactating beef cows. Therefore, during several of the periods, there was a deficiency in protein available from bigalta forage compared to the recommended crude protein composition.

Generally accepted percent crude protein on a dry matter basis for growing-finishing cattle of the weights used in this study would range from 10.5 percent to 12.0 percent from the beginning through the end of the trial, since the percent crude protein requirement generally decreases with body weight.

Average Weights and Gains of Trial Heifers: The average weights and daily gains for the heifers used in the 12-month trial are presented in Table 3. Each of the three pastures were initially stocked with five head per treatment, with these same five head remaining on the pastures through January 17, when numbers of heifers on the Transvala, stargrass, and bigalta pastures were reduced to three, five, and four head, respectively.

As indicated previously, the heifers weighed 442 pounds at the start of the trial. Prior to the trial, they had been in drylot, with a ration composed of silage, green chop and hay. As anticipated, particularly from the relatively high-quality and ample forage available at the start of the trial, average daily gains observed in the March 15-April 12 period were quite high, averaging from 3.12 pounds per day for the bigalta pastures to 3.82 for the Transvala pasture. There were several cases throughout the conduct of the experiment where relatively high compensatory average daily gains were observed. This is common in pasture trials, although the variance between average daily gains achieved by the experimental groups in this study was more than ordinarily observed in most other pasture trials. In addition, filled animal weights (without withdrawal from food or water) were used for each of the weigh periods. A variation between filled (non-shrunk) and shrunk weights of 5% or more is not uncommon. After the trial had been conducted for 56 days (May 10 weigh day), significant differences ($P < .01$) were noted between average weights of cattle from the three pasture treatments. Generally, the significant difference in weights continued through the end of the trial on March 14, 1977. In practically all cases, there was little significance noted between average weights from the Transvala and stargrass pastures, although in practically all cases, average weights of cattle grazing bigalta were significantly ($P < .01$) less than cattle grazing the other two treatments.

As will be discussed later, gains should have been about 20% greater if steers rather than heifers had been used. Also, the rate of gain of the heifers in this trial would be expected to decrease at 800 to 850 pounds as fattening occurred. This probably contributed to the reduced weight gain observed in November and later. Naturally the primary reason for decreased gain in the period was pasture quantity and quality, but the stage of growth in the heifers probably also contributed. The increase in gain observed in February 14-March 14, 1977 probably was due to a combination of increased forage available and compensatory gain.

The average weights and daily gains for the steers on the three pastures (March 14 through July 4, 1977) are summarized in Table 4. During the first 28-day period, the steers grazing the Transvala and stargrass pastures gained significantly ($P < .01$) more rapidly than steers grazing bigalta. The steers used for this trial had grazed moderately mature mixed grass-legume pastures prior to the initiation of the trial, which explains the relatively high rate of compensatory gain during the first 28 days. However, there were significant ($P < .01$) differences in the weights early in the trial (March 4-April 11, 28 days), in favor of the Transvala and stargrass pastures.

At the end of the trial there were no significant differences in the weights or average daily gains, although the steers grazing the bigalta weighed an average of 32.6 and 23.8 pounds less than the Transvala and stargrass groups, respectively.

Table 3. Average Weights and Daily Gains (ADG) of Heifers on Transvala, Stargrass and Bigalta Pastures[a]

Item	Transvala		Stargrass		Bigalta	
	Wt.	ADG	Wt.	ADG	Wt.	ADG
Mar. 15	(5)442.2		(5)443.2		(5)441.2	
Apr. 12	549.0	3.82	545.2	3.68	529.4	3.12
May 10	545.4^{e}	-.13^{bc}	583.3^{f}	1.36^{bc}	502.5^{g}	-.96
June 7	580.6	1.26^{b}	593.6	0.36^{c}	559.4	2.03^{b}
July 5	581.4^{f}	0.03^{e}	571.7^{ef}	-.78^{f}	532.9^{e}	-.95^{f}
Aug 2	662.6^{e}	2.90^{bc}	669.7^{e}	3.50^{b}	594.3^{f}	2.19^{c}
Aug. 30	704.0^{e}	1.48^{b}	722.9^{e}	1.90^{b}	623.9^{f}	1.06^{c}
Sept. 27	775.2^{e}	2.54	782.0^{e}	2.11	678.4^{f}	1.95
Oct. 25	807.0^{b}	1.14	811.1^{b}	1.04	722.3^{c}	1.57
Mar-Nov. ADG		1.63^{a}		1.64^{a}		1.26^{b}
Nov. 22	827.2^{e}	0.72	824.6^{e}	0.48	738.2^{f}	0.57
Dec. 20	829.8^{bc}	0.09^{e}	859.4^{b}	1.24^{f}	776.0^{c}	1.35^{f}
Jan. 17	(4)858.6	0.01	(5)884.9	0.84	(4)791.8	0.50
Feb. 14	878.b^{b}	0.71^{e}	847.6^{b}	-1.33^{f}	759.3^{c}	-1.16^{f}
Mar. 14	(2)901.0^{bc}	1.60^{e}	(5)946.1^{b}	3.61^{f}	(4)825.7^{c}	2.55^{e}
Trial Avg. ADG	-----	1.26^{bc}	-----	1.39^{b}	-----	1.06^{c}
Rounds of Beef per Acre	527.3		564.6		464.5	

[a]All data were analyzed with initial weight held constant; numbers of cattle per treatment are in parentheses; 4 acres for each pasture species.

[bcd]Averages with different superscripts were significantly different ($P < .05$)

[efg]Averages with different superscripts were significantly different ($P < .01$)

Table 4. Average Weights and Daily Gains (lbs., ADG) of Steers on Transvala, Stargrass and Bigalta Pastures[a]

Item	Transvala		Stargrass		Bigalta	
	Wt.	ADG	Wt.	ADG	Wt.	ADG
Mar. 14	(2)616.0		(6)623.7		(5)613.8	
Apr. 11	715.9[d]	3.48[d]	730.6[d]	4.00[d]	674.5[e]	1.99[e]
May 9	746.8[d]	1.10	762.5[d]	1.14	698.1[e]	0.84
June 6	783.9[b]	1.32[b]	767.0[b]	0.16[c]	736.3[c]	1.36[b]
July 4	833.4	1.77	824.6	2.07	800.8	2.30
Trial Avg. ADG		1.92		1.84		1.63

[a]All data were analyzed with initial weight held constant; numbers of cattle per treatment are in parentheses.

[bc]Averages with different superscripts were significantly different ($P < .05$).

[de]Averages with different superscripts were significantly different ($P < .01$)

The period of lowest average daily gains for all three treatments was during November, December, January and most of February, as might be expected from the amount of monthly or seasonal rainfall. The low weight gain of heifers grazing Transvala would have been expected from the relatively low dry matter yield and the percent dry matter digestibility, particularly in January-February. The low gain in Transvala occurred although crude protein percent during this period ranges from 10.98 to 12.69%: indicating that crude protein content of the forage was not the nutritional factor limiting growth. The reasons for the decrease in gains from the stargrass and bigalta pastures are not readily apparent.

Although dry matter digestibility of stargrass decreased during the period of low cattle gains, the decrease was near the end (January-February) of the period.

During this same period, the lowest dry matter yield from bigalta was noted. Regardless of the reasons for decreased forage production, these results indicate that acceptable weight gains cannot be maintained in growing-finishing cattle during November through February without additional supplement (high-quality hay or grain).

Pounds of Live Beef Produced Per Acre--In the heifer trial, the pounds of beef produced during the 12-month period averaged 527.3, 564.6 and 464.5 pounds per acre for the Transvala, stargrass and bigalta pastures, respectively (Table 3). This was calculated from the weight gains of cattle which remained on the pastures the entire trial and does not include the cattle which were added to the pastures when there appeared to be excess forage available (put-and-take or pool animals). However, crediting the pastures for the pool animals would not have added a significant amount to the above estimates, since few pool animals were added.

Since average daily gains were generally adequate through the October 25 weigh day, the amount of beef produced per acre from March 15, 1976, through October 25, 1976, was calculated, and averaged 456.4, 459.2 and 352.8 pounds for the Transvala, stargrass and bigalta pastures, respectively.

Therefore, 86.6, 81.3 and 76% of the beef produced per year from Transvala, stargrass and bigalta pastures, respectively, were produced during 61.5% of the year (from March 15 to October 25). This emphasizes the necessity of supplementing the pasture during the November-February period, or timing the growing-finishing phases so that the cattle reach slaughter weights and condition before the end of October. An additional feasible alternative would be to have available sufficient acreage of a crop such as alfalfa, which could be used for additional grazing of finishing cattle after late October. Probably the best use of the grass pastures used in this trial in the November-February period would be to maintain mature, non-lactating cows.

It should be emphasized that the above per acre production estimates were based on performance of heifers rather than steers. The steers in the steer trial gained 20% more rapidly than did the heifers, which is in agreement with results of other studies. Therefore, 20% more live beef per acre should be obtained with steers or 633, 677, 557 pounds for Transvala, stargrass, and bigalta pastures, respectively.

Animal Units Maintained--The animal units maintained on each pasture for each 28-day period during the heifer and steer trials are presented in Table 5. Naturally, the calculation of animal units does not directly consider the individual animal performance obtained from the different pastures, and has the most usefulness in estimating the number of various types of livestock (i.e., mature cows or ewes) that could be maintained. The averages for animal units maintained on 4 acres in the heifer trials were 3.73, 4.62, and 4.82 for Transvala, stargrass and bigalta pastures, respectively.

In the steer trial, the carrying capacity of Transvala on 4 acres was even less desirable, averaging 2.35 per 28-day period. If a more similar level of performance was desired, the number of animal units maintained on each pasture would have to be reduced by at least one-half, resulting in an average for the November-February period of about 2.5 animal units per 4 acres of stargrass or bigalta pasture. This would result in a per acre average carrying capacity of approximately 0.92 animal units per acre.

Economic Feasibility--The total annual approximate pasture maintenance and amortized establishment cost per acre for grass pastures is estimated to be $257. The stargrass pasture produced an average of 677 pounds of live steer gain per year for a value of $373 (at 55¢ per pound of gain). Therefore, a farmer buying weaned calves and finishing them on grass pastures similar to those used in this study would have a return of $116 per head after paying for the annual pasture costs. This does not include veterinary costs, supplies, interest on the cattle, depreciation, repairs, interest on equipment, or labor and management costs.

SUMMARY:

Growing-finishing yearling Santa Gertrudis steers and heifers were used in a grazing trial to compare the performance of Transvala, stargrass and bigalta pastures. The pastures were evaluated under grazing conditions for yield, forage quality, seasonal carrying capacity and cattle performance.

Annual dry matter production per acre was 6.37, 9.88 and 10.4 tons ($P < .05$) for Transvala, stargrass and bigalta, respectively. The average percent digestibility of the dry matter was highest for bigalta (56%) and similar for Transvala (50%) and stargrass (50.8%), resulting in 6,575, 9,991 and 11,571 pounds of digestible dry matter produced per acre for Transvala, stargrass and bigalta, respectively. The average percent crude protein during the entire trial was highest for Transvala (10.34%) and stargrass (8.91%) and lowest for bigalta (6.5%). Stargrass yielded the greatest pounds of crude protein per acre per year (1,819) followed by Transvala (1,318) and bigalta (1,314). The percent crude protein in bigalta during the period from March 15, 1976 to August 30, 1976 was less than the NRC recommendations for growing-finishing steers and heifers and borderline or less for mature, non-lactating beef cows.

Performance and carrying capacity of both heifers and steers followed the trends that would be expected from the agronomic data.

Table 5. Animal Units Carried on Four Acres of Transvala Stargrass and Bigalta Pastures.

Item	Transvala Stargrass	Bigalta
	Heifer Trial	
Mar. 15	3.25	3.25
Apr. 12	3.25	3.40
May 10	3.25	3.40
June 7	3.85	3.55
July 5	4.00	5.30
Aug. 2	4.00	5.45
Aug. 30	4.00	5.45
Sept. 27	4.00	5.45
Oct. 25	4.00	5.65
Nov. 22	4.00	5.80
Dec. 20	4.65	6.00
Jan. 17	4.00	4.80
Feb. 14	4.00	5.00
Mar. 14	2.00	5.00
Avg., 28-day period	3.73	4.82
	Steer Trial	
Mar. 14	1.30	3.90
Apr. 11	1.30	3.90
May 9	1.30	3.90
June 6	3.85	5.50
July 4	4.00	6.25
Avg., 28-day period	2.35	4.69

The average annual carrying capacity was highest for stargrass and bigalta. In practically all cases, there were few significant differences noted between average weights of both steers and heifers on Transvala and stargrass pastures, although average weights of cattle grazing bigalta were less than cattle grazing the other two treatments. Based on these limited observations it is apparent that when forage yield and quality, and animal performance and carrying capacity are considered, stargrass out-performed both Transvala and bigalta under these conditions.