MANAGEMENT AND UTILIZATION OF COMPLEMENTARY FORAGES: STARGRASS

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INTRODUCTION

Stargrass (*Cynodon* spp.), a member of the bermudagrass family, is also known as giant stargrass and African stargrass. The most notable cultivars in Florida are Ona, McCaleb, Florico and Florona stargrass. Stargrass is a warm season perennial, that grows vigorously and spreads rapidly after planting, provided adequate moisture and fertility is available. When planted in areas where little competition exists, runners 15 to 20 ft long can develop in 40 to 50 days. With proper management these grasses produce dense stands in a short time after planting with good yields of quality forage. Most stargrasses have the capability to continue producing forage into late November and early December in south Florida, when properly fertilized. However, top growth is easily killed by frost, followed by a rapid decline in forage quality. Animal performance for many stargrasses has been excellent, producing live weight gains/animal more than double that of bahiagrass. However, large differences in persistence and in vitro organic matter digestion (IVOMD) exist between stargrasses. The persistence of both Florico and Florona has been superior to most stargrasses, with the persistence of Florona being far superior to any stargrass tested at Ona (Table 1). Crude protein (CP) levels of stargrass cultivars have been quite similar. Quality of stargrass hay when harvested at the proper stage of maturity (4 to 5 wk) is very good.

One of the most important factors when developing a stargrass forage program to be used in a grazing or hay system is management. The performance of a grass on a specific soil, seed bed preparation, method of establishment, fertility program, annual forage production cycle, grazing management, forage quality, advantages and disadvantages are management factors that need to be considered. The following discussion will address many of these factors.

GROWING CONDITIONS

Region of Adaptation Stargrasses are well adapted to many soil types. They prefer moist, well-drained soils ranging from sands to clays. However, stargrasses will tolerate short (3-5 days) periods of soil surface water, and perform well under these conditions. However, they will not tolerate long periods of flooding. The tropical nature of these stargrasses limits their productivity and persistence to the southern two-thirds of peninsular Florida or where temperatures do not drop below 25°F.

Season of Growth Stargrasses, like bermudagrasses, grow during the warm season, but will continue to make excellent growth under cool conditions. When adequate fertility is provided, these grasses can initiate early spring growth under limited moisture conditions, with Florona exhibiting considerable drought tolerance. However, once stargrasses are frosted, all desirable forage must be consumed within one week, since forage quality drops rapidly.

CULTURAL PRACTICES

Establishment Stargrasses are established vegetatively from stolons (runners) or stem pieces. When placed in a moist, firm seedbed, nodes germinate in 5 to 10 days.

Stargrass is planted by distributing freshly cut planting material on clean (free of common bermudagrass and all other vegetation) moist cultivated soil, covered by disking 2 to 4" deep or crimping stem pieces 4" deep, followed by an extremely firm packing. Fresh planting material must be covered with soil or crimped into the soil immediately after distribution to prevent drying on the soil surface. Planting material must be uniformly distributed over the seedbed, with areas no larger than 3 ft^2 void of planting material.

Approximately 7-10 days after planting and signs of stargrass vegetative growth appear, the newly planted area should be sprayed with 1.0 lb/A Weedmaster® in 20 to 30 gal/A of water to help control annual sedges (watergrass) and broadleaf weeds. When new tillers (shoots) are about 1 to 3" tall, the newly planted stargrass should be fertilized with 35-35-35 lb/A N-P_2O_5-K_2O, respectively + 10 lb/A of a micronutrient mix equivalent to IPI 303.[1]

A second application of fertilizer (30-50 lb/A N) should be applied when plants are 8 to 10" tall. This should be sufficient to provide a dense stand of grass 24 to 30" tall within 60 to 90 days after planting.

Recommended fertilizer practices for established stargrass should follow soil test results or 200-50-100 lb/A N-P_2O_5-K_2O. Nitrogen should be applied in three or four applications. A pH of 5.5 to 6.0 is adequate for stargrass.

Weeds Broadleaf weeds such as dog fennel (*Eupatorium capillifolium*), Carolina geranium (*Geranium carolinianum*), pepperweed (*Lepidium virginicum*) etc. are easily controlled by applying 1.0 lb/A Weedmaster® when plants are 6 in. tall or less and 1.5 lb/A when dog fennel is taller than 6 in. Apply herbicides in 20 to 30 gal/A water.

Insects Insect problems on stargrasses are generally limited to the striped grass looper (*Mocis latipes*) and fall armyworm (*Spodoptera frugiperda*). Both insects will feed on stargrass and can destroy the entire crop if not controlled (Figure 1).

The two-lined spittlebug (*Prosapia bicincla*) has been found on stargrass but does not appear to cause any serious damage. However, if signs of spittlebug are evident, burning the previous years stubble during the dry season is one of the best control measures.

Disease A 'leafblight' disease (*Rhizoctonia solani*) has been found occasionally on most stargrass entries in grazing studies during August and September at Ona. Grazing stargrass under a continuous system to a 6 to 10 in. stubble, or under a rotational system with a 4-wk grazing interval, revealed no foliar blight. The incidence of blight seemed to be associated with dense stands of tall, uncut, ungrazed forage and tended to disappear after October 15. Cattle consumed infected plants relatively well with no signs of rejection. Since this disease appears very infrequently it is not of economic importance. No other diseases of significance have been noted on stargrass.

Hydrocyanic Acid Potential (HCN-p) Many stargrass cultivars (Florico, Florona, McCaleb, and Ona) have been reported to contain substantial amounts of hydrocyanic acid potential, also known as prussic acid (Caro-Costas et al., 1972; Mislevy et al., 1981; Rodel, 1972). This chemical is also a concern in the use of sorghums as forage for grazing where seasonal variations and stress conditions have created hazardous levels. However, cattle have grazed stargrass at the AREC, Ona in all seasons since 1972 with no adverse effect. Similar favorable results were reported from Puerto Rico by Vincente-Chandler et al., (1974) where a stargrass with high HCN-p

[1]IPI 303 contains the following elemental content: Iron, 18%; Zinc, 7%; Manganese, 7.5%; Copper, 3%; and Boron, 3%.

assay has been grazed on extensive areas. Large-scale or experimental use over a 20 yr period has not revealed any HCN problems with stargrass at the AREC, Ona. The following pasture practices will help keep HCN-p content at a normal level: 1) limit N fertilization to about 60 lb/A N per application for grazing; 2) delay grazing for 2 to 3 wk after N fertilization; and 3) do not turn excessively hungry animals onto lush pasture, especially if cattle are not accustomed to stargrass. These procedures have no bearing on grass harvested as hay or silage since HCN-p content of dried forage or silage is low.

MANAGEMENT AND UTILIZATION

Clipping and grazing studies have demonstrated that stargrasses should be allowed a rest period of four to five weeks between grazing or clipping. This rest period can be extended by one or two weeks during periods of slow vegetative growth, such as cool or dry conditions. The above management variables result in excellent persistence and high dry matter yields (Table 2), with good CP (Table 3) and in vitro digestion (Table 4). If the average rest period is shortened, forage quality increases, but persistence of the stand decreases. If the rest period is increased to 7+ weeks, persistence is improved, but CP (7-8%) and in vitro digestion (42 to 53%) are relatively low. Research has shown that the in vitro digestion is variable between stargrass cultivars harvested at the same physiological stage. Florico stargrass tends to average about 2 to 3 percentage units higher than Florona, Ona or McCaleb stargrass.

The stubble height of most stargrasses should be maintained at 6 to 10 in. for best persistence. However, since plant height above the stubble has a major effect on forage yield and quality, plants should be grazed when plant height above the stubble ranges between 6 and 18 in. Research has shown that stubble height is also important on root development of stargrass. Studies have demonstrated root dry matter yield was reduced by 97% compared with the unharvested check when plants were repeatedly harvested back to a 2 in. stubble after attaining 6 in. of top growth above the stubble.

Grazing studies with stargrasses at the AREC, Ona, produced a 3 yr average daily gain (ADG) of 1.1 lb and 663 lb/A live weight gain (LWG) on Florico stargrass and 0.92 ADG and 585 lb/A LWG on Florona stargrass (Table 5). Both grasses were stocked at 3.0 yearling steers/A over a 200-day summer period.

Stargrass-Bermudagrass Pasture Rotation (1 wk vs 2 wk) A three year study was conducted on stargrass and bermudagrass to compare a one and two wk cattle rotation on LWG and ADG. Cattle that were rotated weekly were on a 5 pasture rotation and those cattle rotated every 2 wk were on a 3 pasture rotation. Both rotation treatments were allowed a 4-wk regrowth period between grazings. Results indicate the stargrasses (Florico and Florona) (586 lb/A) produced 61% more LWG/A than the bermudagrasses (Callie hybrid and Brazos) (365 lb/A) (Table 6). The average gain for the stargrasses (0.80 lb/day) was also 11% higher than for the bermudagrasses (0.72 lb/day). Rotating cattle on a weekly schedule almost always resulted in higher LWG/A and ADG for both stargrasses and bermudagrasses. Florico (650 lb/A) and Florona (580 lb/A) produced 14% and 6% higher LWG, respectively when cattle were rotated on a weekly basis compared with every other wk (Table 6). Brazos bermudagrass showed the greatest response to a weekly cattle rotation, by producing 18% and 27% higher LWG/A and ADG, respectively when compared with rotating cattle every 2 wk.

Stargrass tends to consistently produce more than 50% higher LWG when compared with bermudagrass (Table 6) and bahiagrass (Mislevy and Adjei, 1980). Possible reasons for

higher animal performance when grazing stargrass compared with bahiagrass are higher DM yields, CP and IVOMD from stargrasses (Figures 3, 4, and 5). Stargrasses consistently average about 0.2 t/A higher DM yield than bahiagrass each month throughout the warm season. Stargrasses also produce 2 to 3 times more forage than bahiagrass from October through December (Figure 2).

Crude protein levels of stargrass and bahiagrass were similar, with the greatest difference coming in April and during the summer (June through July) (Figure 4). Crude protein values during this time of the season range from 1.2 to 3.0 percentage units higher for stargrass.

In vitro organic matter digestion was consistently higher for stargrass, throughout the entire growing season. Average IVOMD for stargrass harvested every 4 wk was 62% compared with 58% for bahiagrass (Figure 5). These data represent a 4 percentage unit increase for stargrass throughout the season over bahiagrass.

These data indicate high DM yield, CP, and IVOMD for stargrass throughout the warm season or from October through December could provide high quality feed for replacement heifers and weaned calves.

SUMMARY

Advantages of Stargrass

1) Rapid establishment from vegetative cuttings.
2) Dry matter yields of stargrasses adapted to a specific location are excellent.
3) Palatable and high forage quality when harvested or grazed at four to five week intervals.
4) Large differences exist between persistence and digestibility of stargrass cultivars. Florona stargrass is extremely persistent when properly managed. Florico is one of the higher digestible stargrasses.
5) Stargrasses make excellent growth under cool conditions provided plants have adequate moisture and fertility.
6) Stargrasses tend to produce more forage under drought conditions than Pangolagrass.
7) Grazing studies at Ona during the warm season have yielded daily gains of 0.92 to 1.1 lb and 585 to 663 lb/A LWG at a stocking rate of 3.0 yearling steers/A.
8) Live weight gains from stargrasses averaged 61% higher when compared with bermudagrass.
9) Rotating cattle weekly, compared to every other wk, resulted in almost always higher LWG and ADG for both stargrass and bermudagrass. Florico and Brazos averaged 14 and 18% increase, respectively.
10) Hay cures rapidly during favorable weather conditions.

Disadvantages of Stargrass

1) Forage quality drops rapidly after six to seven weeks of regrowth with considerable rejection by cattle.
2) Should not be grown where temperature intrusions drop below 25°F.
3) Requires higher fertility program than bahiagrass, hemarthria and pangolagrass under Florida conditions.
4) Vegetatively propagated from stem cuttings.
5) Top growth easily killed by frost followed by rapid decline in forage quality.
6) Most stargrasses contain high HCN-p following heavy nitrogen (100 lb N/A) fertilization, any time during the growing season.

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Table 1. Ground Cover Occupied by Common Bermudagrass in Stands of Stargrass After 3 Years Of Grazing

Stargrass Entry	Initial Common Bermudagrass Cover	Grazing Frequency (wk), %		
		2	3	5
Florico	0.3	8.0 ab[a]	3.8 ab	0.8 a
McCaleb	12.0	32.0 c	14.3 a-c	12.5 a
Costa Rica	0.1	9.3 ab	10.5 ab	6.5 a
Florona	0.1	2.8 ab	1.0 a	0.8 a
Sumner	0.3	10.8 ab	25.0 bc	10.8 a
Ona	3.4	16.0 a-c	21.5 a-c	8.3 a
Sarasota	6.2	12.8 a-c	6.5 ab	4.0 a

[a]Means within a column followed by the same letter(s) are not significantly different at the 0.05 level according to Duncan's multiple range test.

Table 2. Dry-Matter Yields of Subtropical Grasses Grazed at Five Frequencies, 1976-1978

Common Name	Grazing frequency (wks) t/A/Year				
	2	**3**	**4**	**5**	**7**
Florico stargrass	3.4 de[a]	4.3 cd	4.8 ab	6.6 bc	9.1 a
McCaleb stargrass	3.9 b-d	4.7 b-d	4.2 b-d	5.7 de	8.0 b-d
Costa Rica stargrass	3.9 b-d	4.8 b-d	4.7 ab	6.0 c-e	8.5 a-c
Florona stargrass	4.5 a-c	5.4 ab	5.1 ab	6.6 bc	8.9 a
Sumner stargrass	4.4 a-c	5.6 ab	5.0 ab	6.3 b-d	8.6 ab
Ona stargrass	4.4 a-c	4.9 b-d	3.8 cd	6.7 bc	7.6 cd
Sarasota stargrass	4.6 ab	5.9 a	5.0 ab	7.2 ab	9.0 a
Callie bermudagrass	3.6 c-e	4.9 b-d	4.7 ab	6.4 b-d	7.8 b-d
Alicia bermudagrass	5.2 a	5.5 ab	5.5 a	7.2 ab	8.6 ab
Pangola digitgrass	2.2 f	2.2 f	2.7 ef	3.1 g	5.8 e
Transvala digitgrass	2.5 f	3.2 e	2.2 f	4.7 f	6.4 e
Pensacola bahiagrass	4.5 a-c	4.1 d	3.5 de	4.4 f	4.7 f

[a]Means within a column followed by the same letter(s) are not different at the 0.05 level of probability according to Duncan's multiple range test.

Source: Modified from Mislevy et al., 1983.

Table 3. Effect of Grass Entry and Grazing Frequency on Percentage Crude Protein of June-Harvested Forage, Averaged Over 2 Years

Entry	Grazing Frequency (Wks), %					Avg.
	2	**3**	**4**	**5**	**7**	
Cynodon spp. (stargrass)			13 ab			
Florico	18 a[a]	16 a	12 a-d	12 a-c	8 a	13
McCaleb	17 ab	13 cd	12 a-d	11 b-d	8 a	12
Costa Rica	17 ab	15 ab	12 a-d	11 b-d	8 a	13
Florona	16 b-f	14 a-c	12 a-d	11 b-d	8 a	12
Sumner	15 c-h	15 ab	13 ab	11 b-d	9 a	12
Ona	17 ab	14 a-c	12 a-d	11 b-d	8 a	13
Sarasota	14 f-h	14 a-c	12	10 cd	8 a	12
Avg.	16	14		11	8	12
(bermudagrass)				11 b-d		
Callie	18 a	14 a-c	12 a-d	10 cd	8 a	13
Alicia	16 b-f	15 ab	14 a	11	7 a	12
Avg.	17	15	13		8	13
Digitaria spp.			11 b-e	13 ab		
Pangola	15 c-h	15 ab	10 c-e	13 ab	8 a	12
Transvala	14 f-h	15 ab	11	13	7 a	12
Avg.	15	15			8	12
Paspalum sp.						
Pensacola	14 f-h	13 cd	11 b-e	10 cd	7 a	11

[a]Means within a column followed by the same letter(s) are not significantly different at the 0.05 level of probability according to Duncan's multiple range test.

Source: Mislevy et al., 1982.

Table 4. Effect of Grass Entry and Grazing Frequency on in Vitro Organic Matter Digestion of June-Harvested Forage, Averaged Over 2 Years

Entry	Grazing Frequency (Wks), %					Avg.
	2	**3**	**4**	**5**	**7**	
Cynodon spp. (stargrass)						
Florico	68 a[a]	67 ab	60 a	59 ab	53 a	61
McCaleb	61 f	61 c-f	55 cd	54 cd	46 c-e	55
Costa Rica	63 c-f	64 bc	55 cd	53 cd	46 c-e	56
Florona	62 d-f	59 e-g	51 ef	51 de	44 ef	53
Sumner	60 fg	62 c-e	57 a-c	53 cd	47 c-e	56
Ona	64 b-e	61 c-f	55 cd	52 de	45 d-f	55
Sarasota	56 h	56 g	51 ef	46 f	42 f	50
Avg.	62	61	55	53	46	55
(bermudagrass)			55 cd	55 cd		
Callie	65 a-c	62 c-e	49 f	41 g	47 c-e	57
Alicia	53 i	53 h	52	48	36 g	46
Avg.	59	58			42	52
Digitaria spp.	68 a					61
Pangola	67 ab	68 a	59 ab	60 ab	53 a	60
Transvala	68	66 a	56 bc	61 a	52 ab	61
Avg.		67	58	61	53	
Paspalum sp.			52 de			
Pensacola	57 gh	57 g		52 de	47 c-e	53

[a]Means within a column followed by the same letter(s) are not significantly different at the 0.05 level of probability according to Duncan's multiple range test.

Source: Mislevy et al., 1982.

Table 5. Seasonal Steer Average Daily Gain (ADG) and Live Weight Gain (LWG) per Acre of Callie Hybrid 35-3 Bermudagrass (CH), Florico (FC) and Florona (FO) Stargrass Pastures in 1986, 1987 and 1988

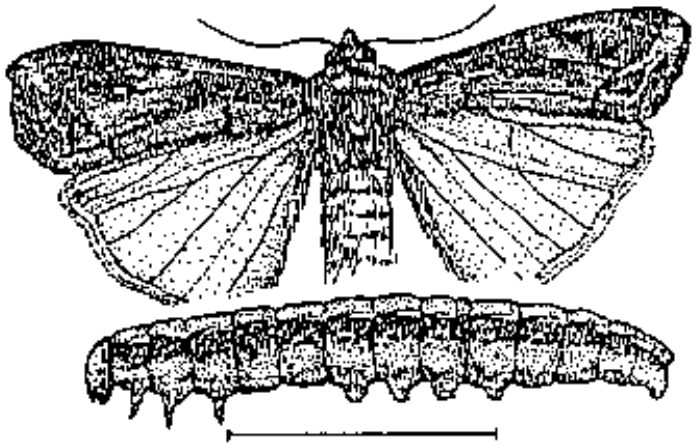
Year	ADG, lb			LWG, lb/A		
	CH	FC	FO	CH	FC	FO
1986	0.66 b[a]	1.06 a	0.81 b	398 c	640 a	521 b
1987	1.06 b	1.36 a	1.08 b	539 c	821 a	670 b
1988	0.77 b	0.95 a	0.90 a	388 b	528 a	565 a
Mean	0.84 b	1.12 a	0.92 b	442 b	663 a	585 a

[a]Means between grasses for each year followed by the same letter(s) do not differ significantly at the 0.05 level of probability according to Duncan's multiple range test.

Table 6. Comparison of Weekly and Biweekly Cattle Rotation on Live Weight Gain and Average Daily Gain for Stargrass and Bermudagrass (1988-1990)[a]

	Live Weight Gain Rotation (wk)				Average Daily Gain Rotation (wk)			
	2	1	2	1	2	1	2	1
	lb/A		% Change		lb/day		% Change	
Stargrass								
Florico	570	650		14	0.81	0.90		11
Florona	545	580		6	0.73	0.77		6
Bermudagrass								
Callie hybrid	360	380		5	0.59	0.62		5
Brazos[b]	330	390		18	0.73	0.93		27

[a]All grasses had a 4 wk rest period
[b]AVerage of 2 yr.



FALL ARMYWORM

GRASS LOOPER

Figure 1. Comparison of larva from grass looper (*Mocis latipes*) and fall armyworm (*Spodoptera frugiperda*). Note that grass looper has two pairs of prolegs and armyworm has four pairs of prolegs.

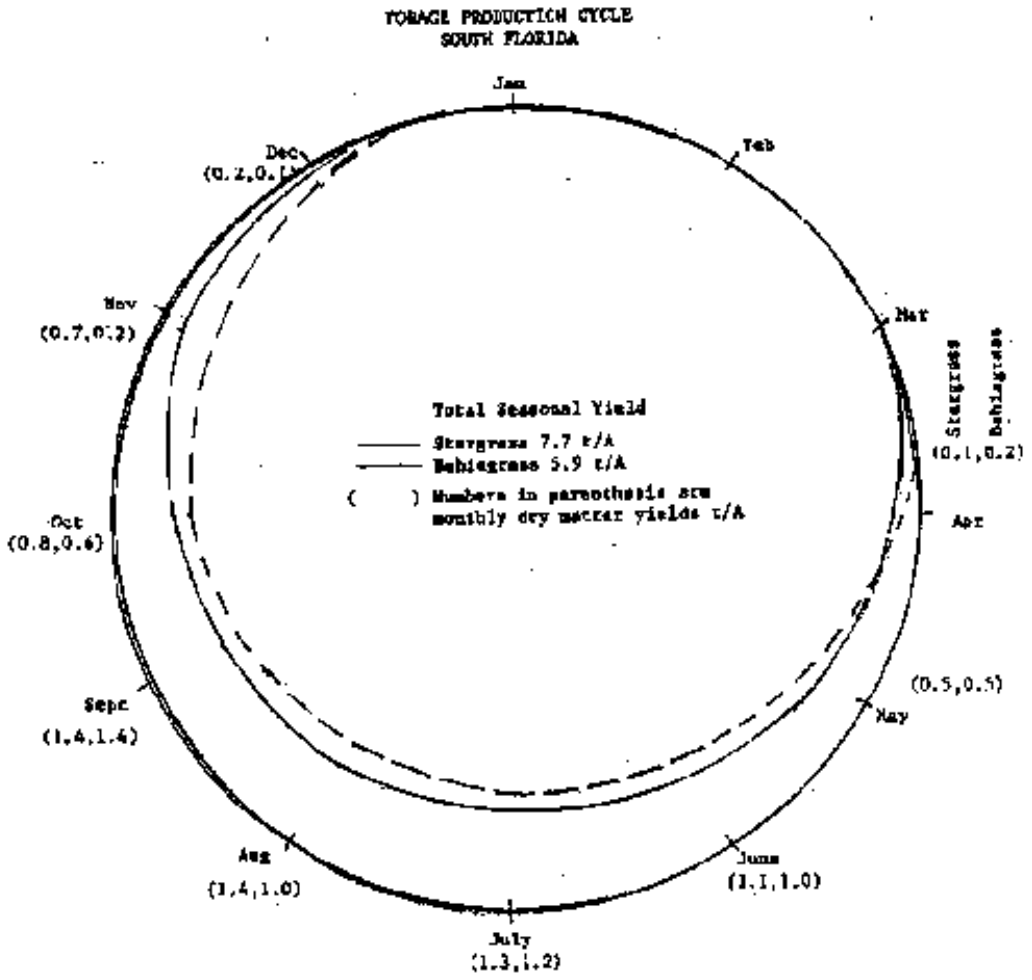


Figure 2. Dry matter forage production during the warm season for stargrasses and bahiagrass in south Florida.

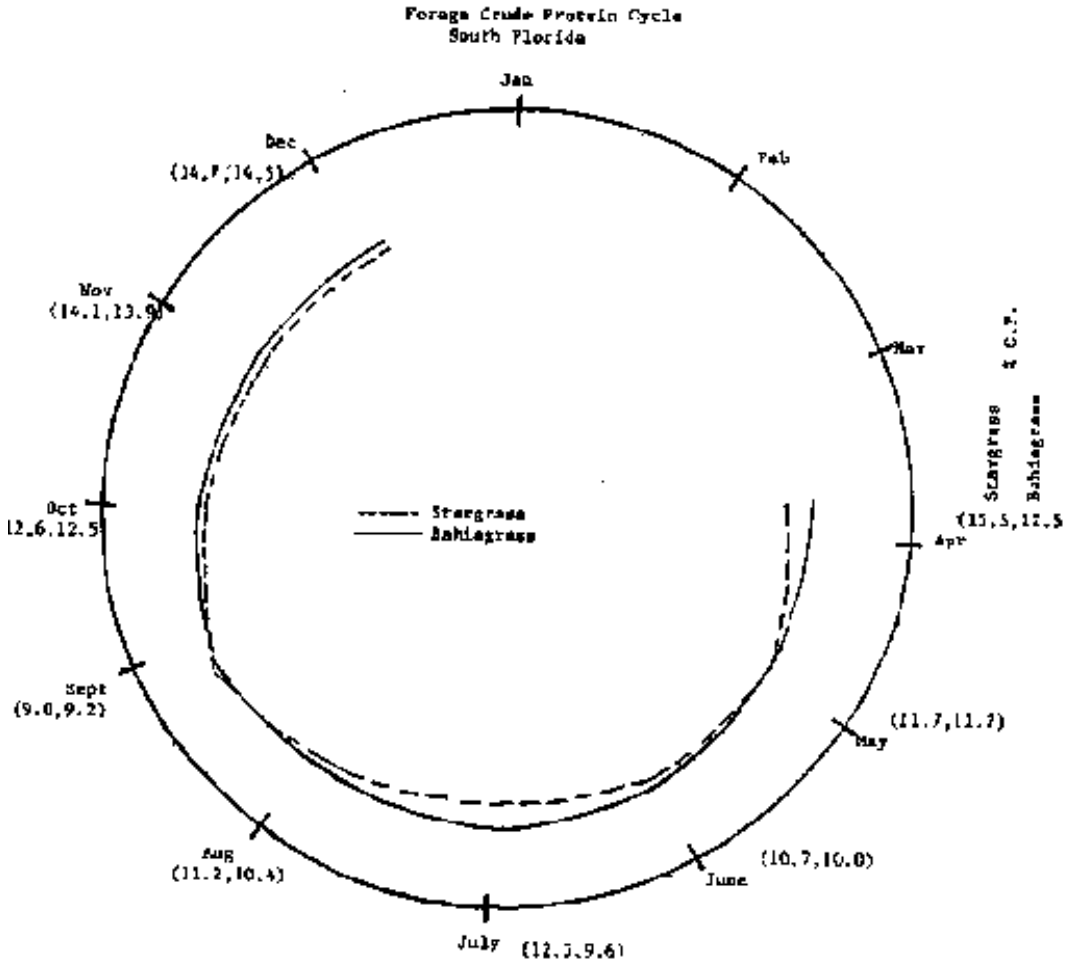


Figure 3. Percentage crude protein for stargrasses and bahiagrass during the warm season in south Florida.

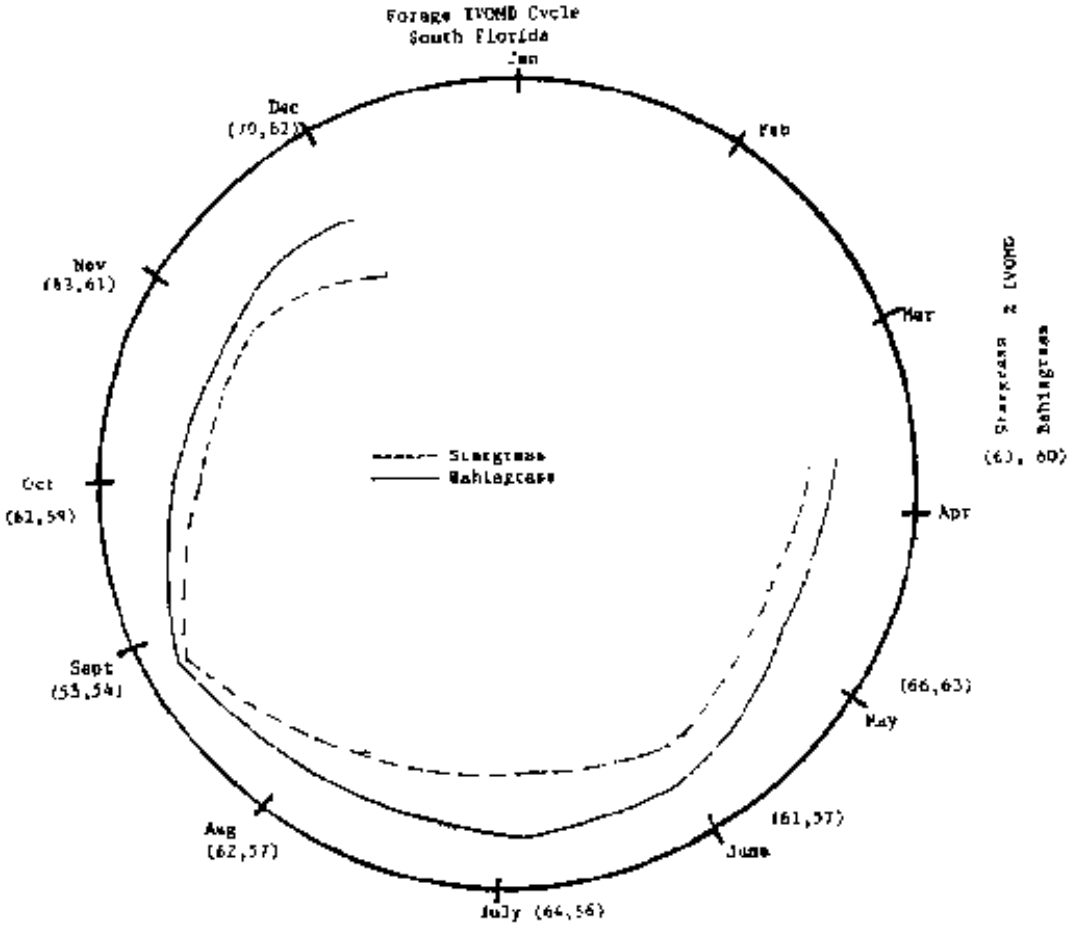


Figure 4. Percentage in vitro organic matter digestion (IVOMD) for stargrasses and bahiagrass during the warm season in south Florida.