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Bahiagrass Seed Production in Peninsular Florida[1]

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Introduction

Bahiagrass (*Paspalum notatum)* is the most widely grown warm-season perennial grass in Florida. There are approximately 2.7 million acres of bahiagrass which represent more than 70% of improved permanent pastures in Florida. Its popularity stems from the fact that it is easily established from seed in a wide range of soil fertility and drainage conditions, and is persistent under low fertility and poor grazing management.

Current Production Practices

Most seedsmen in Florida operate their business on a share-harvest basis. Companies provide for harvesting, hauling, cleaning, storage, and sale of seed. Actual seed production is undertaken by cattlemen to generate secondary income, especially in years when beef prices are low. Typical management of bahiagrass pasture for seed includes fertilization with N in early spring (February to March) followed by grazing until June or the first sign of inflorescence. Cattle are then withdrawn to allow inflorescence development and seed harvest. Three major problems of this production system are: (1) when pastures are more than 3-yr old they often experience reduction in seed yield; (2) Vacating pastures in June or at the first sign of inflorescence may not be the best timing for good seed yield or quality; (3) pasture fertilization in February or March, although a good practice for obtaining spring forage for grazing, does not coincide with optimum day length for seedhead production.

The purpose of this publication is to indicate which cultural practices lead to improved bahiagrass seed yield and quality.

Cultural Practices for Overcoming Sod-Bound Pasture

When a large amount of residue is carried over from the previous season, flowering may be inhibited and, hence, seed production on bahiagrass pastures may decline. Initial studies conducted in1985 on pastures that were more than 7-yr old showed no statistical difference in seed yield between close grazing pasture from late fall to spring and burning the sod in spring (Table 1). However, seed production declined when old pasture was roller chopped because it allowed competition from re-seeding legumes such as aeschynomene and from weeds. The application of giberellic acid to a sod-bound bahiagrass pasture did not improve seed yield either. In 1986, Pensacola seed yield was depressed on all treatments, except under burning, by heavy summer (June & July) rains (11.7" in 1985 vs.

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20.2" in 1986). Burning delayed seed production and provided an escape mechanism from saturated soil condition. Argentine is late flowering so seed production was not adversely affected by excessive June and July rains in 1986. Pensacola bahiagrass seed yield responded only to N application, but Argentine seed yield responded to both N and P applications (Figure 1). Soil test recommendation for that trial was 67-115-75 lb/A N-P_2O_5-K_2O.

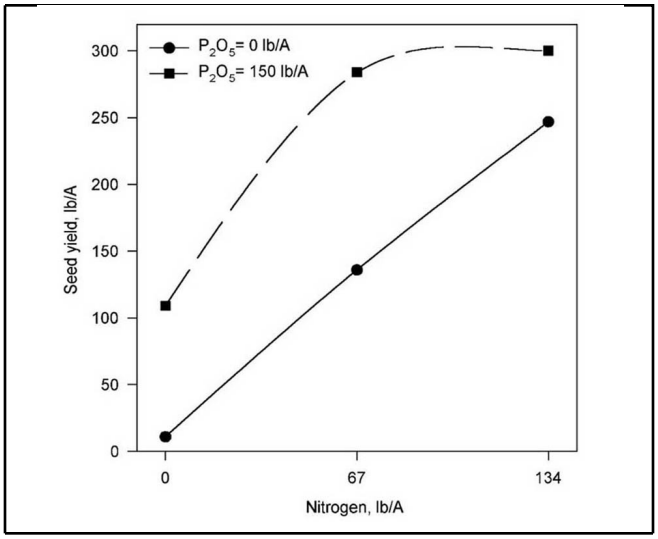

Figure 1. Argentine Bahiagrass seed yield averaged over 1985 and 1986 as affected by N and P fertilizer application.

Timing of Residue Removal, Cattle Withdrawal and Nitrogen Fertilization

The research in1985 and 1986 on residue removal for seed production was done once during the spring. In order to determine the most suitable time in the growing season to remove residue and fertilize pasture, further research was conducted between 1987 and 1990. The outcome showed a difference between Pensacola and Argentine bahiagrasses regarding the best time for withdrawing cattle and applying N to pasture to initiate seed production.

Pensacola bahiagrass

An experiment was conducted on a 7-yr old Pensacola bahiagrass pasture in 1987 and 1988. Sections of residue from the previous year were removed at five periods: (*i*) dormancy in early-March, (*ii)* early vegetative stage in mid-April, *(iii)*, first inflorescence visible in early-June, (*iv)* 2-wk after first inflorescence visible in mid-June, and *(v)* 4 wk after first inflorescence visible in late-June. Residue was removed by two methods burning vs. mowing to 3 inches to simulate close grazing. Immediately following each residue removal, N was applied at 0, 45 or 90 lb N/A. Plots were rested after treatment. Seed was harvested by hand when ripe which occurred between mid-July and early-September, depending on treatment.

Seed Yield

Pensacola seed yield was highest (300 to 700 lb/A) when residue was removed at the dormant or early-vegetative stages of maturity compared with residue removal after inflorescence appearance (Table 2). The 2-yr mean seed production across fertilizer treatments when residue was removed at the first inflorescence appearance was 150 lb/A (Table 2). Pensacola seed yield progressively declined the longer the delay of residue removal after inflorescence (Table 2) as expressed by both reductions in inflorescence density (Table 3) and seed size (Table 4).

Method of residue removal (burned vs. mowed) did not affect the overall seed yield of Pensacola bahiagrass (Table 2). This means that both methods will give good seed yield if applied at the proper time. When 45 lb/A of N was applied to pasture at either the dormant or early vegetative stage, seed yield was increased by about 70% (325 vs.556 lb/A, Table 5) and inflorescence density by 60% (data not shown)) over the no fertilization treatment. Increasing the N application rate to 90 lb/A following residue removal at the dormant stage of development increased seed yield by an additional 30%. However, the 90 lb N/A application following residue removal at the vegetative stage gave no additional benefit to seed yield. Therefore, 50 to 100 lb N/A is adequate for Pensacola bahiagrass seed yield, depending on when pasture is deferred for seed production.

Seed Germination

Observations in the field indicated that Pensacola seed development after flowering was severely inhibited by wet soil conditions that occurred in summer. When residue removal was delayed until the first inflorescence appearance, reproductive tiller development, flowering and seed development coincided with wet summer conditions. This resulted in premature seed ripening, empty caryopses, reduced seed size, low seed yield, and poor seed quality. Consequently, average total seed germination declined from 58% for residue removal at dormancy or early vegetative stage to 17% when residue removal was delayed till the first inflorescence appearance stage of plant development. Residue removal by burning or mowing and N fertilization did not affect seed quality.

For best yield and quality of Pensacola bahiagrass seed, producers in peninsular Florida should withdraw cattle from pasture after close grazing by 15 April (i.e. early-vegetative stage of plant development) and immediately fertilize with 50 lb N/A.

Argentine bahiagrass

A similar study was carried out in 1989 and 1990 on a 10-yr old Argentine bahiagrass pasture to determine the optimum time of the growing season to remove cattle and apply fertilizer. A set of 3 paddocks was grazed from October to February each year compared with a set that was not grazed (ungrazed). In late-February, late-March, late-April and late-May, portions of residue in both grazed and ungrazed paddocks were burned or mowed. Three rates of N (0, 90 and 180 lb/A) were applied immediately after residue removal. Inflorescence density at harvest and seed yield were measured in 1989 and 1990. Seed germination was only determined in 1989.

Seed Yield

Grazing from October to February or method of residue removal (burned vs. mowed) did not affect seed production or quality in 1989. However, burning in late-May increased seed yield from 70 to 130 lb/A in 1990. No inflorescences were produced in 1989 and only a few were produced in 1990 when residue was removed in late-February and forage was allowed to accumulate. Inflorescence density (data not shown) and seed yield (20 to190 lb/A) increased progressively as residue removal and N fertilization were delayed from late-February through late-April in 1989 and through late-May in 1990. In 1989, highest seed yields (125 to 190 lb/A) were obtained following residue removal in late April or late-May and 90 lb N/A, and there was no difference between burning and mowing (Table 6). In 1990, highest seed yield (130 lb/A) resulted from late-May burning and 90 lb N/A fertilization. Increasing the N application rate from 90 to 180 lb/A did not add any additional benefit to seed production, and actually reduced seed germination.

Seed Germination

Mean seed germination for 1989 Argentine seed lot was 71%, 73% and 58% for the 0, 90, and 180 lb N/A, respectively. Unlike Pensacola, seed germination of Argentine was not affected by method or time of residue removal, suggesting that Argentine inflorescence development is tolerant to summer water saturated soil conditions.

Summary

Burning and close grazing (<3") were the best pretreatments for promoting seed yield of both Pensacola and Argentine bahiagrass cultivars. Highest yield and quality of Pensacola bahiagrass seed resulted when residue was removed by burning or close grazing up to mid-April followed immediately by N fertilization. This time limit for grazing deferment on Pensacola bahiagrass could be extended for dry summer years. By contrast, Argentine seed yield was highest when residue was removed by burning or close grazing and field fertilized in late-May. Argentine seed germination remained high (75%) regardless of time of residue removal. Future trials should address interaction of N rate and duration of spring grazing on bahiagrass seed yield.

Recommendations for Bahiagrass Seed Production in Peninsular Florida

PENSACOLA

1. Withdraw cattle from pasture no later than mid April.
2. Burn or mow stubble if pasture is not closely grazed (3" stubble or less).
3. Fertilize immediately with 50 lb N/A.
4. Harvest seed in July when ripe.

ARGENTINE

1. Graze pasture closely (3" stubble or less) in April-May.
2. Withdraw cattle from pasture in late-May.
3. Immediately apply 100 lb N/A (Argentine seed yield may also respond to P)
4. Harvest seed in August when ripe.

References

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Table 1. Pensacola and Argentine bahiagrass seed production with different treatments averaged over 1985 and 1986.

		Pretreatment			
Cultivar	**Year**	**Chop**	**Burn**	**GA[1]**	**Graze**
		yield lb/A			
Pensacola	1985	81	125	102	126
	1986	54	111	44	50
Argentine	1985 & 1986	185	217	154	204

Source: Data from Martin Adjei and Paul Mislevy (1989)

[1]Gibberellic acid

Table 2. Seed yield of Pensacola bahiagrass as influenced by stage of plant development at time of residue removal and method of residue removal in 1987 and 1988.

	Method of residue removal					
Stage of Plant Development[1]	**1987**		**1988**		**2-yr mean**	
	Burn	**Mow**	**Burn**	**Mow**	**Burn**	**Mow**
	lb/A					
Dormant	278	347	561	614	420	481
EV	522	405	696	544	609	475
FIV	117	235	152	104	135	170
FIV-2	54	96	66	51	60	74
FIV-4	16	47	5	5	11	26

Source: Data from Martin Adjei, Paul Mislevy and Wallace Chason (1992)

[1]Dormant (early March); EV=early vegetative (mid-April); FIV=first inflorescence visible (early June); FIV-2= 2 wk after first inflorescence visible (mid-June); FIV-4= 4 wk after first inflorescence visible (late June).

Table 3. Number of mature seedheads of Pensacola bahiagrass as influenced by stage of plant development at time of residue removal and method of residue removal in 1987 and 1988.

Stage of plant development[1]	Method of residue removal					
	1987		1988		2-yr mean	
	Burn	Mow	Burn	Mow	Burn	Mow
	No. of seedhead m^{-2}					
Dormant	112	126	268	232	190	179
EV	266	191	300	279	283	235
FIV	119	307	206	259	113	283
FIV-2	46	92	91	115	54	104
FIV-4	28	50	27	33	28	42

Source: Data from Martin Adjei, Paul Mislevy and Wallace Chason (1992)

[1]Dormant (early March); EV=early vegetative (mid-April); FIV=first inflorescence visible (early June); FIV-2= 2 wk after first inflorescence visible (mid-June); FIV-4= 4 wk after first inflorescence visible (late June).

Table 4. Seed weight of Pensacola bahiagrass as influenced by stage of plant development at time of residue removal and method of residue removal in 1987 and 1988.

Stage of plant development[1]	Method of residue removal					
	1987		1988		2-yr mean	
	Burn	Mow	Burn	Mow	Burn	Mow
	1000-seed wt, g					
Dormant	1.39	1.47	1.39	1.48	1.39	1.48
EV	1.09	1.16	1.36	1.43	1.23	1.30
FIV	0.82	0.72	0.79	0.73	0.81	0.73
FIV-2	0.83	0.76	0.87	0.78	0.85	0.77
FIV-4	0.85	0.81	0.79	0.70	0.82	0.76

Source: Data from Martin Adjei, Paul Mislevy and Wallace Chason (1992)

[1]Dormant (early March); EV=early vegetative (mid-April); FIV=first inflorescence visible (early June); FIV-2= 2 wk after first inflorescence visible (mid-June); FIV-4= 4 wk after first inflorescence visible (late June).

Table 5. Seed yield of Pensacola bahiagrass as influenced by stage of plant development at time of residue removal and N fertilization rate in 1987 and 1988.

Stage of plant development[1]	Nitrogen rate	1987	1988	2-yr mean
	lb/A			
Dormant	0	229	342	286
	45	358	616	487
	90	351	805	578
EV	0	338	390	364
	45	529	723	626
	90	526	747	637
FIV	0	118	74	96
	45	185	125	155
	90	225	183	204
FIV-2	0	46	27	37
	45	74	82	78
	90	107	68	88
FIV-4	0	20	3	12
	45	32	7	20
	90	45	7	26

Source: Data from Martin Adjei, Paul Mislevy and Wallace Chason (1992)

[1]Dormant (early March); EV=early vegetative (mid-April); FIV=first inflorescence visible (early June); FIV-2= 2 wk after first inflorescence visible (mid-June); FIV-4= 4 wk after first inflorescence visible (late June).

Table 6. The effects of time and method of residue removal, and rate of N application on Argentine bahiagrass seed yield in 1989 and 1990.

Calendar month	1989 nitrogen rate			1990 nitrogen rate (lb/A)					
				0		90		180	
	0	90	180	Burn	Mow	Burn	Mow	Burn	Mow
	lb/A								
Late-February	0	0	0	7	3	8	4	8	6

Table 6. The effects of time and method of residue removal, and rate of N application on Argentine bahiagrass seed yield in 1989 and 1990.

Calendar month	1989 nitrogen rate			1990 nitrogen rate (lb/A)					
				0		90		180	
	0	90	180	Burn	Mow	Burn	Mow	Burn	Mow
	lb/A								
Late-March	45	48	45	40	21	70	36	41	43
Late-April	96	188	146	52	21	71	46	89	36
Late-May	109	125	88	47	44	132	66	108	44
Mean	63	90	70	37	22	70	38	62	32

Source: Data from Martin Adjei, Paul Mislevy and Wallace Chason (2000)