EL NIÑO-SOUTHERN OSCILLATION IMPACT ON NITROGEN LEACHING IN NORTH FLORIDA DAIRY FORAGE SYSTEMS

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The Suwannee River Basin has received much attention in recent years due to increased N levels and dairy waste has been pointed as an important factor. Evidence indicates that climatic variation measured by the El Niño Southern Oscillation (ENSO) impacts greatly on north Florida forage systems. Improvements in climate predictions (lead times of 6 to 12 months) can play an important role in devising management strategies that dairy farmers in north Florida could adopt to pursue economic and ecological sustainability. This study investigates the variability of N leaching and biomass accumulation of north Florida dairy forage systems by using crop simulation models, DSSAT v4.0. (Jones et al., 2003), under different ENSO phases: El Niño, La Niña, and neutral years.

Five focus groups and 21 interviews were held to better understand north Florida dairy forage systems. Soil series for the 63 dairy farms in the study area were located. Daily weather information was selected from Levy station (29.42° N, 82.82° W) between the years 1956 and 1998 (Mavromatis et al., 2002). During this time, 11 years were classified as El Niño, 10 as La Niña, and 23 as neutral years. Each (El Niño, La Niña, or neutral) year was defined as beginning in October and running through September of the next calendar year (O'Brien et al., 1999).

Forage systems in north Florida include a spring-summer crop, followed by a summer-fall crop, and a winter crop that is an association of oats, rye, wheat, and/or ryegrass. The most common sequences are: Bermuda-Bermuda-winter crop and corn-sorghum-winter crop. Monthly rates of manure N received for fields were estimated for a number of north Florida dairy farms; these varied between 20 and 160 kg ha^{-1} $month^{-1}$, and considering that sprayfields usually receive two applications in a month, four treatments were arranged at 10, 20, 40, and 80 kg per application. Results of these most common sequences, with the most common application rate of 40 kg N manure ha^{-1} $application^{-1}$, for an average of all soil types are presented in Table 1.

		All Years		La Niña		Neutral		El Niño	
		N LEACHED	BIOMASS	N LEACHED	BIOMASS	N LEACHED	BIOMASS	N LEACHED	BIOMASS
		kg ha^{-1}							
	n	43		9		23		11	
WINTER FORAGE	DEC	11	86	13	102	8	77	16	92
	JAN	109	1,491	83*	1698*	109	1451*	127*	1425*
	FEB	78	2,501	84*	2,497	80	2582*	71*	2335*
	MAR	19	1,554	22	1,382	19	1684*	17	1409*
BERMUDA GRASS	APR	1	2,167	1	2,376	2	2,147	1	2,309
	MAY	6	3,489	6	3,494	6	3,532	5	3,395
	JUN	15	2,340	14	2,341	16	2,332	13	2,354
	JUL	15	2,138	15	2,150	15	2,119	14	2,169
	AUG	9	1,830	8	1,828	8	1,846	10	1,799
	SEP	5	1,169	5	1,164	5	1,184	6	1,142
	OCT	5	757	5	788	5	722	5	806
	NOV	2	214	2	250	2	224	2	205
CORN	APR	2	348	2	400	3	337	2	326
	MAY	9	6,907	10	7,075	9	6,929	8	6,725
	JUN	19	7,298	19	7,297	20	7,297	18	7,300
	JUL	13	3,516	15	3,538	13	3,535	12	3,457
SORGHUM	AUG	20	111	20	115	18	111	23	109
	SEP	31	3,276	29	3,336	30	3,260	37	3,261
	OCT	31	3,638	27	3,848	30	3,599	30	3,546
	NOV	7	1,112	5	1,238	7	1,117	8	999

*Significant at the 0.05 probability level.

Table1. Monthly N leaching and biomass accumulation for north Florida forages.

There is substantially more N leaching in winter when less biomass accumulation is observed. January and February are critical months when the maximum leaching is predicted and significantly ($p<0.05$) different between El Niño and La Niña years; higher for El Niño in January (35%) and for La Niña (18%) in February. Biomass accumulation in El Niño and neutral years was significantly ($P<0.05$) lower (19 and 17%) than La Niña years in January and El Niño events were significantly lower than neutral years in February (11%) and March (20%). No significant differences were found during the other months, but consistently the most N leaching is predicted during El Niño years, and the least during La Niña years and the opposite with respect to biomass accumulation. Bermuda grass is more efficient to prevent N leaching than corn and sorghum together during the spring-fall period.

References

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