

Optimization of Nitrogen Fertilization Rate for Florida Strawberry Cultivars

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Summary

We evaluated five nitrogen (N) rates during early (Wk 3-8), middle (Wk 9-14), and late (Wk 15-20) seasons for four cultivars. Increasing N rate from 0 to 2 lb/acre/d significantly increased yields, but increasing N rate further to 3 lb/acre/d resulted in relatively small or negligible yield increases. The effectiveness of N fertilization depends highly on cultivars and plant growth stages. Based on the previous and this season's experiments, N requirement is highest in the order: Medallion > Brilliance > Peal 'FL18.52-66' > Sensation > Pearl 'FL16.78-109'

Nitrogen Fertilization

The 2021–2022 season fertility trials demonstrated that the effectiveness of N fertilization is high, moderate, and low during the early, mid-, and late seasons, respectively. The optimum N rate depends on cultivars. For example, Medallion® requires higher N rates than Pearl® especially during the early season. FL18.52-66 is a new pineberry selection, and its season-specific N demands are unknown. The objective of this study was to quantify the optimum N rates during early, middle, and late seasons for 'Florida Brilliance', Medallion®, Pearl® 'FL16.78-109' and Pearl® 'FL18.52-66' (new pineberry cultivar).

Methods

We evaluated early, mid, and late season N rates in three separate field experiments during the 2022-2023 season at the UF/IFAS GCREC in Balm, FL. Tables 1–3 show the N rates in the three experiments. Total N application rates ranged from 84 to 210 lb/acre. All three experiments were conducted using a split-plot design with N rate as the main plot factor and cultivar

as the sub-plot factor with 4 replicates per treatment. Bare-root transplants (Crown Nursery, CA) were planted on Oct 12, 2022. Commercial production and pest management practices were followed. Strawberries were harvested twice a week from November through February.

Table 1. Early-season N fertilization treatments.

Early-season N rate	Daily N application rate (lb/acre/d)					Total N (lb/acre)
	Oct	Nov	Dec	Jan	Feb	
0 lb/acre/d	Sprinkler	0.0	1.0	1.0	84	
0.5 lb/acre/d		0.5	1.0	1.0	105	
1 lb/acre/d		1.0	1.0	1.0	126	
2 lb/acre/d		2.0	1.0	1.0	168	
3 lb/acre/d		3.0	1.0	1.0	210	

Transplanting = Oct 12, 2022

Wk 1–2 = establishment with sprinkler irrigation

Wk 3–8 (6 wk) = early season

Wk 9–14 (6 wk) = mid-season

Wk 15–20 (6 wk) = late season

Table 2. Mid–late season N fertilization treatments.

Mid-season N rate	Daily N application rate (lb/acre/d)					Total N (lb/acre)
	Oct	Nov	Dec	Jan	Feb	
0 lb/acre/d	Sprinkler	1.0	0.0	1.0	84	
0.5 lb/acre/d		1.0	0.5	1.0	105	
1 lb/acre/d		1.0	1.0	1.0	126	
2 lb/acre/d		1.0	2.0	1.0	168	
3 lb/acre/d		1.0	3.0	1.0	210	

Transplanting = Oct 12, 2022

Wk 1–2 = establishment with sprinkler irrigation

Wk 3–8 (6 wk) = early season

Wk 9–14 (6 wk) = mid-season

Wk 15–20 (6 wk) = late season

Table 3. Late–late season N fertilization treatments.

Late-season N rate	Daily N application rate (lb/acre/d)					Total N (lb/acre)
	Oct	Nov	Dec	Jan	Feb	
0 lb/acre/d	Sprinkler	1.0	1.0	0.0		84
0.5 lb/acre/d		1.0	1.0	0.5		105
1 lb/acre/d		1.0	1.0	1.0		126
2 lb/acre/d		1.0	1.0	2.0		168
3 lb/acre/d		1.0	1.0	3.0		210

Transplanting = Oct 12, 2022

Wk 1–2 = establishment with sprinkler irrigation

Wk 3–8 (6 wk) = early season

Wk 9–14 (6 wk) = mid-season

Wk 15–20 (6 wk) = late season

Results

Early season N rate effects on yield (Table 1)

In all tested cultivars, canopy growth was promoted by increasing early season N rate. Increasing early season N rate from 0 to 2 lb/acre/d significantly increased yields, but increasing N rate further to 3 lb/acre/d resulted in relatively small or negligible yield increases.

In ‘Florida Brilliance’, increasing early season N rate from 0 to 2 lb/acre/d increased Nov-Dec, Jan, Feb, and total marketable yields by 163%, 191%, 38%, and 66%, respectively. Increasing early season N rate from 1 to 2 lb/acre/d increased Nov-Dec, Jan, Feb, and total marketable yields by 16%, 13%, 2%, and 5%, respectively.

In Medallion®, increasing early season N rate from 0 to 2 lb/acre/d increased Nov-Dec, Jan, Feb, and total marketable yields by 70%, 67%, 42%, and 70%, respectively. Increasing early season N rate from 1 to 2 lb/acre/d increased Nov-Dec, Jan, Feb, and total marketable yields by 26%, 20%, 22%, and 22%, respectively.

In Pearl® ‘FL16.78-109’, increasing early season N rate from 0 to 2 lb/acre/d increased Nov-Dec, Jan, Feb, and total marketable yields by 74%, 35%, 42%, and 43%, respectively. Increasing early season N rate from 1 to 2 lb/acre/d increased Feb and total marketable yields by 17% and 13%, respectively, but it did not increase Nov-Dec and Jan marketable yields.

In Pearl® ‘FL18.52-66’, increasing early season N rate from 0 to 2 lb/acre/d increased Nov-Dec, Jan, Feb, and total marketable yields by 219%, 107%, 47%, and 59%, respectively.

Increasing early season N rate from 1 to 2 lb/acre/d increased Nov-Dec, Jan, Feb, and total marketable yields by 17%, 12%, 15%, and 15%, respectively.

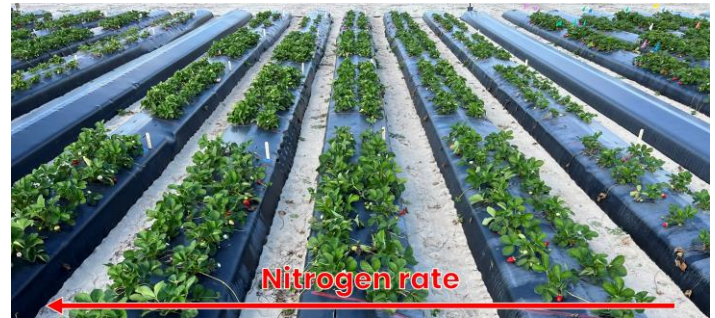


Figure 1. Canopy growth responses to increasing early season N rate. This photo was taken on Jan 2, 2023.

Table 1. Marketable yield of four strawberry cultivars as affected by early season nitrogen (N) rates.

Cultivar	Early season N rate (lb/acre/d)	Marketable yield (8-lb flat #/acre)			
		Nov-Dec	Jan	Feb	Total
Florida Brilliance	0.0	92	186	1,511	1,789
	0.5	203	320	1,775	2,298
	1.0	289	481	2,045	2,815
	2.0	334	543	2,090	2,967
	3.0	381	419	2,366	3,166
	0 → 2 lb	263%↑	191%↑	38%↑	66%↑
	1 → 2 lb	16%↑	13%↑	2%↑	5%↑
Medallion	0.0	120	238	1,272	1,630
	0.5	249	472	1,477	2,198
	1.0	258	531	1,477	2,266
	2.0	325	636	1,808	2,769
	3.0	330	664	1,786	2,779
	0 → 2 lb	170%↑	167%↑	42%↑	70%↑
	1 → 2 lb	26%↑	20%↑	22%↑	22%↑
Pearl ‘FL16.78-109’	0.0	97	139	1,414	1,651
	0.5	176	269	1,664	2,109
	1.0	177	200	1,717	2,095
	2.0	170	188	2,004	2,362
	3.0	182	280	2,073	2,535
	0 → 2 lb	74%↑	35%↑	42%↑	43%↑
	1 → 2 lb	4%↓	6%↓	17%↑	13%↑
Pearl ‘FL18.52-66’	0.0	58	124	1,224	1,406
	0.5	142	232	1,476	1,850
	1.0	157	229	1,568	1,954
	2.0	184	258	1,799	2,240
	3.0	181	314	1,925	2,420
	0 → 2 lb	219%↑	107%↑	47%↑	59%↑
	1 → 2 lb	17%↑	12%↑	15%↑	15%↑

Mid-season N rate effects on yield

In all tested cultivars, increasing mid-season N rate from 0 to 2 lb/acre/d significantly increased yields, but increasing N rate further to 3 lb/acre/d resulted in relatively small or negligible yield increases.

In ‘Florida Brilliance’, increasing mid-season N rate from 0 to 2 lb/acre/d increased Jan, Feb, and total marketable yields by 101%, 115%, and 90%, respectively. Increasing mid-season N rate from 1 to 2 lb/acre/d increased Jan, Feb, and total marketable yields by 18%, 18%, and 14%, respectively.

In Medallion®, increasing mid-season N rate from 0 to 2 lb/acre/d increased Jan, Feb, and total marketable yields by 99%, 114%, and 85%, respectively. Increasing mid-season N rate from 1 to 2 lb/acre/d increased Jan, Feb, and total marketable yields by 0%, 22%, and 14%, respectively.

In Pearl® ‘FL16.78-109’, increasing mid-season N rate from 0 to 2 lb/acre/d increased Jan, Feb, and total marketable yields by 182%, 47%, and 52%, respectively. Increasing mid-season N rate from 1 to 2 lb/acre/d increased Jan, Feb, and total marketable yields by 40%, 8%, and 11%, respectively.

In Pearl® ‘FL18.52-66’, increasing mid-season N rate from 0 to 2 lb/acre/d increased Jan, Feb, and total marketable yields by 66%, 92%, and 74%, respectively. Increasing mid-season N rate from 1 to 2 lb/acre/d increased Jan, Feb, and total marketable yields by 34%, 12%, and 13%, respectively.

Table 2. Marketable yield of four strawberry cultivars as affected by mid-season nitrogen (N) rates.

Cultivar	Mid-season N rate (lb/acre/d)	Marketable yield (8-lb flat #/acre)			
		Nov-Dec	Jan	Feb	Total
Florida Brilliance	0.0	300	277	1,069	1,646
	0.5	269	457	1,915	2,641
	1.0	334	470	1,947	2,751
	2.0	267	555	2,301	3,123
	3.0	267	492	2,300	3,060
	0 → 2 lb	--	101%↑	115%↑	90%↑
	1 → 2 lb	--	18%↑	18%↑	14%↑
Medallion	0.0	300	256	868	1,424
	0.5	297	478	1,556	2,331
	1.0	259	508	1,531	2,298
	2.0	257	509	1,861	2,627
	3.0	252	517	1,898	2,667
	0 → 2 lb	--	99%↑	114%↑	85%↑
	1 → 2 lb	--	0%↑	22%↑	14%↑
Pearl ‘FL16.78-109’	0.0	162	105	1,376	1,643
	0.5	163	205	2,008	2,377
	1.0	154	211	1,878	2,242
	2.0	178	296	2,022	2,496
	3.0	144	279	1,846	2,270
	0 → 2 lb	--	182%↑	47%↑	52%↑
	1 → 2 lb	--	40%↑	8%↑	11%↑
Pearl ‘FL18.52-66’	0.0	170	156	948	1,274
	0.5	162	294	1,687	2,144
	1.0	153	194	1,615	1,961
	2.0	142	259	1,816	2,217
	3.0	167	307	1,756	2,230
	0 → 2 lb	--	66%↑	92%↑	74%↑
	1 → 2 lb	--	34%↑	12%↑	13%↑

Late season N rate effects on yield

In all tested cultivars, increasing late season N rate from 0 to 2 lb/acre/d significantly increased yields, but increasing N rate further to 3 lb/acre/d resulted in relatively small or negligible yield increases.

In ‘Florida Brilliance’, increasing late season N rate from 0 to 2 lb/acre/d increased Feb and total marketable yields by 21% and 20%, respectively. Increasing late season N rate from 1 to 2 lb/acre/d increased Feb and total marketable yields by 1% and 6%, respectively.

In Medallion®, increasing late season N rate from 0 to 2 lb/acre/d increased Feb and total marketable yields by 23% and 8%, respectively. Increasing late season N

rate from 1 to 2 lb/acre/d increased Feb and total marketable yields by 9% and 3%, respectively.

In Pearl® ‘FL16.78-109’, increasing late season N rate from 0 to 2 lb/acre/d increased Feb and total marketable yields by 14% and 8%, respectively. Increasing late season N rate from 1 to 2 lb/acre/d increased Feb and total marketable yields by 3% and 0%, respectively.

In Pearl® ‘FL18.52-66’, increasing late season N rate from 0 to 2 lb/acre/d increased Feb and total marketable yields by 25% and 20%, respectively. Increasing late season N rate from 1 to 2 lb/acre/d increased Feb and total marketable yields by 6% and 6%, respectively.

Table 3. Marketable yield of four strawberry cultivars as affected by late season nitrogen (N) rates.

Cultivar	Late season N rate (lb/acre/d)	Marketable yield (8-lb flat #/acre)			
		Nov-Dec	Jan	Feb	Total
Florida Brilliance	0.0	319	549	1,787	2,654
	0.5	315	614	2,145	3,074
	1.0	291	581	2,154	3,026
	2.0	347	679	2,170	3,196
	3.0	283	571	2,319	3,172
	0 → 2 lb	--	--	21%↑	20%↑
	1 → 2 lb	--	--	1%↑	6%↑
Medallion	0.0	381	737	1,579	2,697
	0.5	330	585	1,794	2,709
	1.0	346	711	1,778	2,835
	2.0	357	622	1,946	2,926
	3.0	344	684	1,957	2,985
	0 → 2 lb	--	--	23%↑	8%↑
	1 → 2 lb	--	--	9%↑	3%↑
Pearl ‘FL16.78-109’	0.0	200	272	1,756	2,228
	0.5	180	260	1,802	2,242
	1.0	204	254	1,946	2,404
	2.0	187	210	2,008	2,405
	3.0	192	176	1,924	2,293
	0 → 2 lb	--	--	14%↑	8%↑
	1 → 2 lb	--	--	3%↑	0%↑
Pearl ‘FL18.52-66’	0.0	214	302	1,456	1,973
	0.5	211	326	1,717	2,254
	1.0	199	313	1,723	2,234
	2.0	209	325	1,827	2,361
	3.0	207	226	1,807	2,240
	0 → 2 lb	--	--	25%↑	20%↑
	1 → 2 lb	--	--	6%↑	6%↑

Takeaways

- 2 lb/acre/d is recommended during the early growth stage for most cultivars. For Pearl ‘FL16.78-109’, 1.5 lb/acre/d may be sufficient, or the duration of 2 lb/acre/d can be shortened.
- 1–2 lb/acre/d is recommended during the mid-growth stage, depending on cultivars
- 0.5–1.0 lb/acre/d is sufficient during the late growth stage for all cultivars.
- Optimum N rate depends on the soil, plant spacing, and weather conditions, and site-specific adjustments are required.
- Monitor leaf nutrient status by tissue analysis – optimum leaf N range = 3.0% to 3.5%.

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