

Carinata yield components, seed and oil yields response to sulphur and nitrogen nutrition

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- Nitrogen (N) is generally the limiting nutrient in carinata production
- N fertilizer cost is the most expensive of the variable production costs (~40% of input costs)
- Oilseed brassicas have a high S requirement. Soil sulphur content has an effect on yield response (Walker and Booth, 2003)
- Nitrogen and S are both vital structural elements needed for synthesis of proteins and oils
- Sulphur availability has an effect on glucosinolate and oil content
- Nitrogen may not be fully utilized if S is deficient
- Optimum N and S rates required to increase yield and profitability



 To quantify the effects of N and S application rate on carinata growth, yield components, seed and oil yields



Materials and Methods

- Greenhouse study, NFREC, Quincy, FL
- Planted Dec. 2 2015

Soil	рΗ	%OM	Ν	N P	
Sand	6.1	0	0.01	42	0

- Treatment imposed on Jan 9 2016 (38 DAP)
- Four treatments
 - 1. 100 N, 100 S (+N +S)
 - 2. 100 N, 0 S (+N –S)
 - 3. 0 N, 100 S (–N +S)
 - 4. 0 N, 0 S (–N, –S)
- Modified Hoagland solution
- Harvested April 12 2016 (132 days after planting, 94 DAT)



39 DAP

Effect of N and S nutrition on *B. carinata* and *napus growth*



Effect of N and S nutrition on *B. carinata* and *napus physiology*



Sulphur does not have an effect when N is limited

Effect of N and S nutrition on B. carinata and napus seed yield





Effect of N and S nutrition on *B. carinata* and *napus pod numbers*



Effect of N and S nutrition on B. carinata and napus protein and oil

Species = 0.06; Treatment = <0.0001; Species*Treatment = 0.05



Effect of N and S nutrition on B. carinata and napus oil yield







- Sulphur limitation changed the physiology (photosynthesis, conductance and transpiration) of carinata only when N was optimum.
- Seed yield was responsive to S availability only under optimum N conditions.
- Oil concentration increased with nutrient stress.
- Oil yield did not change with S availability when N was optimum. When N was limiting, oil yield decreased by 72% regardless of S availability.



- 2-yr field study conducted at NFREC, Quincy FL during the 2015/2016 and 2016/2017 winter/spring growing season
- Two factor factorial in RCBD with four replications of N-fertilization rates and four S-fertilization rates
- Treatments:
 - N rates (0, 45, 90 and 135 kg N ha⁻¹)
 - S rates (0, 17, 34 and 51 kg S ha⁻¹)
- N source: ammonium nitrate (34-0-0); S source: sulphate of potash (0-0-50-17). K levels were corrected with muriate of potash (0-0-60)
- N applied at planting (25), bolting (50) and flowering (25) and S applied at planting (50) and bolting (50)

	2016	2017		
Variety	11099	94EM		
Planting date	Dec. 1 2015	Nov. 14 2016		
Seeding rate	5 kg ha ⁻¹			
Row spacing	30.5 cm			
Plot size	2m × 6 m			
Harvested area	9.3 m ²			
Harvest date	June 3 2016 (185 DAP)	May 16 2017 (183 DAP)		

Weather, Quincy, FL



Month

Soil chemical properties

Soil extractable nutrients (Mehlich 1) Dothan sandy loam (fine, loamy siliceous, thermic Plinthic Kandiudults)

2016

Р	К	Mg	Са	S	В	Zn	Mn	Fe	Cu	pН	CEC
				kg	ha ⁻¹						meq/100g
68	136	168	874	40	0.34	6	16	28	0.45	6.5	5
М	М	А	А	М	L	А	L	А	L		

2016 and 2017: N modified carinata growth

N rate = <0.05, S rate = > 0.05, N rate × S rate = > 0.05

2016

 N rate	Height	Mainstem nodes	Primary branches	Secondary branches	Pods plant ⁻¹
 (kg ha ⁻) cm			no		
 0	100.4 b	21.6 c	9.2 c	25.7 b	219.9 c
45	111.0 b	22.8 bc	9.7 bc	27.0 b	258.3 cb
90	115.0 ab	24.8 b	10.9 b	37.9 a	343.3 ab
 135	133.1 a	28.3 a	13.5 a	43.1 a	393.7 a

Linear increase in plant height, nodes, branches and pods per plant with N rate

2016 Carinata seed yield response to N and S application

N rate = 0.0015, S rate = <0.0001, N×S = 0.9427



2017 Carinata seed yield response to N and S application

N rate = <0.0001, S rate = 0.0319, N×S = 0.8798



2016 protein, oil content and yield as function of N and S rate

N rate = <0.05, S rate = < 0.05, N rate × S rate = > 0.05

\mathbf{N} rote (kg be-1)	Protein content	Oil content	Oil yield	
N fale (kg fla ')		g kg⁻¹	L ha ⁻¹	
0	323 c	398 a	1271.6 b	
45	335 b	388 b	1373.6 ab	
90	335 b	388 b	1419.0 a	
135	350 a	372 c	1393.3 ab	

- Protein content and oil yield increased linearly with N rate, oil content decreased linearly with N rate
- Increasing S rate decreased protein content and oil yield while oil content increased linearly

2017 protein, oil content and yield as function of N and S rate

N rate = <0.05, S rate = < 0.05, N rate × S rate = > 0.05

N roto (ka bol)	Protein content	Oil content	Oil yield		
N Tale (kg ha ')		g kg⁻¹	L ha ⁻¹		
0	205 c	508 a	358.9 d		
45	207 c	509 a	576.1 c		
90	217 b	495 b	936.2 b		
135	238 a	476 c	1103.4 a		

- Protein content and oil yield increased linearly with N rate, oil content decreased linearly with N rate
- Oil yield increased linearly with S rate

Increasing seed and oil yield through nutrient management



- Nitrogen modified plant height, branching patterns, pod numbers and seed weight. S application did not have an effect on these parameters
- Carinata seed yield increased with N and S application rates in both years
- Oil content and oil yield was responsive to S fertilizer application while glucosinolates and erucic acid remain unchanged
- Oil yield is strongly correlated with seed yield providing opportunities to enhance oil output through N and S fertilizer application

UF Carinata Team



March 29 2018, *Brassica carinata* Field Day | Quincy, Fl Topics include carinata agronomy, fertility, pathology, pest management, weed management, markets and economics, insurance and contracts, research plot tours, commercial production site visit and more.....







