

# Growing carinata in the Southeastern U.S.

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*Brassica carinata* is a non-food oilseed crop that is currently being grown in the U.S. Southeast as a low-input, sustainably certified winter crop. This article looks at its biology, management (nutrient, weed, and harvest), and economics. **Earn 1 CEU in Crop Management** by reading this article and taking the quiz at [www.certifiedcropadviser.org/education/classroom/classes/702](http://www.certifiedcropadviser.org/education/classroom/classes/702).

*Brassica carinata*, or Ethiopian mustard, derived from the interspecific cross between *B. nigra* (black mustard) and *B. oleraceae* (wild cabbage), is a non-food oilseed crop that is currently being grown in the U.S. Southeast as a low-input, sustainably certified winter crop. Research is ongoing in the Northern Plains with plans to develop carinata as a spring rotational crop, especially adaptable for semi-arid regions.

Carinata offers benefits over other brassica species in terms of seed size, frost and drought tolerance, disease resistance, higher yields, and less seed shattering at maturity and during harvest. It is high in oil content (>40%) with a favorable fatty acid profile that converts easily into aviation biofuel for jets and biodiesel. Once oil is removed, the seed meal is high in protein (43–46%), currently approved for beef cattle rations, with ongoing research to certify the meal for use in poultry, swine, and aquaculture.

Carinata is currently being grown in a closed-loop, sustainably-grown contract system between farmers and Agrisoma, and it doesn't disrupt normal summer cash crops. To date, carinata has been commercially contracted

in Florida, Georgia, Alabama, and Tennessee in the Southeast with expansion ongoing as far west as Texas. Demonstration acres continue in other southern-tier states and the Midwest, and future expansion into the Northern Plains is planned.

Canadian-based Agrisoma Biosciences is the driving force behind a global sustainably certified supply chain and varietal development, owning the world's largest collection of carinata genetics. Thanks to USDA and a \$15 million, five-year research project funded in 2017 to a SPARC (Southeast Partnership for Advanced Renewables from Carinata) team of academia, industry, and other stakeholders, a supply chain for carinata-based sustainable jet fuel, bioproducts, and co-product animal feed is being developed. The mission of SPARC is to overcome any physical, environmental, economic, and social constraints of regional carinata production, ensure stable markets for jet fuel and bioproducts, and enhance value across the supply chain. It has a five-year goal of establishing more than 800,000 ac in the Southeast alone.

In a report released earlier this year by the University of Florida Institute of Food and Agricultural Sciences



*Brassica carinata* at (from l to r): cotyledon stage, rosette stage, bolting, flowering, mature pods, and as harvested grain.

Photos courtesy of Agrisoma (<https://agrisoma.com/>).

Extension, Seepaul et al. (2019) present solid agronomic background and management of the crop.

Carinata prefers cooler temperatures, so it makes a good winter crop in the Southeast to help growers add revenue following summer row crops. The authors note that not only does it add diversity to a crop rotation to break pest and disease cycles, it increases soil organic matter and moisture retention, reduces soil erosion, and recycles nutrients. It is also not an invasive plant in the Southeast as subsequent soil preparation and herbicide use for summer crops will eliminate volunteer seedlings.

## Biology

Biology of carinata features a 5- to 6-ft-tall, highly branched, canola-like plant at maturity, which begins as small plants that resemble mustard or collards. It tolerates heat and drought with a 2- to 3-ft-deep taproot, an extensive root system in the upper foot of the soil, a cool canopy, and thick, waxy leaves. The crop cycle in north Florida ranges from 180 to 200 days (November–May), depending on variety, row spacing, and weather.

Seedling emergence of the current commercial variety (Avanza 641) occurs 7 to 14 days after planting from early November on research plots in Quincy, FL. First bolting occurs at 86 days after planting, with 50% bolting at 93 days. First flower begins around 96 days after planting, 50% flowering at 107 days, and completion at 136 days.

Pod development begins from the bottom to top of the plant with subsequent seed maturity occurring between 136 and 170 days after planting. Pods are 1.5 to 2 inches long with 10 to 16 seeds per pod, and 1,000 seeds weigh 4.2 g.

Carinata can be seeded into conventional-, minimum-, or strip-tilled soil or seeded no-till into standing stubble—similar to small-grain crops. The authors state a fine and firm seedbed allows for good seed-to-soil contact, germination, and uniform emergence.

Seedling emergence and stand establishment are very important. “A timely planting date in November is critical, with earlier seeding dates as you go north, as young seedlings are sensitive to cold and crusting from heavy rains, which can be tough for carinata cotyledons to push through,” says agronomist David Wright, University of Florida. “Some nitrogen at planting helps because carinata has slow initial growth, which becomes rapid growth by February.”

Carinata fits well into most crop rotations in the Southeast (every third year on the same field), whether it’s corn, cotton, peanuts, soybeans, or other summer crops like sesame, sorghum, and peas. Agrisoma Biosciences agronomist Christine Bliss, who works with farmers that grow contracted Carinata for the company, says it’s ideal following corn. “The remaining nitrogen benefits carinata, allowing farmers to reduce applied N.” She highly recommends a review of Agrisoma’s *Carinata Commercial*



**Left:** Fungicide application in carinata. Source: Ramdeo Seepaul. **Right:** Pest inspection in carinata. Source: Paula-Moraes/WFREC/UF.

*Production Manual: 2018–19—Fall Planting, Winter Season Southern US* as it contains specific advice from both university research and farmer experience. Click on your state (<https://growcarinata.com/map/>) to download the production guide (Agrisoma, 2019).

Variety improvement is ongoing, as Agrisoma continues to work with researchers to develop region-specific, high-yielding (seed and oil), disease-resistant, cold-tolerant, and early maturing lines. The current commercial Agrisoma variety for the Southeast, Avanza 641, produces approximately 2,300 lb/ac (46 bu at 50 lb/bu), which is higher than yields reported in the northern U.S. states and Canada.

## Nutrient management

This oilseed crop grows best on well-drained soils with a pH between 5.5 and 6.5. If following a soil test, nutrient requirements are similar to those of canola. The authors note that without the benefit of a soil test, growers should plan on a two-way (sandy loam soils) or three-way split (sandy soils) nutrient application to avoid early-season deficiencies and/or excessive leaching from heavy rains. Check the Florida Extension publication and Agrisoma production guide for nutrient details.

Authors of the Florida Extension publication state that S deficiency at any stage will reduce yields. For the split-application on sandy loam, apply 20 to 30 lb/ac N, 10 to 15 lb/ac S, and all of the P and K fertilizers at planting. Apply the remaining N and S fertilizer at bolting (when plants produce elongated shoots with buds at the terminal). For a three-way split application on deep sandy soils (at planting or emergence), apply the same N and S rates above, plus 50% of the K and 100% of P. The second ap-

plication at bolting is 20 to 30 lb/ac N and 10 lb/ac S and the remaining 50% K. Apply the remaining N fertilizer as the third application at early flowering. Fertilizer can be broadcast and incorporated at planting followed by topdress, sidedress, or through center pivots at bolting and flowering.

Agrisoma agronomist Bliss says growers have had success with poultry litter as an initial application. “It is a good slow-release N source, along with available P, K, and micronutrients. The manure also is more sustainable as it increases soil organic matter.”

## Weed management

Another important pre-planting task is weed management. The authors state that it is very important to start with a clean field. Apply a pre-plant burndown of a no-residual postemergence herbicide such as glyphosate, glufosinate, paraquat, 2,4-D, or carfentrazone in no-till or reduced till at least seven days before planting. A pre-plant soil-incorporated application of a residual herbicide like trifluralin or ethalfluralin will reduce weed pressure during the first 4 to 6 weeks, giving carinata time to get established and canopy the row.

A couple precautions mentioned by the authors include making sure fields are free of wild radish and wild mustard as they can survive carinata-registered herbicides to compete with the crop and reduce yields. Secondly, carinata seedlings are susceptible to herbicide residual from the previous crop, such as ALS and PPO herbicides, depending on application timing and rates used. Most summer crops like corn, cotton, and soybeans should not represent a major risk to carinata as long as they were

applied in early spring and rotational intervals are met (similar to canola).

Since there are no selective herbicides for control of broadleaf weeds in season, row spacing and seeding rate are important to help close the canopy to reduce weed competition. Grass herbicides like sethoxydim, quizalofop, and clethodim are safe for use on carinata for grass control. Check the Florida Extension publication and Agrisoma production guide for more herbicide details.

Planting should take place 3 to 4 weeks before first frost. An optimum row spacing of 7 to 14 inches produced highest yields in small-plot research, but Bliss says farmers have succeeded with 30-inch rows and up to 40-inch twin rows. Ideally, carinata should be seeded 0.5 inches deep at 5 lb/ac, with a target plant density of 6 to 10 plants/ft<sup>2</sup>. A lower seeding rate of 4 lb/ac is suggested if air or vacuum planters are used.

While the crop is fairly easy to grow, in-season scouting for diseases and insects is still important. Disease management is similar to canola and other mustards. Watch for *Sclerotinia* stem rot (white mold) at any growth stage after prolonged rains or irrigation. Other diseases that were found in research plots include *Alternaria* black spot, *Fusarium* seed rot, and turnip mosaic virus.

Regarding insects, the authors state that diamondback moth and yellow margined leaf beetle were the predominant species in commercial and experimental fields. Other potential pests include aphids, cabbage seedpod weevils, silver whitefly, cabbage looper, and imported cabbage-worm. The economic threshold has yet to be determined.

Check the Florida Extension publication and Agrisoma production guide for fungicide use and insect control details.

## Harvest management

While carinata has a high level of resistance to lodging and pod shattering, timing, proper combine adjustments, and harvest methods are critical for optimum yield and quality.

To improve carinata crop maturity, as well as help dry down the stalks for easier harvesting, the authors and Agrisoma's Bliss recommend use of a harvest aid desiccant, applied when more than 70% of the seeds are physiologically mature. At this time the upper branches and pods will have turned brown, but the main stem may remain slightly green. The authors state that Reglone (diquat dibromide) and Sharpen (saflufenacil) can be used on carinata (since they are labeled for canola/rapeseed).

Normal seed desiccation progresses rapidly, indicated by a drop in moisture content from 50% to 10% in four weeks. Agronomist Wright says once seed pods turn yellow, then harvest is normally two to three weeks away.

When seed moisture content is <10%, carinata may be combined with an auger or draper head (cut 1 to 1.5 ft off the ground, below the seed pods, to minimize clogging) using machine settings and screens for rapeseed, as outlined in operator manuals and fine-tuned for field conditions. To minimize harvest seed loss, travel at a slower speed than small-grain harvest and check behind the combine for seeds and adjust accordingly. See details in the Florida Extension publication and Agrisoma production guide.

To effectively deal with carinata's heavy biomass (2 tons/ac), be sure to optimize your combine spreader. This biomass on the surface can assist weed control and save soil moisture for the following summer crop.

## Carinata economics

While carinata does require more inputs than a normal cover crop for higher yields, the crop is relatively easy to grow and can provide an economic return without major investment. A net return chart in the Florida Extension publication shows a per-acre return range from \$87 to \$327, which can change from year to year depending on yield and price per bushel. Crop insurance (\$15–25/ac) is available for carinata under the canola/rapeseed provisions by written agreement with USDA Risk Management Association. It can also be based on your actual farm yields based on three years of grain yields. If data is not available, producers may be eligible for Noninsured Crop Disaster Assistance Program (NAP) from the Farm Service Agency.

In summary, the authors of these reports believe carinata's potential as a winter oilseed crop in the Southeast has been demonstrated, and promising varieties have been identified for commercialization. Baseline management and agronomic production practices have been developed and continue to improve. Be sure to review both the Florida Extension publication and Agrisoma production guide for more details and production photos/charts. &

## References

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