SPARC

CARINATA FACTS

Social Science Initiative

Understanding the Barriers to Carinata Adoption in the Southeast United States

Carinata (*Brassica carinata*) is an emerging cool-season crop for growers in the Southeast US capable of powering jets and commercial planes. The industrial oilseed that serves as the feedstock for such fuel, can also be utilized as a high-protein meal, and may be a lucrative and agronomically beneficial opportunity for growers. However, these benefits are only extended to those who adopt the crop; the likelihood of which is wrapped up in the complex web of cultural, socio-economic, and agronomic conditions of the region.

The SPARC social science team developed a study that focused on the factors that drive decision-making among producers and exploring what influences their willingness to adopt *Brassica carinata*. This fact sheet summarizes the conceptual framework, methods, principal results and discussion of their work.

Citation Information

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For a more in-depth discussion, please refer to the source material:

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***Figure 1**: Participants of a carinata field day review the study fields in bloom.*

Conceptual Considerations

Our conceptual understanding of growers' decision-making starts beyond the farmgate. Here, the regional biophysical and socioeconomic context informs the basis of information and knowledge. This knowledge extends to recommendations, regional Extension programs, industry, and scope of technology. Knowledge is then exchanged between and within stakeholder groups. For the study's scope, these groups include private industry, land grant research and Extension, regional value chain actors, and the individual grower themselves. This knowledge is then distilled and brought within the farmgate. This process is outlined in more detail in Figure 2.

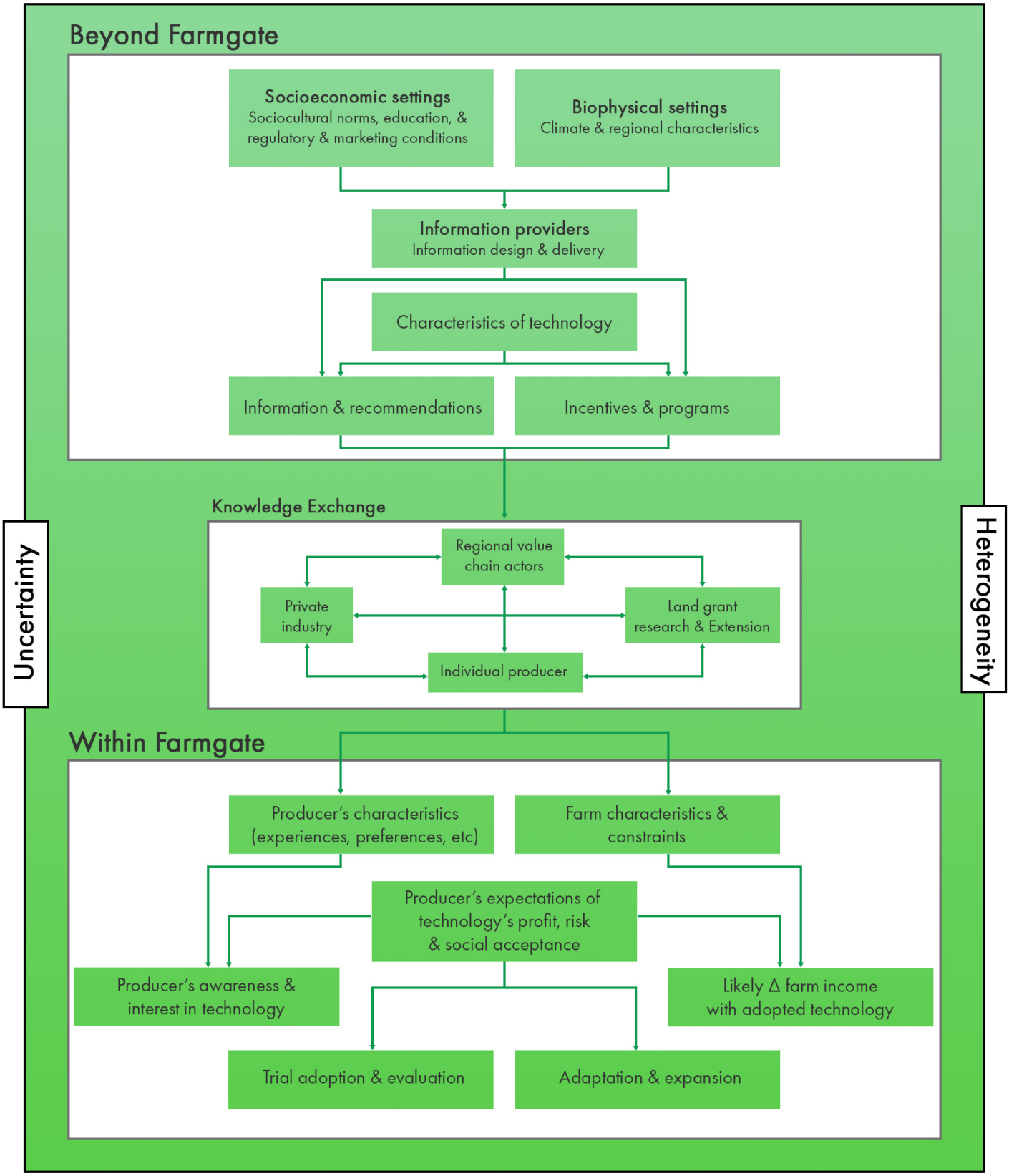

Figure 2: *The study's conceptual framework, illustrating how decisions regarding the adoption of technology are seated within a web of socio-economic, biophysical, cultural, and environmental factors both within and beyond farmgate framed by uncertainty and heterogeneity. Arrows indicate the proposed flow of information and influence between factors and actors. A system of knowledge exchange, seated at the center of the framework, captures the direction and scales of influence and decision-making. Adapted from Liu et al.*[5]

Methods

Utilizing a mixed-methods approach was key to understanding and identifying the barriers to carinata adoption. Table 1 illustrates the methods and sample size of each data collection instrument.

Results

Perceived benefits of the crop

Participants noted that the benefits of growing carinata were both agronomic and economic. Agronomically, implementing a winter cover crop can enhance soil health–something of which farmers are conscious. Economically, carinata provides an additional stream of revenue. Winter cover crop options are limited and the area is in need of cover crop alternatives, especially ones with profit potential. Meanwhile, environmental benefits were rarely discussed and largely not acknowledged. One participant even noted that internal pressure to adhere to sustainability standards may have hurt project implementation.

Perceived barriers to adoption

The study documented barriers both within and beyond farmgate, as listed in Table 2. Within farmgate, there are a number of specific barriers to adoption. Unfamiliarity with the crop was the number one barrier facing the adoption of carinata. Historical barriers, such as the negative past experiences growing the crop and premature commercial introduction of the crop before adequate research had been conducted, cannot be overlooked as they obscure the future potential of carinata. The yield gap between research plots and commercial production is another challenge. Labor concerns are apparent, as many growers would rather spend the winters pursuing other activities (such as recreational hunting) rather than manage another crop. Furthermore, this increased labor cost was associated with equipment constraints. The small seed size of carinata means additional work calibrating and maintaining equipment. Finally, non-adoption may be a risk-mitigating behavior due to insufficient cash reserves to offset potential crop failure.

Beyond farmgate, previous growers chose limitations of crop insurance as the key barrier to carinata adoption. There is little understanding of the mechanics of crop insurance, however having shelter against losses could improve adoption. Previous growers also highlighted weather risks as an important barrier, many referring to crop failure following freeze damage and poor cold tolerance of carinata, generally. Carinata's small seed size poses issues for harvesting and transportation, noting a lack of specialized equipment and additional labor required to minimize losses. Furthermore, the distance of storage and processing facilities to growers was identified as a potential barrier.

A selection of top five barriers from within and beyond farmgate were chosen by participants during an exercise. Of this selection, participants then sorted them into top three. Table 3 outlines these results. The score illustrates the frequency of which the barrier was selected each round.

Potential solutions from stakeholders

Stakeholder solutions to adoption barriers fall into three distinct categories: (1) Suggestions for industry and business practices, (2) the role of university and industry-driven research, and (3) land grant Extension as a catalyst for information sharing among stakeholders.

Table 1: *Mixed-methods approach to data collection from Sept. 2017 to Sept. 2019. The methods allowed the research team to engage carinata stakeholders involved in the production and processing of the crop.*

Timeline	*2017*	*2018*		*2019*	
Data Collection Instrument	Semi-structured interviews	Surveys & ranking exercise	Semi-structured interview & sorting exercise	Semi-structured interview	Focus group
Research Audience (sample size)	Key informants (n=15)	Carinata event attendees (n=34)	Previous carinata growers (n=8)	Carinata event organizers (n=7)	Growers (n=4), Extension faculty (n=2), carinata agronomist (n=1)

Table 2: Barriers identified from key informant interviews.

Barriers within farmgate	Unfamiliarity Low selling price Poor fit into crop rotations Equipment constraints Difficult to achieve high yield Too much time & energy demanded Limited growing area Insufficient cash reserves to offset failure Negative prior experience Poor soil quality
Barriers beyond farmgate	Limitations of insurance Market proximity Custom combining Lack of visible evidence of success Quality of grain transport Smokestacking research Weather risks Petroleum price/barrel Absence of policy incentives Delays in RSB certification* Pushback against feedstock Shipping to Europe

*https://rsb.org/the-rsb-standard/about-the-rsb-standard/

Table 3: Cumulative sorting results considering all barriers. Barriers were selected by growers during the final round of sorting (not included: those receiving an overall score of 0).

Score	*Adoption barrier*
5	Limitations of insurance
4	Unfamiliarity
3	Weather risks
2	Low selling price Visible evidence of success
1	Poor fit into rotations Equipment constraints Difficulty getting high yield Market proximity Custom combining

Previous growers provided feedback on the importance of information flow between actors. In a survey offering eight potential information sources, the options chose most frequently were Extension and companies that are associated with the crop.

Facilitating knowledge exchange

Participating stakeholder groups noted that processes of knowledge exchange may guide adoption of carinata. Previous growers expressed a desire to learn from other carinata growers who had success with the crop. Meanwhile, growers and Extension professionals in focus group discussions identified interactions between stakeholders at Extension-run events such as field days are opportunities to expand adoption of carinata in the SE US. Highlighting carinata alongside relevant crops or technological practices and holding field days closer to farmers were presented as potential strategies to increase attendance at field day events. Potential examples of events that could feature carinata include: cover crops, small grain, and winter crop field days.

Discussion

The study illustrates that different stakeholder groups understand and perceive adoption barriers differently. Key informants related with the public-private partnership perceived particular barriers as simpler to solve, such as crop insurance. Growers, on the other hand, ranked crop insurance as a high barrier. This difference may be pronounced because the means of resolving this challenge continues to elude growers, while the lack of protection is viscerally experienced. Thus, it is noted that quantitative efforts to separate, rank, and list barriers to adoption need to be contextualized by an in-depth qualitative analysis.

The study found that a barrier can exist at multiple points in the value chain. Unfamiliarity, for example, can include lack of agronomic on-farm knowledge and lack of research. Such complexities caution against simple solutions that solely focus on actors within

farmgate. Indeed, barriers are embedded in complicated relationships to stakeholders along the value chain and are dependent on the perspective of the stakeholder and their placement in the value chain.

Key informants revealed a dependence on early adopters to showcase the success of carinata for further adoption, complying with diffusion of innovation theory[1]. Reliance on such an approach, however, places emphasis on an industry bias of working with wealthier, capital-laden clients and largely ignores alternative adoption pathways[2,3]. This is not to say diffusion of innovation does not have value, rather the study notes that the approach is better suited toward understanding the multitude of factors that shape the adoption of technologies.

Study respondents expressed an interest in shifting away from conventional approaches to knowledge exchange where growers passively receive information from experts. Many proposed a system where grower expertise actively contributes to the co-production of knowledge. Such a system requires facilitation of knowledge exchange between community members to build social capital, relying on clearly defined roles of each actor: grower, researcher, Extension professional[4].

Extension agents play a critical role in knowledge sharing and frequently facilitate carinata conversations with producers. However, these agents face multiple challenges. One emergent constraint relates to conventional institutional performance indicators that prioritize the quantity of producers who participate in events (i.e. # of attendees) over the quality of that engagement (i.e. depth of dialog). This may limit the learning that is common when small groups of producers tackle barriers, brainstorm solutions, and develop ways to reframe commodities as regional opportunities. Furthermore, different agents perceive their roles and relationships with industry differently. For instance, although many view themselves as primarily transferring neutral information to producers, others are eager to assist industry by promoting products. Such incongruence in reward structures and role identity may undermine the efficacy of opportunities for shared learning and knowledge co-creation.

Finally, the study notes that despite the importance of carinata as a renewable biofuel feedstock internationally, most study participants failed to make global linkages when discussing crop benefits. The study does not suggest that climate change or environmental components of carinata is inconsequential; however, it may not be a key to decision-making processes surrounding adoption for growers. Instead, agronomic and economic benefits of carinata are clearly expressed by growers.

Acknowledgments

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