

Increasing Demand and Willingness-to-Pay for Arizona-Grown Pecans

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Summary

In recent years, the production of pecans has approximately increased by 32% in Arizona. At the same time, the demand for pecans has been stagnant. With this research, we aim to support the design of marketing and communication strategies that specifically target existing and potential customers of Arizona-grown pecans. We used online consumer surveys to analyze consumers' purchase and consumption habits of nuts in general and Arizona-grown pecans in particular. Factors that affect consumers' demand and willingness to pay for Arizona-grown pecans were also investigated. This sheds light on those characteristics that consumers find pertinent when shopping. This insight offers a better understanding of consumer behavior related to pecans. We also presented consumers with information about (Arizona-grown) pecans and tested which information consumers consider the most important. This provides marketers the capability to better understand shoppers and create consumer-oriented strategies to more effectively promote Arizona-grown pecans. Our analysis draws on a national online consumer study comprising 3,030 participants.

Key takeaways

1. Educate on specific characteristics of pecans and Arizona-grown pecans
2. Use user-imagery
3. Position based on usage occasion
4. Employ storytelling
5. Capitalize on pecan production methods
6. Capitalize on current marketplace trends
7. Enhance seasonal marketing
8. Inform on proper storage

1. Introduction

Arizona is among the leading commercial producers of pecans in the United States. In 2022, Arizona ranked third in highest utilized production (in-shell basis) behind Georgia and New Mexico (USDA, 2023). Pecans are grown in Arizona because they are economical, well-adapted to the environment, exhibit relatively high yields, and result in high-quality products. Arizona has low humidity, cloud cover, and an abundance of bright sunlight. It has not yet experienced high instances of diseases found in pecans produced on the East Coast and parts of New Mexico. With about 4 feet of water annually, pecans use less water than cotton, alfalfa, and lettuce, and Arizona farmers have made efforts to change their irrigation systems to use water more effectively (Dahl, 2018). From 2013 to 2023, Arizona pecan production increased from 22 to 37 million pounds of pecans per year. The Arizona pecan industry was valued at \$75 million annually, making it an increasingly important specialty crop for Arizona (USDA 2018, 2021, 2023). Additionally, the pecan industry is economically and culturally significant to the U.S., and the success of Arizona-grown pecans provides a host of economic, societal, and environmental benefits to Arizona and its pecan growers, shellers, and other stakeholders (Lillywhite et al., 2014).

Nuts are promoted as healthy and nutritious, potentially reducing the risk of heart disease, and helping to lower blood pressure. Furthermore, tree nuts are popular because they are very versatile and can be used as snacks for dairy, cereal, baked goods, and sports nutrition. However, there is a difference in the quantity of the different nuts consumed. For instance, almond consumption has increased five times since 1976, while pecan consumption has been stagnant over the past 3.5 decades (Asci & Devadoss 2021, Lillywhite et al. 2014). Hence, it is beneficial to understand how much consumers know about pecans and what their demand and willingness to pay for Arizona-grown pecans are. In this analysis, we examine factors that influence consumers' choices of Arizona pecans and their demand compared to other nuts. Using a national consumer survey, this analysis aims to determine consumer demand and willingness to pay for Arizona-grown pecan nuts.

2. Research Objectives

- (1) Develop a predictive model for the demand and willingness to pay for Arizona-grown pecans.
- (2) Inform on consumer demand characteristics and willingness to pay for Arizona-grown pecans.
- (3) Identify the impact of price of Arizona-grown pecans on consumer choice of these crops.
- (4) Educate and inform consumers about the benefits of Arizona-grown pecans.

3. Study Design

3.1. Methods Used

In this study, we conducted an online consumer survey across the U.S. with n=3,030 participants to elicit consumer behavior relevant to Arizona-grown pecans. We programmed the survey in Qualtrics, and the data was collected through the Qualtrics’ consumer panel. We elicited willingness to pay and demand related to pecans, Arizona-grown pecans, and main competing nut products. We collected data regarding consumers’ nut shopping and consumption patterns, as well as their knowledge regarding tree nuts. In addition, we surveyed socio-demographic characteristics of participants.

3.2. Sample Characteristics

As mentioned above a professional research company was hired to administer an online survey to a sample of 3,030 adult respondents. The sample was a nationally representative sample of nut consumers in the U.S. Consumers in the study were shoppers of tree nuts, such as pistachios, cashews, walnuts, almonds; and peanuts. Consumers who reported a nut allergy or never purchase nuts were excluded from the study.

In the sample, respondents were somewhat evenly split for gender, with 52 percent female and 48 percent male. On average, participants were 48 years old and lived in households of three people. Twenty-nine percent had children living in the household. The average household size is a bit smaller than the national average. Approximately 60 percent held a college degree, which is skewed high for the national average. Figure 1 illustrates the varying levels of education. The sample also ranked high on reported income. Over 30 percent reported household income before taxes above \$100,000. Figure 2 provides a snapshot of the income distribution for the sample.

Figure 1. Sample Characteristics: Level of Education

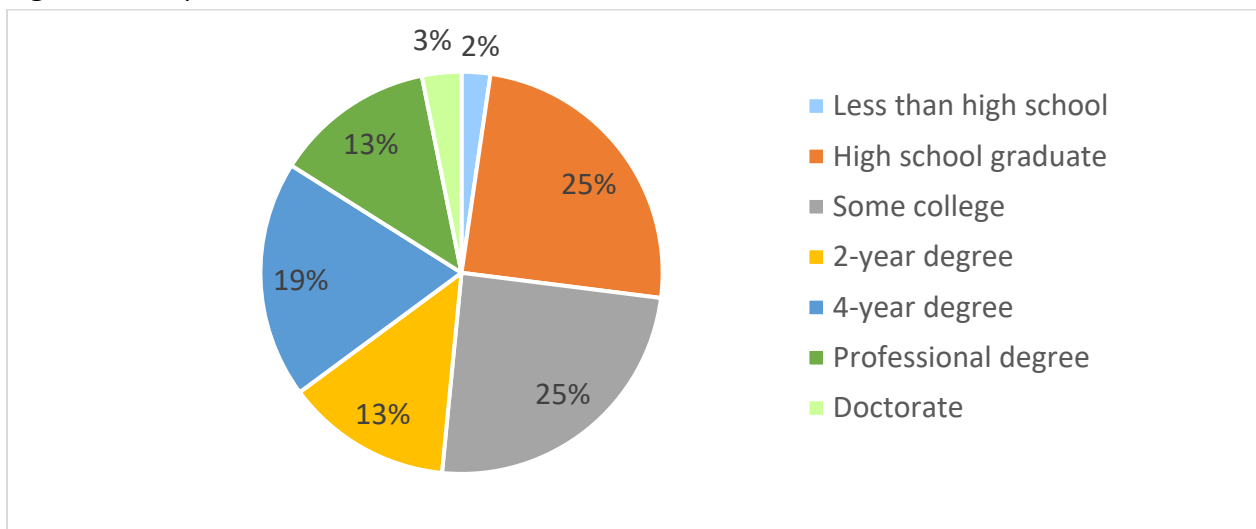
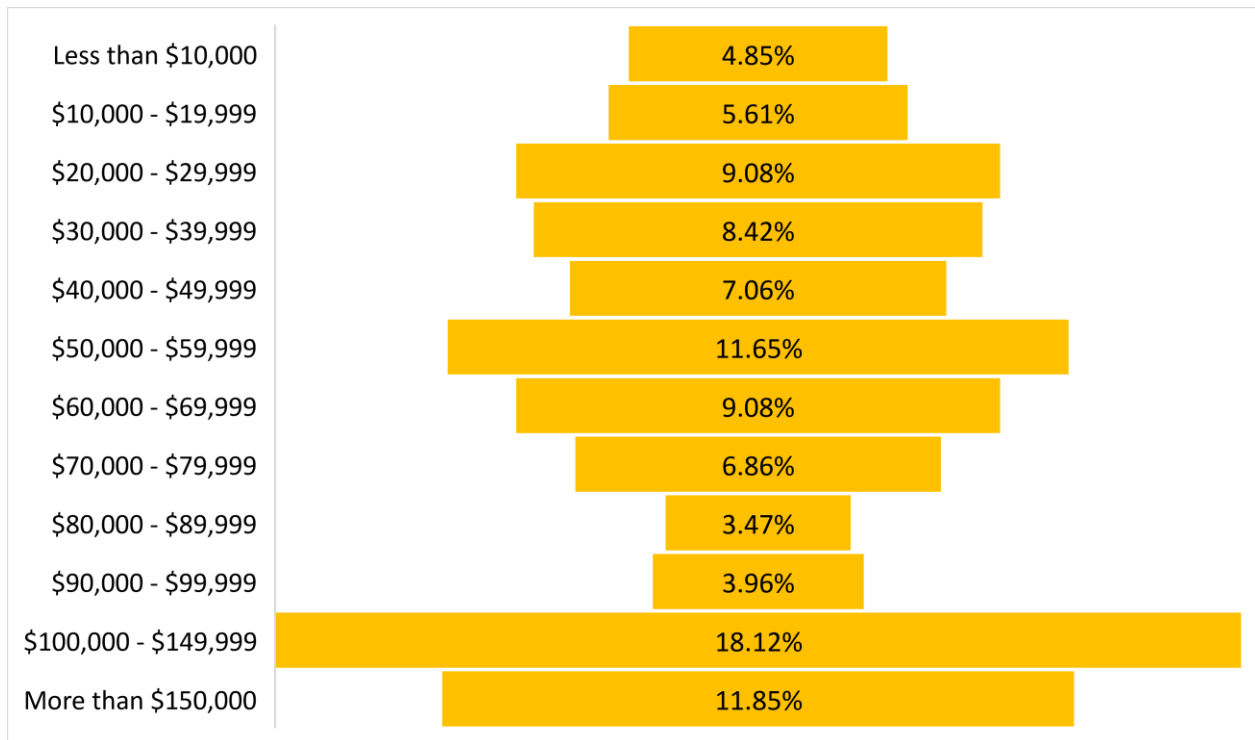


Figure 2. Sample Characteristics: Household Income



4. Results

4.1. Purchase Frequency of Pecans and Substitute Products

Respondents were asked about the frequency with which they purchased pecans, other tree nuts, and peanuts. The other tree nuts included in this study were identified as possible competitors or substitutes to pecans through conversations with industry representatives. The tree nuts included were pistachios, cashews, walnuts, and almonds. Respondents identified themselves as nut consumers in general; however, the data indicates that, on average, respondents purchased various tree nuts and peanuts only a few times a year (figure 3).

18 percent never buy pecans -- which makes them potential buyers. A majority of fifty-one percent of shoppers buy pecans only a few times a year – which presents an opportunity to increase their purchase frequency. Some 16 percent buy pecans about once a month, only 8 percent buy them about every two weeks, and the same holds for those who buy pecans at least once a week. Three percent purchase them daily.

The fact that the majority buys nuts only a few times a year leads to the question of whether consumers purchase tree nuts and peanuts in greater quantities, leaving less need to purchase more frequently, or if tree nuts and peanuts are simply consumed less frequently. If the answer

to this question is less consumption, then the opportunity to increase consumption may point to possible growth opportunities.

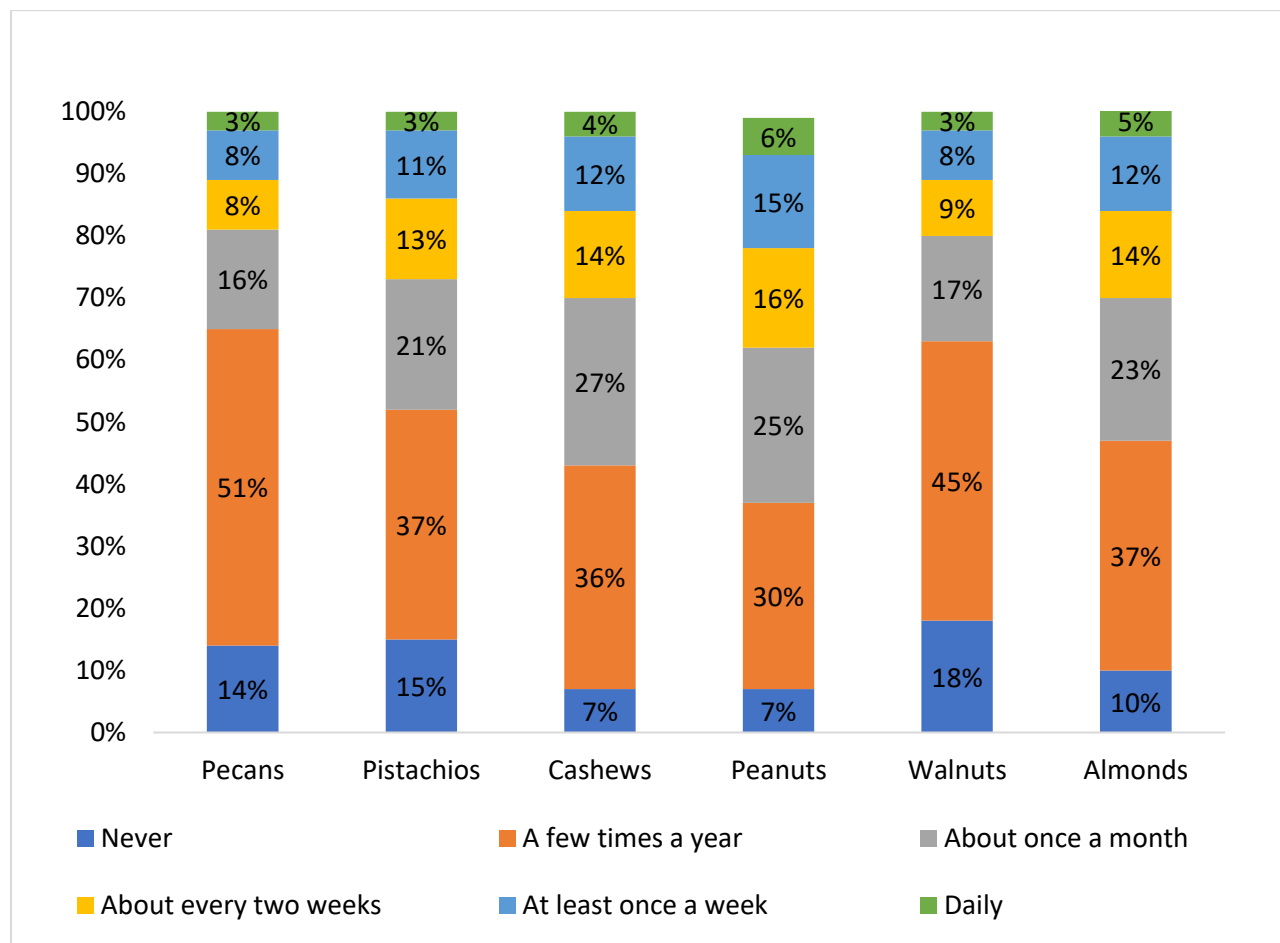
Why do consumers not purchase pecans? Reasons for consumers not to buy pecans are, among

Respondents do not purchase pecans because they perceive them as expensive and less healthy than other tree nuts.

others, that they are perceived as too expensive, have a sweet flavor that is disliked, hard on the teeth, that mixed nuts are preferred, and that the other nuts are perceived to be healthier. Some also associate them with baking only rather than a healthy option for snacking. This presents a marketing opportunity where consumers can be educated about pecans. For example, if pecans are not stored cool, the flavor might change quickly. Educating consumers on appropriate storage could

remedy negative taste experiences. In addition, providing information on the health value of pecans can improve perception, and influence purchase decisions positively.

Figure 3. Purchase Frequency of Nuts and Peanuts



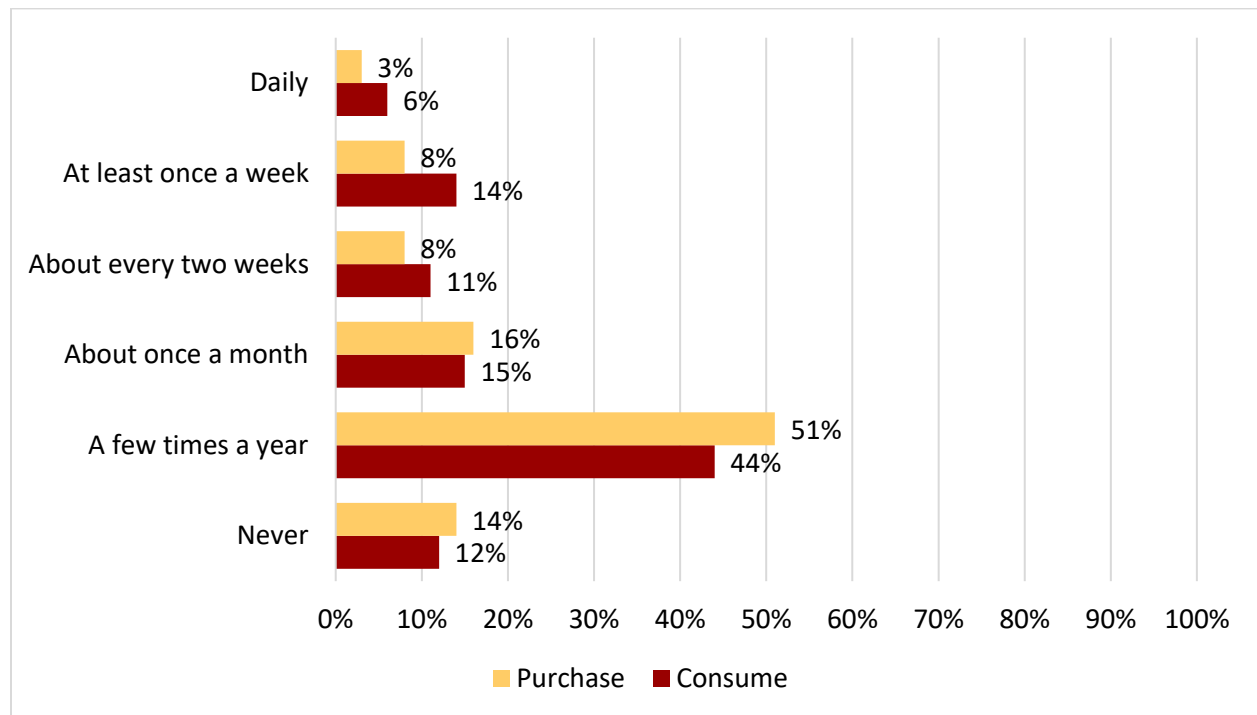
4.2. Consumption Frequency of Pecans and Substitute Products

Additionally, we investigated consumption patterns of pecans by asking participants the question, “How often do you eat pecans?” As shown in figure 4, 44 percent of respondents indicated that they eat pecans a few times a year, 14 percent at least once a week, and 11 percent indicated about every two weeks.

44% eat pecans only a few times a year.

Results suggest that the frequency in which pecans are purchased and consumed are very similar. Figure 4 illustrates the differences between the purchase and consumption habits of participants. 12% of the sample never eat pecans. Unless the reason to not eat them is taste, there is an opportunity to increase market share by educating these consumers on the benefits of pecans, and, for example, inform them about usage of the product, appropriate storage, and the like. As evidenced by the reasons not to buy them, consumers might have misperceptions about pecans. Alleviating them could change their purchase and consumption.

Figure 4. Purchase and Consumption Habits of Pecans



To answer the question **what affects consumption and purchase of pecans**, we employ statistical models. We find that being familiar with pecans, knowing more about pecans in general, and being knowledgeable about pecan nutrition facts specifically increases consumption and purchase frequency. The same holds for higher income individuals. Children in the household only affect purchase frequency (increasing it). Being White decreases both consumption and purchase frequency. Being female and older decreases purchase frequency only.

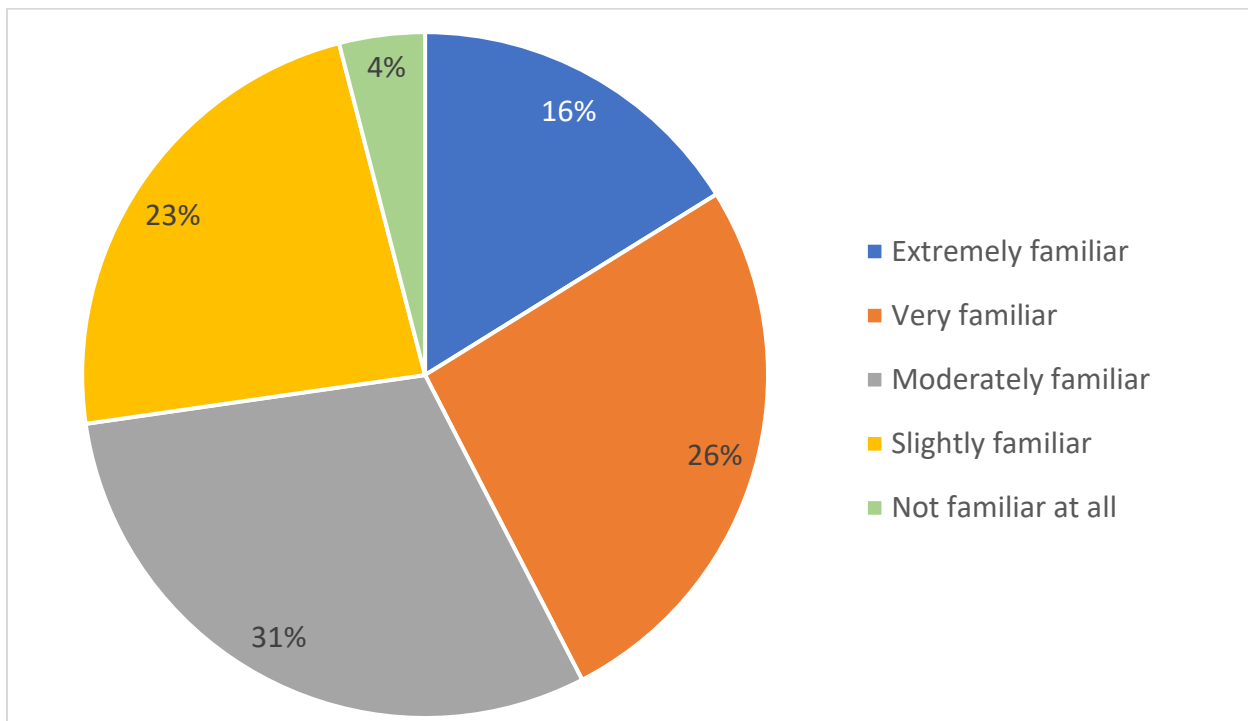
Then, we answered the question **what affects the likelihood to buy Arizona-grown pecans** in a similar fashion and find that the likelihood to buy them is increased when consumers are familiar with pecans, know more about pecans and pecan nutrition information, are female, older and with a higher income. A lower education level decreases the likelihood.

It appears that most people might only buy pecans for special occasions (Thanksgiving, Christmas), which means that there is an opportunity to increase purchase/ consumption by providing year-round recipes (smoothies, salad topping, snacking) to move the “few times a year” shoppers to “about once a month.”

4.3. Familiarity and Knowledge of Pecans and Arizona-Grown Pecans

In addition to looking at purchase and consumption patterns, respondents were asked about their familiarity with pecans and Arizona-grown pecans, as well as their knowledge about pecans and related health benefits. Sixteen percent stated they were extremely familiar and 26 percent stated they were very familiar with pecans. However, about 57 percent of participants indicated they were only moderately or slightly familiar with pecans. Four percent responded that they were not at all familiar with pecans in general (see figure 5).

Figure 5. Familiarity with Pecans

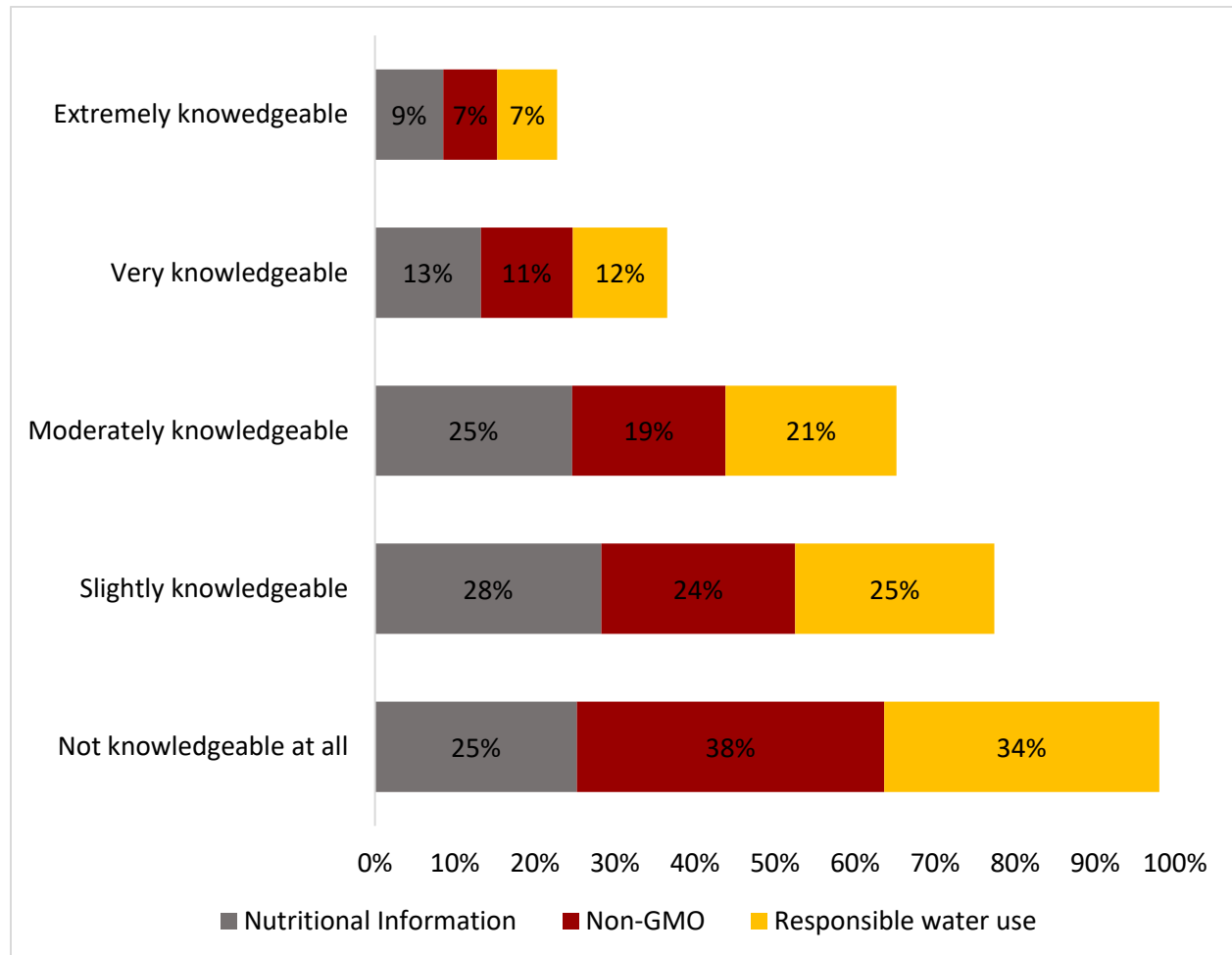


Regarding the question “Have you heard of Arizona-grown pecans?” almost half of the sample (49.5%) said they had never heard of Arizona-grown pecans before. These results indicate there are opportunities to inform consumers who are rather unfamiliar with pecans and Arizona-grown pecans to increase their purchase and consumption frequency.

When asked about their knowledge of pecans in general, 73 percent responded that they were moderately knowledgeable to not knowledgeable, which indicates a strategic opportunity to inform consumers.

We further asked about the type of knowledge consumers had about pecans. More than half of the respondents indicated they were slightly to not knowledgeable at all about the nutritional information of pecans, the non-GMO project verified label, and about responsible use of water in food production (see figure 6).

Figure 6. Knowledge of Pecan Production



We also asked participants how much they liked pecans and Arizona-grown pecans, and 63 and 41 percent, respectively, responded that they liked them much or very much. This indicates a marketing opportunity for Arizona-grown pecans to capitalize on the favorability of pecans in general and gain market share.

41% like Arizona-grown pecans much or very much.

4.4. Preferred Retail Format and Package Size

Next, we split the sample between participants who indicated that they are buying pecans ($n=2,647$) and those who currently do not buy pecans ($n=383$). We asked those who indicated they buy pecans, where they usually buy them, and what package size they buy most often. Participants who indicated they do not buy pecans were asked where they *would* buy them and which package size they *would* prefer if they were to make a purchase.

Traditional grocery stores are preferred to buy pecans.

As shown in figure 7, both current shoppers and potential shoppers prefer to buy or would prefer to buy pecans in conventional grocery stores. However, when referring to preferred package size, current shoppers preferred the 8oz. package, while potential shoppers preferred the smallest option (1.5oz.) (see figure 8). These results indicate that potential pecan shoppers might be interested in trying small quantities of pecans rather than bigger packages. To target potential pecan consumers, marketing efforts could emphasize attractive snack-sized packages at conventional grocery stores.

Shoppers prefer 8oz. packages of pecans.

Future shoppers prefer pecan snack packs (1.5oz).

Figure 7. Current Pecan Shoppers vs. Potential Pecan Shoppers: Preferred Point of Sale

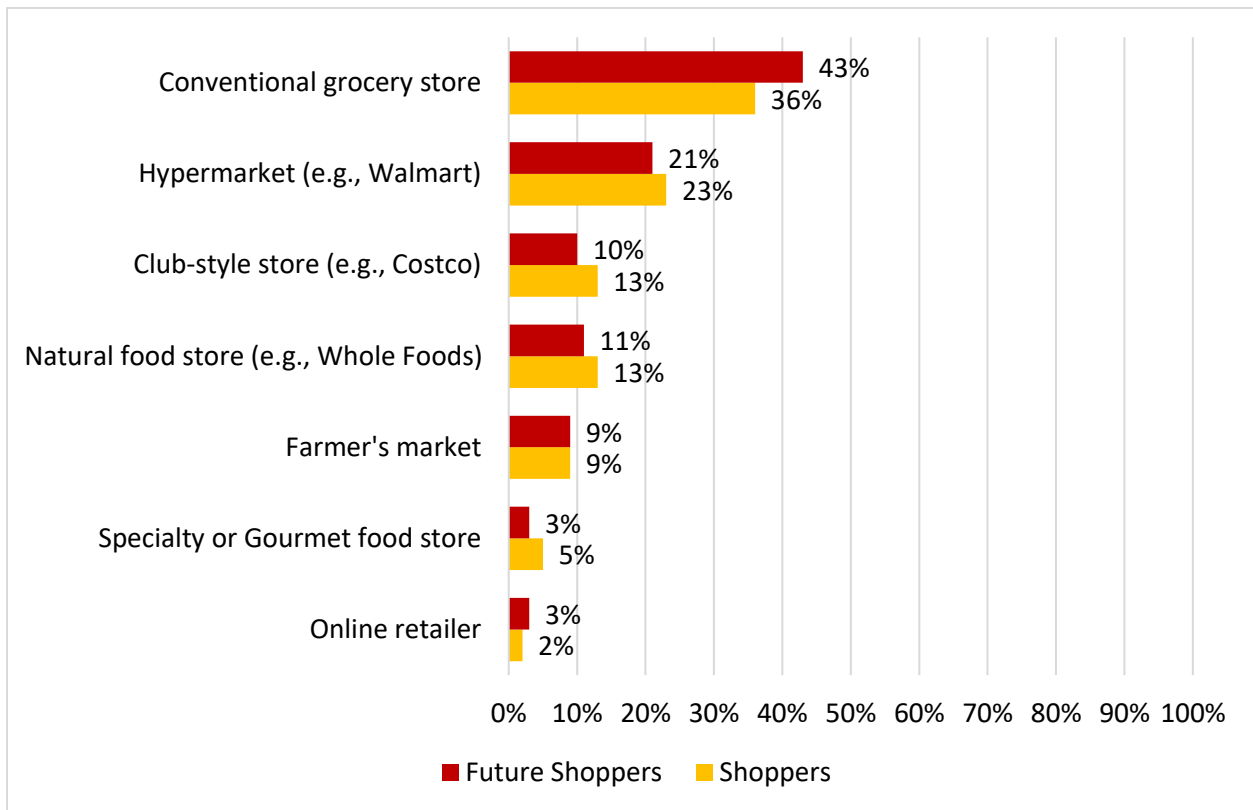
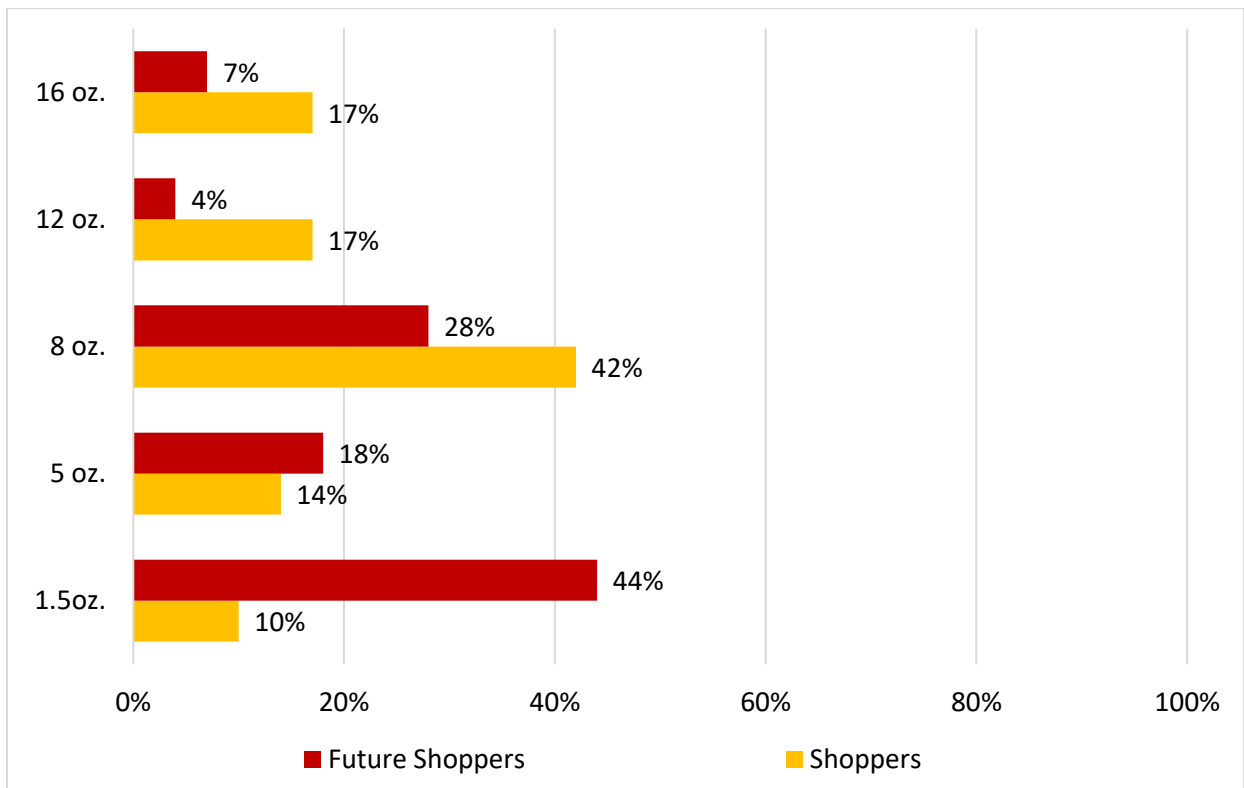


Figure 8. Current Pecan Shoppers vs. Potential Pecan Shoppers: Preferred Package Size



4.5. Relationship between Pecan Information and Pecan Purchase Likelihood

To test the effect of information on the purchase likelihood of pecans, we provided participants with nutritional and production information. Similarly, we included information about Arizona-grown pecans. Participants received the information displayed in table 1.

Participants mentioned that they didn't know much about pecans, and that the information provided in the survey was helping them to investigate more about pecans and make more informed decisions about their nut purchase. One participant noted, *"I had no clue pecans were grown in Arizona, I always think of pecan pie which is more a southeastern thing."* Another one highlighted the importance of environmental information, *"I know that almonds use an obscene amount of water. Not sure about pecans but will research!"* And another one expressed the willingness to try Arizona-grown pecans after learning about them: *"I had no idea Arizona was a producer of pecans. I will look for them next time I'm at the store."*

Table 1. Information Provided to Consumers¹

Pecan Information
Pecans are the only major tree nut truly native to the U.S.
Pecans can be used whole, chopped, or ground in baked goods; pecan halves are often placed on top of cookies, pies, and cakes for decoration. They can also be used in recipes for candy, or it could be a good addition to ice cream.
Pecans are a good source of plant protein, healthy fats, and fiber that can keep you energized and satisfied.
You can find pecans in grocery stores, natural food stores, club-style stores, hypermarkets, and farmer's markets. You can also order pecans through online platforms.
None of the U.S.-grown pecans contain GMOs.
Pecans are cholesterol-free, sodium-free, and low in carbohydrates.
Most of the fat found in pecans is a healthy type called monounsaturated fat. Eating foods with monounsaturated fat instead of foods high in monosaturated fats can help lower levels of bad cholesterol. Keeping your LDL cholesterol low cuts down your risk of having a stroke or heart attack.
Pecans are a good source of calcium, magnesium, and potassium, which help lower blood pressure.
Pecans grown in Arizona use fewer pesticides than pecans grown in other states because the climate excludes some pests and diseases in more humid areas.
Arizona is the fourth largest pecan producer nationwide.

¹ Sources: 1). <https://americanpecan.com/pecans-101/>, 2). <https://americanpecan.com/health-nutrition/>, 3). <http://www.sciencedirect.com/science/article/pii/S0271531706001278>, and 4). <https://www.ncbi.nlm.nih.gov/pubmed/10719404>

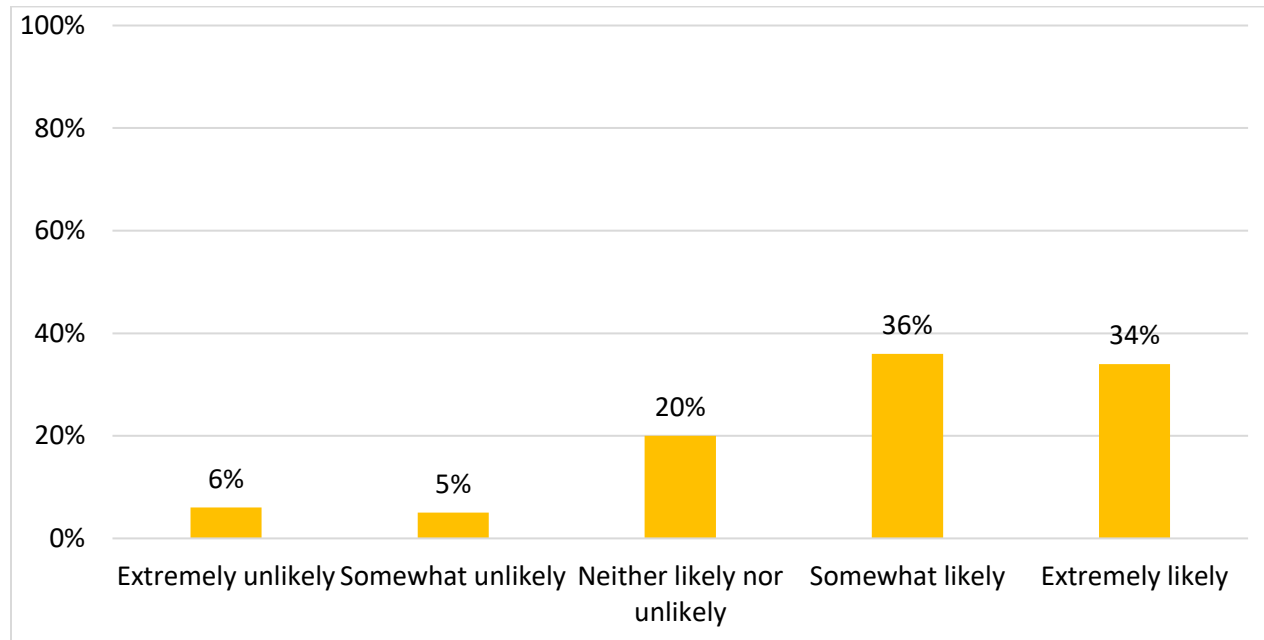
After providing consumers with this information, we asked if they were aware of it, to which 7 percent responded that they were aware of all provided information. However, 66 percent said they were only aware of some of the information, and 27 percent responded that they were completely unaware of it.

Providing specific information on (Arizona-grown) pecans could increase purchase likelihood by 2/3.

To identify the role that this information plays when purchasing pecans, we asked how likely consumers would be to purchase Arizona-grown pecans after they had learned all this about (Arizona-grown) pecans. We found that providing this information increased the likelihood

that a consumer would purchase Arizona-grown pecan nuts (see figure 9). **About 70 percent of respondents indicated they would purchase Arizona-grown pecans.** Hence, providing specific information could increase purchases of Arizona-grown pecans by two-thirds.

Figure 9. Purchase Likelihood for Arizona-grown Pecans after Providing Information

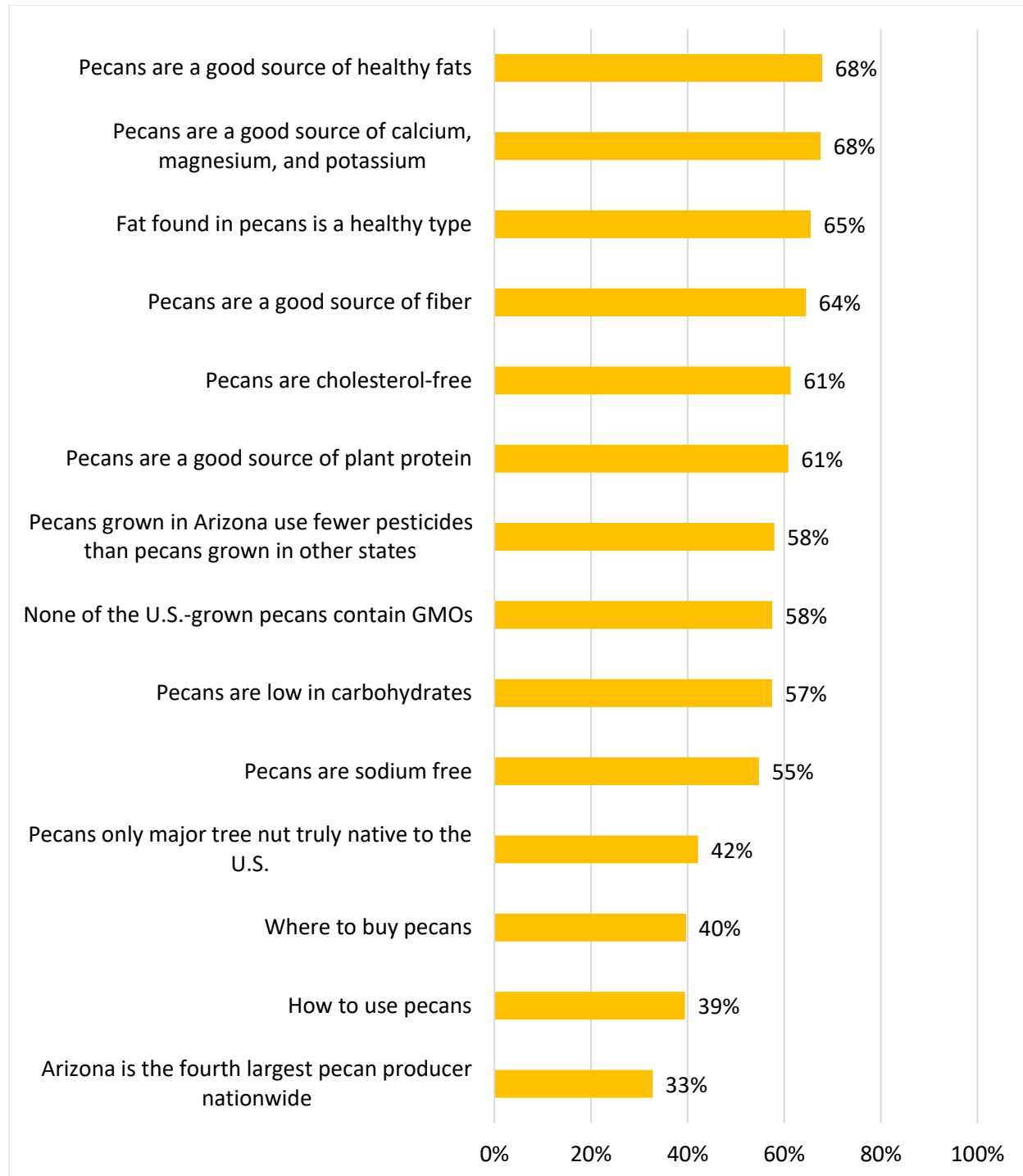


Since the information provided ranged from nutritional facts and production processes to specific Arizona-grown information, we tested which information was most important for consumers; focusing on the likelihood of purchasing pecans in the future. Results in figure 10 indicate that the most important information is related to the nutritional benefits, followed by production techniques (lower use of pesticides and not using GMOs). Given

Nutrition and production information are most important to consumers.

the fact that the nutritional and health aspects of pecans are most important and attractive to consumers, it is vital to increase the information available to consumers regarding the health benefits of pecans. In other words, educating consumers can make a difference between buying and not buying pecans.

Figure 10. Importance of Information about Pecans to Consumers



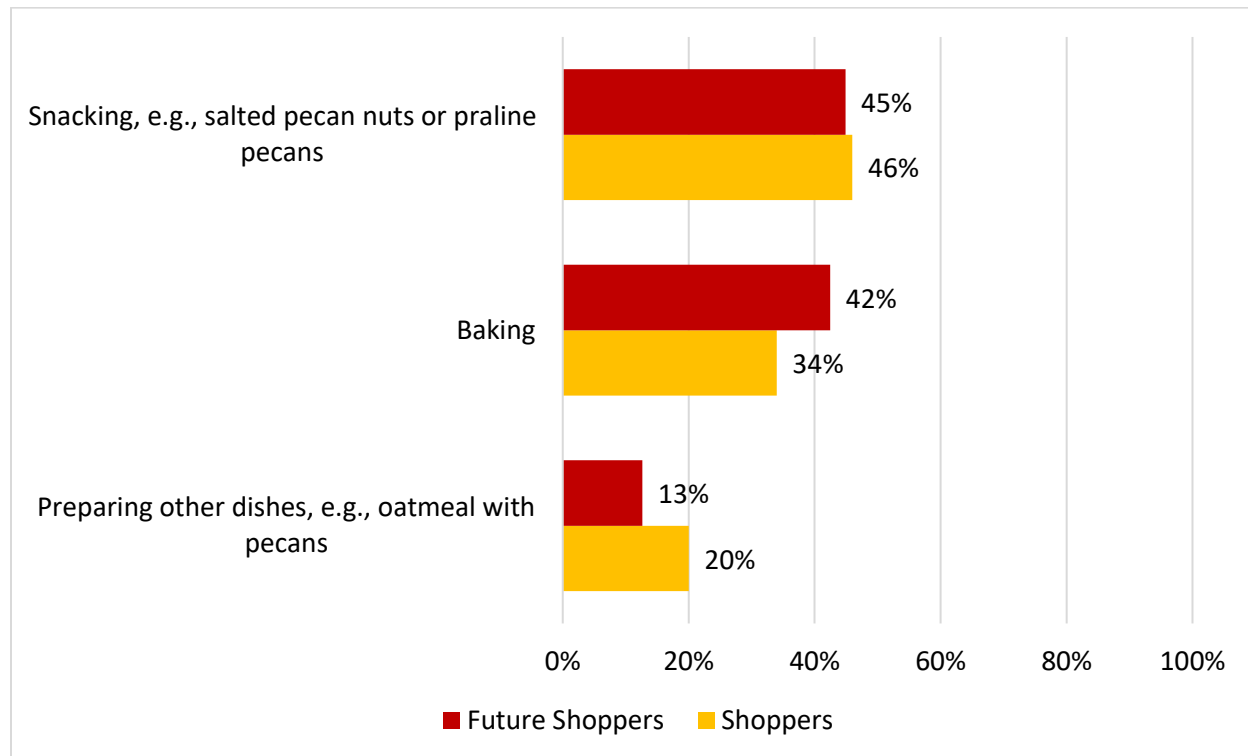
Related question: *“What information about pecans is most important for you to know?”*

4.6. Use of Pecans

Next, we analyzed the main usage of pecans by current pecans consumers. Furthermore, we asked potential customers how they would use pecans. We offered three options. Responses are shown in Figure 11. Both groups responded similarly to snacking on pecans. Interestingly, a larger percentage of potential customers than current consumers indicated they would use it for baking. The usage that was least popular was the use of pecans in recipes, i.e., to prepare other dishes. This leads us to recommend providing recipes in-store and in magazines for future shoppers to encourage them to increase their use of pecans when preparing other dishes.

Pecans used mainly for snacking & baking.

Figure 11. Usage of Pecans by Current and Future Shoppers

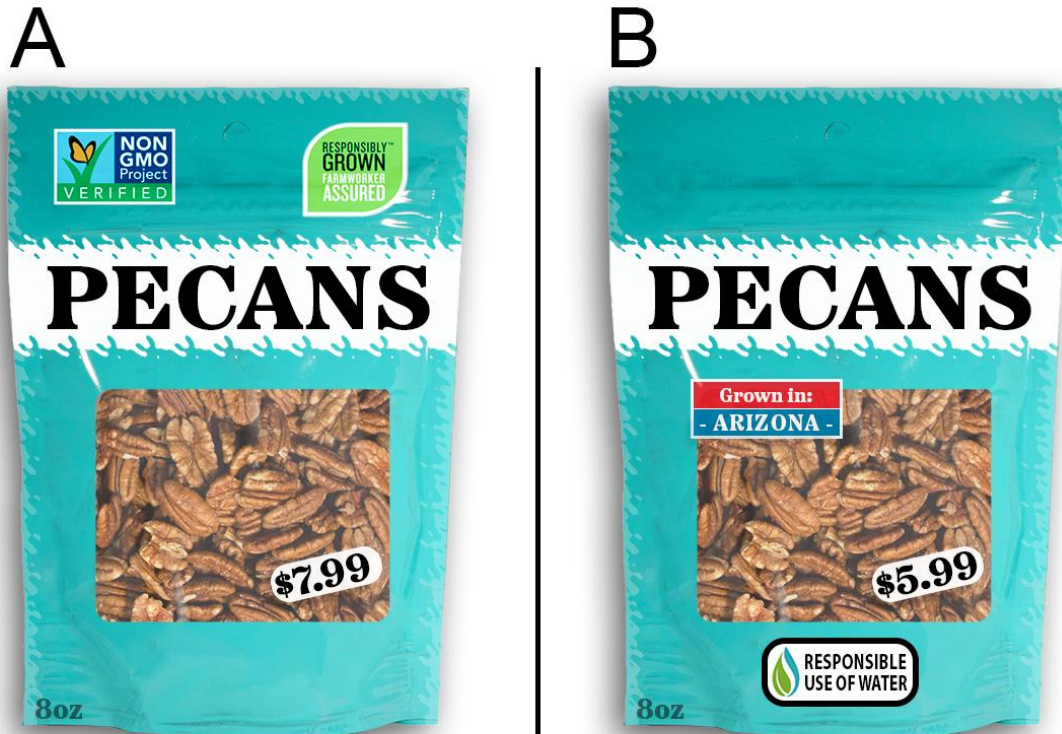


Cross-tabulations were performed to explore this further. The data indicate that households with children purchase pecans more frequently; 18% purchase pecans once a month and 16% once a week. At the same time, 16% of households without children never purchase pecans and 57% purchase them only a few times a year. These statistics combined with the tendency to consume pecans as snacks and in baking suggests that consumers are using pecans as snacks for children, and that consumers are more interested in using healthier ingredients in their recipes, especially after the COVID 19 pandemic.

4.7. Consumer Willingness to Pay for Arizona-grown Pecans

We investigated consumers' willingness to pay for Arizona-grown pecans using a choice task where participants had to choose between different packages of pecans. This was led by the question: *Imagine you are in a grocery store and would like to purchase an 8oz. bag of pecans. Do you choose Option A or Option B? Choose your preferred option or choose "None of these".* Figure 12 presents an example of such a choice task.

Figure 12. Example of Pecan Choice Task



To test the willingness to pay for Arizona-grown pecans, we offered Arizona-grown and Georgia-grown pecans and compared this to packages without any indication of the origin of the nuts. The willingness to pay for Arizona-grown pecans was a 30 cents premium for an 8oz. package of pecans compared to an unlabeled package. In comparison consumers were willing to pay 47 cents more for pecans from Georgia (8oz. package). These figures are similar to other labels, such as, a label indicating “responsible use of water” and a “social” label that indicated “Responsible Grown: Farmworker

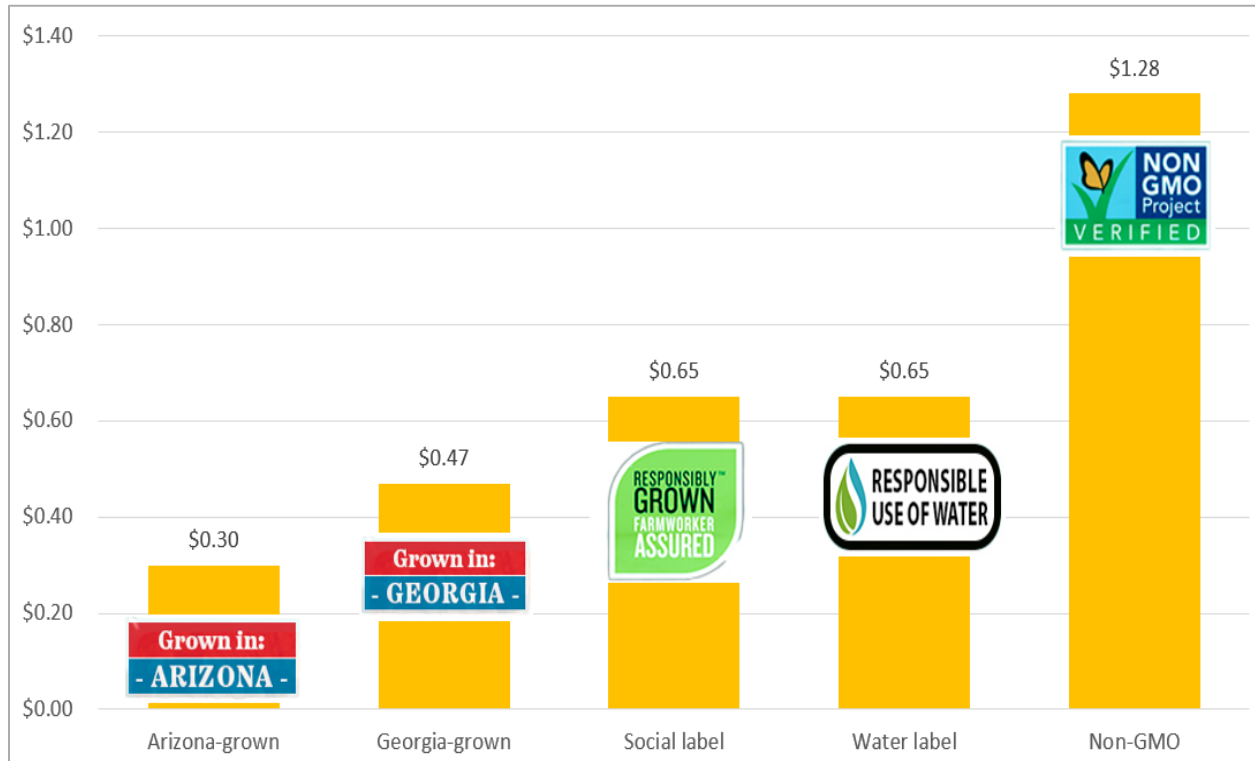
**Willingness to pay for
Arizona-grown
currently the lowest
among the tested
labels**

--

GMO-free the highest.

Assured” (both 65 cents/8oz.). However, the highest premium was reached by the “Non GMO Project” label where consumers’ willingness to pay reached \$1.28/8oz.

Figure 13. Willingness to Pay for Pecan Attributes (\$/8oz)



4.8. Factors of Consumer Willingness to Pay for Arizona-grown Pecans

Price impacts pecan purchase decisions the most.

Using regression analysis, we analyzed drivers of consumer willingness to pay for Arizona-grown pecans. We used sociodemographic information to identify consumer characteristics that increase or decrease willingness to pay for Arizona-grown pecans. Results show that older shoppers are willing to pay slightly less for Arizona-grown pecans

compared to younger shoppers, and that larger households are willing to pay more for Arizona-grown pecans. An interesting finding is that having children in the household decreases consumers’ willingness to pay by 13 cents / 8oz. package of pecans. Consumers who earn over \$50,000 a year before taxes are willing to pay 13 cents more for the 8 oz bag of pecans.

Approximately 64% of participants indicated that the price was the factor that impacted their decisions the most, followed by the GMO-free label, and the water and social labels.

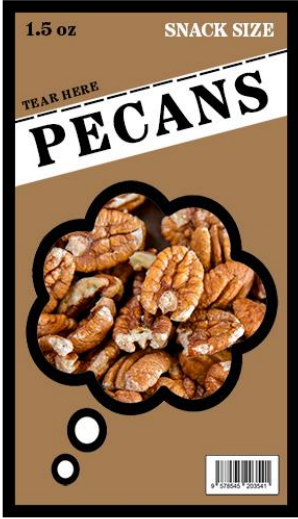
4.9. Consumer Demand for Pecans and Arizona-Grown Pecans to other popular Nuts

Using open-ended choice experiments, we tested how the prices of competing nut products and (Arizona-grown) pecans affect demand for pecans and Arizona-grown pecans. Participants had to indicate how many 1.5 oz snack packs they would buy for a number of purchase scenarios.

A scenario indicates the pair of prices for which the competing nuts, e.g., almonds, and pecans are offered. For example, in Scenario 1 almonds are offered for \$4.49 and pecans and Arizona-grown pecans are offered for \$2.49 per 1.5 oz snack pack.

Participants were asked to imagine they were in a grocery store and would like to buy, e.g., almond and pecan 1.5 oz snack packs. They were shown almond and pecan samples displayed as in the picture below (figure 14). They were presented with different combinations of prices of almonds and pecans. Then, they had to indicate the number of 1.5 oz snack-sized packages of each product they would like to buy for each of the price combinations under each scenario (scenario 1 through 9). If they didn't want to buy the product, they could enter 0.

Figure 14. Example purchase scenario: *Please enter the number of 1.5 oz snack packs that you want to buy for each product. If you do not want to buy any, enter 0.*

	Almonds at \$4.49	Pecans at \$2.49	Arizona-grown Pecans at \$2.49
I would like to buy...	 <p>A 1.5 oz snack size package of almonds. The packaging is brown with a white diagonal banner that says "ALMONDS". Above the banner, it says "1.5 oz" and "SNACK SIZE". Below the banner, there is a thought bubble containing almonds. At the bottom, there is a barcode and the number "8 518543 200541".</p>	 <p>A 1.5 oz snack size package of pecans. The packaging is brown with a white diagonal banner that says "PECANS". Above the banner, it says "1.5 oz" and "SNACK SIZE". Below the banner, there is a thought bubble containing pecans. At the bottom, there is a barcode and the number "8 518543 200541".</p>	 <p>A 1.5 oz snack size package of Arizona-grown pecans. The packaging is brown with a white diagonal banner that says "PECANS". Above the banner, it says "1.5 oz" and "SNACK SIZE". Below the banner, there is a thought bubble containing pecans. At the bottom, there is a barcode and the number "8 518543 200541".</p>

4.9.1. Demand for Pecans compared to Almonds

A total of 207 participants had to indicate how many 1.5 oz snack packs they would buy for a number of purchase scenarios offering almonds and (Arizona-grown) pecans.

Table 2 and figure 15 show that the demand for almonds is independent from the demand for pecans which means that whether pecans have a higher or lower price than pecans does not affect demand for almonds. This in turn means that almonds and pecans are complements not substitutes.

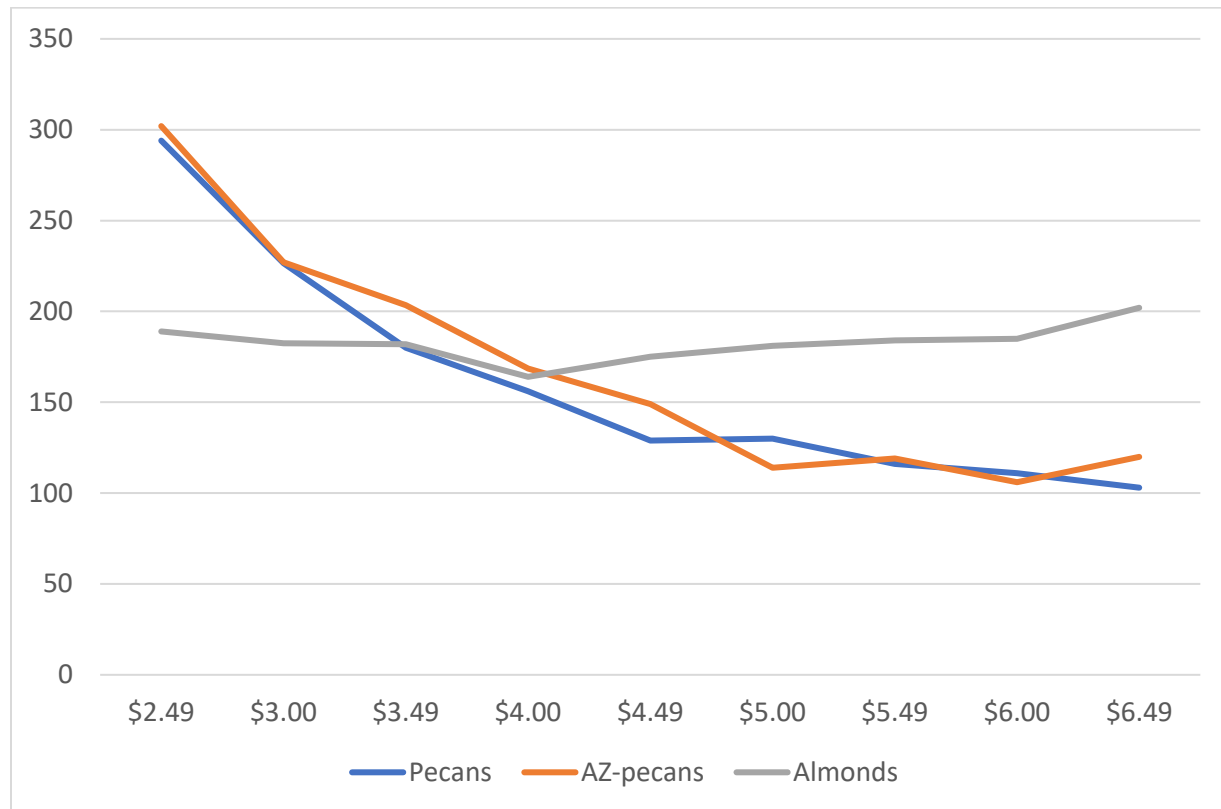
The demand for pecans and Arizona-grown pecans is very similar. As expected, the higher the price the lower the demand. Furthermore, as expected, the percentage of times that no pecans are chosen increases drastically with an increase in price. When the price for pecan snack packs is \$2.49, about one-third of participants choose not to buy any pecans. This number increases drastically as the price increases reaching about three-quarters of participants who choose not to buy any pecans when the price is \$6.00 per snack pack and higher.

Table 2. Demand for pecans compared to almonds

Almonds			Pecans			AZ-Pecans		Scenario
Price	Quantity	% zero	Price	Quantity	% zero	Quantity	% zero	
\$ 4.49	189	44%	\$ 2.49	294	27%	302	29%	1
\$ 4.49	183	46%	\$ 3.00	227	43%	227	42%	2
\$ 4.49	182	50%	\$ 3.49	180	51%	204	51%	3
\$ 4.49	164	50%	\$ 4.00	156	59%	169	58%	4
\$ 4.49	175	48%	\$ 4.49	129	65%	149	64%	5
\$ 4.49	181	49%	\$ 5.00	130	69%	114	71%	6
\$ 4.49	184	47%	\$ 5.49	116	71%	119	72%	7
\$ 4.49	185	49%	\$ 6.00	111	74%	106	76%	8
\$ 4.49	202	48%	\$ 6.49	103	76%	120	77%	9
Total								
demand	1,645			1,446		1,509		

Note: Quantity indicates the number of snack packs that participants stated they would purchase at the given price, measured in number of 1.5oz snack packs. % Zero indicates the percentage of times that no snack packs were chosen. AZ=Arizona-grown.

Figure 15. Demand for pecans compared to almonds (x-axis shows prices, y-axis shows quantity in number of 1.5oz. snack packs)



Note: Two outliers of a quantity of 99 snack packs for pecans and 100 snack packs for Arizona-grown pecans were excluded from the analysis as these were deemed to be typos.

4.9.2. Demand for Pecans compared to Cashews

A total of 200 participants had to indicate how many 1.5 oz snack packs they would buy for a number of purchase scenarios offering cashews and (Arizona-grown) pecans.

Table 3 and figure 16 show that the demand for cashews is independent from the demand for pecans which means that whether pecans have a higher or lower price than pecans does not affect demand for cashews. This in turn means that cashews and pecans are complements not substitutes.

The demand for pecans and Arizona-grown pecans is very similar. As expected, the higher the price the lower the demand. Furthermore, as expected, the percentage of times that no pecans are chosen increases drastically with an increase in price. When the price for pecan snack packs is \$2.49 about one-quarter of participants choose not to buy any pecans. This number increases drastically as the price increases reaching about three-quarters of participants who choose not to buy any pecans when the price is \$6.00 per snack pack and higher.

Table 3. Demand for pecans compared to cashews

Cashews			Pecans			AZ-Pecans		Scenario		
Price	Quantity	% zero	Price	Quantity	% zero	Quantity	% zero			
\$ 4.49	254	31%	\$ 2.49	302	25%	280	27%	1		
\$ 4.49	231	37%	\$ 3.00	255	37%	232	38%	2		
\$ 4.49	227	40%	\$ 3.49	221	46%	202	44%	3		
\$ 4.49	213	40%	\$ 4.00	170	56%	198	51%	4		
\$ 4.49	4	98%	\$ 4.49	168	60%	180	56%	5		
\$ 4.49	214	38%	\$ 5.00	141	67%	136	68%	6		
\$ 4.49	210	38%	\$ 5.49	131	71%	139	71%	7		
\$ 4.49	218	36%	\$ 6.00	121	75%	123	76%	8		
\$ 4.49	215	38%	\$ 6.49	113	77%	112	79%	9		
Total demand			1,785			1,622			1,601	

Figure 16. Demand for pecans compared to cashews (x-axis shows prices, y-axis shows quantity in number of 1.5oz. snack packs)



4.9.3. Demand for Pecans compared to Peanuts

A total of 201 participants had to indicate how many 1.5 oz snack packs they would buy for a number of purchase scenarios offering peanuts and (Arizona-grown) pecans.

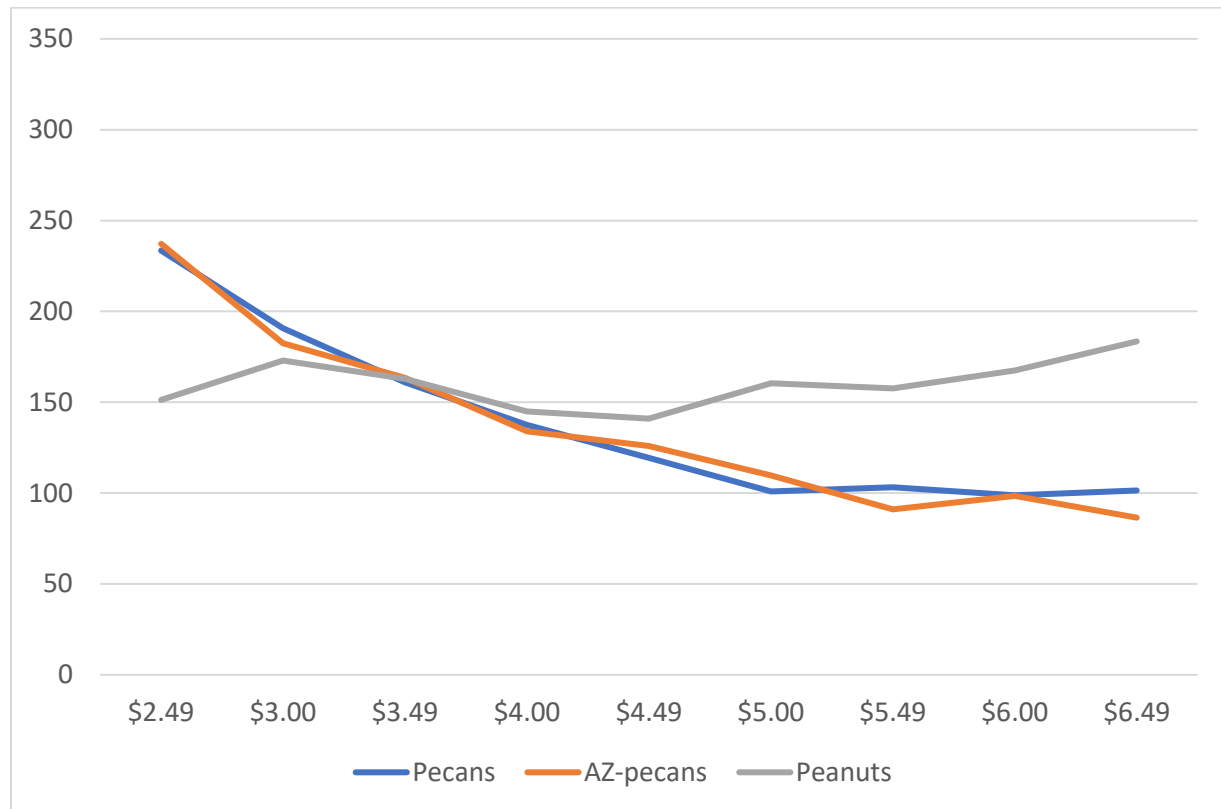
Table 4 and figure 17 show that the demand for peanuts is independent from the demand for pecans which means that whether pecans have a higher or lower price than pecans does not affect demand for peanuts. This in turn means that peanuts and pecans are complements not substitutes.

The demand for pecans and Arizona-grown pecans is very similar. As expected, the higher the price the lower the demand. Furthermore, as expected, the percentage of times that no pecans are chosen increases drastically with an increase in price. When the price for pecan snack packs is \$2.49 about one-third of participants choose not to buy any pecans. This number increases drastically as the price increases reaching about three-quarters of participants who choose not to buy any pecans when the price is \$5.00 per snack pack and higher.

Table 4. Demand for pecans compared to peanuts

Peanuts			Pecans			AZ-Pecans		Scenario
Price	Quantity	% zero	Price	Quantity	% zero	Quantity	% zero	
\$ 4.49	151	52%	\$ 2.49	234	32%	237	38%	1
\$ 4.49	173	54%	\$ 3.00	191	41%	183	48%	2
\$ 4.49	163	56%	\$ 3.49	161	51%	164	52%	3
\$ 4.49	145	56%	\$ 4.00	138	61%	134	60%	4
\$ 4.49	141	57%	\$ 4.49	120	63%	126	61%	5
\$ 4.49	161	52%	\$ 5.00	101	75%	110	70%	6
\$ 4.49	158	52%	\$ 5.49	103	77%	91	75%	7
\$ 4.49	168	51%	\$ 6.00	99	79%	99	76%	8
\$ 4.49	184	53%	\$ 6.49	102	79%	87	79%	9
Total demand			1,443			1,247		1,229

Figure 17. Demand for pecans compared to peanuts (x-axis shows prices, y-axis shows quantity in number of 1.5oz. snack packs)



4.9.4. Demand for Pecans compared to Pistachios

A total of 196 participants had to indicate how many 1.5 oz snack packs they would buy for a number of purchase scenarios offering pistachios and (Arizona-grown) pecans.

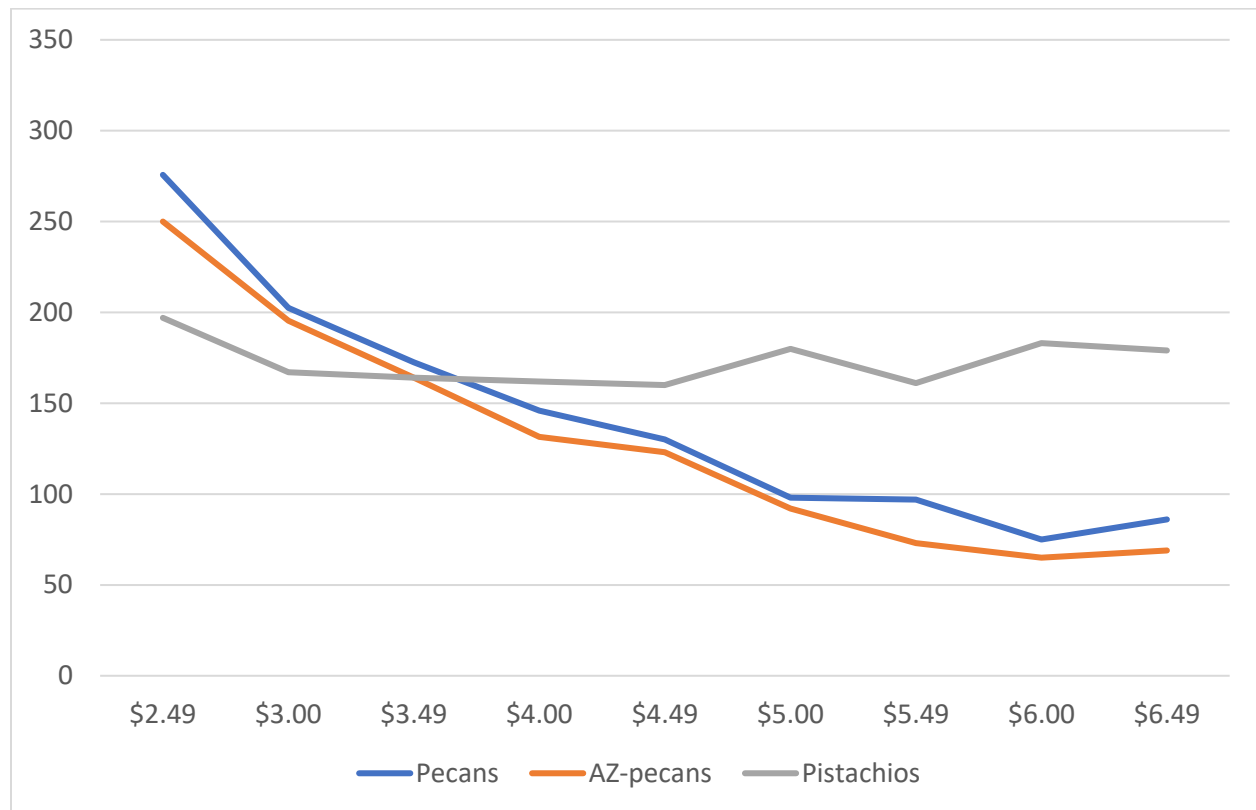
Table 5 and figure 18 show that the demand for pistachios is independent from the demand for pecans which means that whether pecans have a higher or lower price than pecans does not affect demand for pistachios. This in turn means that pistachios and pecans are complements not substitutes.

The demand for pecans and Arizona-grown pecans is very similar. As expected, the higher the price the lower the demand. Furthermore, as expected, the percentage of times that no pecans are chosen increases drastically with an increase in price. When the price for pecan snack packs is \$2.49 about one-quarter of participants choose not to buy any pecans. This number increases drastically as the price increases reaching about two-thirds of participants who choose not to buy any pecans when the price is \$5.00 per snack pack and higher.

Table 5. Demand for pecans compared to pistachios

Pistachios			Pecans			AZ-Pecans		Scenario		
Price	#	% zero	Price	#	% zero	#	% zero			
\$ 4.49	197	34%	\$ 2.49	275.7	22%	250	29%	1		
\$ 4.49	167	39%	\$ 3.00	202.5	36%	196	35%	2		
\$ 4.49	164	39%	\$ 3.49	172.5	47%	164	51%	3		
\$ 4.49	162	41%	\$ 4.00	146	55%	132	58%	4		
\$ 4.49	160	41%	\$ 4.49	130	60%	123	60%	5		
\$ 4.49	180	35%	\$ 5.00	98	68%	92	71%	6		
\$ 4.49	161	35%	\$ 5.49	97	72%	73	77%	7		
\$ 4.49	183	35%	\$ 6.00	75	79%	65	83%	8		
\$ 4.49	179	32%	\$ 6.49	86	76%	69	81%	9		
Total demand			1,553			1,283			1,163	

Figure 18. Demand for pecans compared to pistachios (x-axis shows prices, y-axis shows quantity in number of 1.5oz. snack packs)



4.9.5. Demand for Pecans compared to Walnuts

A total of 202 participants had to indicate how many 1.5 oz snack packs they would buy for a number of purchase scenarios offering walnuts and (Arizona-grown) pecans.

Table 6 and figure 19 show that the demand for walnuts is independent from the demand for pecans which means that whether pecans have a higher or lower price than pecans does not affect demand for walnuts. This in turn means that walnuts and pecans are complements not substitutes.

The demand for pecans and Arizona-grown pecans is very similar. As expected, the higher the price the lower the demand. Furthermore, as expected, the percentage of times that no pecans are chosen increases drastically with an increase in price. When the price for pecan snack packs is \$2.49 about one-quarter of participants choose not to buy any pecans. This number increases drastically as the price increases reaching about three-quarters of participants who choose not to buy any pecans when the price is \$5.00 per snack pack and higher.

Table 6. Demand for pecans compared to walnuts

Price	Walnuts		Price	Pecans		AZ-Pecans		Scenario
	Quantity	% zero		Quantity	% zero	Quantity	% zero	
\$ 4.49	151	48%	\$ 2.49	297	23%	298	27%	1
\$ 4.49	151	49%	\$ 3.00	205	39%	220	43%	2
\$ 4.49	139	51%	\$ 3.49	189	44%	195	46%	3
\$ 4.49	149	50%	\$ 4.00	151	55%	174	54%	4
\$ 4.49	151	53%	\$ 4.49	128	60%	137	62%	5
\$ 4.49	153	53%	\$ 5.00	102	73%	104	73%	6
\$ 4.49	189	49%	\$ 5.49	94	76%	104	75%	7
\$ 4.49	161	49%	\$ 6.00	87	78%	101	79%	8
\$ 4.49	171	47%	\$ 6.49	79	80%	98	78%	9
Total demand	1,414			1,330		1,430		

Figure 19. Demand for pecans compared to walnuts (x-axis shows prices, y-axis shows quantity in number of 1.5oz. snack packs)



Demand for pecans and Arizona-grown pecans is price-sensitive.

Demand for competing nut products is stable and independent of price for (Arizona-grown) pecans.

Demand for pecans and Arizona-grown pecans is very similar.

If the price for a snack pack is \$4 and higher less than 50% are buying.

4.10. Factors of Consumer Demand for Arizona-grown Pecans

Next, we used Tobit model estimations to determine what affects the demand for pecans in general and Arizona-grown pecans in particular. We find that:

- When compared to almonds, the demand for pecans goes down by -0.6 snack packs (equivalent to about 0.9 oz) with every increase in price by \$1, the demand for Arizona-grown pecans goes down by -0.7 snack packs (equivalent to about 1 oz).
- When compared to cashews, the demand for pecans goes down by -0.7 snack packs with every increase in price by \$1, the demand for Arizona-grown pecans also goes down by -0.7 snack packs.
- When compared to peanuts, the demand for pecans goes down by -0.6 snack packs with every increase in price by \$1, the demand for Arizona-grown pecans also goes down by -0.6 snack packs.
- When compared to pistachios, the demand for pecans goes down by -0.7 snack packs with every increase in price by \$1, the demand for Arizona-grown pecans also goes down by -0.7 snack packs.
- When compared to walnuts, the demand for pecans goes down by -0.7 snack packs with every increase in price by \$1, the demand for Arizona-grown pecans also goes down by -0.7 snack packs.

This shows that the demand for (Arizona-grown) pecans is sensitive to price. On average, demand goes down by about 1 ounce with a one dollar increase in price, and this result is the same no matter to which other nuts pecans are compared to.

We used additional estimations to investigate factors that affect the demand. When comparing pecans to almonds, findings show the older consumers are, the lower the demand for both pecans and Arizona-grown pecans. If the consumer is female, they will buy one snack pack of Arizona-grown pecans less than men with every dollar increase in price. Consumers with higher incomes are displaying a greater demand for Arizona-grown pecans.

When comparing pecans to cashews, findings show the older consumers are, the lower the demand for both pecans and Arizona-grown pecans. If the consumer is female, they will buy one snack pack of pecans less than men with every dollar increase in price. Consumers with higher education are displaying a greater demand for pecans.

When comparing pecans to peanuts, findings show that larger households have a higher demand for pecans, and White consumers have a considerably lower demand for pecans.

When comparing pecans to pistachios, findings show the older consumers are, the lower the demand for both pecans and Arizona-grown pecans. If the consumer is female, they will buy less pecans and Arizona-grown pecans than men with every dollar increase in price. Consumers with higher income and children in the household are displaying a greater demand for Arizona-grown pecans. The latter also holds for pecans. Larger households display a lower demand for pecans.

When comparing pecans to walnuts, findings show the older consumers are, the lower the demand for pecans. If the consumer is female, they will buy one snack pack of (Arizona-grown) pecans less than men with every dollar increase in price. Consumers with higher income are displaying a greater demand for Arizona-grown pecans. Table 7 displays these results.

Table 7. The effect of price and socio-demographics on demand for pecans and Arizona-grown pecans depending on competing nuts

Compared to	Almonds		Cashews		Peanuts		Pistachio		Walnut	
	Pecans	AZ- Pecans	Pecans	AZ- Pecans	Pecans	AZ- Pecans	Pecans	AZ- Pecans	Pecans	AZ-Pecans
Price	-0.63***	-0.70***	-0.69***	-0.69***	-0.58***	-0.57***	-0.67***	-0.69***	-0.73***	-0.73***
Female	-0.40	-1.08***	-0.98*	-0.93	0.18	0.02	-0.59*	-1.05***	-1.35***	-1.00**
Age	-0.03***	-0.04***	-0.04**	-0.05**	-0.01	-0.02	-0.04***	-0.06***	-0.03***	-0.01
Income	0.02	0.07***	-0.11	-0.05	-0.04	0.02	0.08	0.11*	0.05	0.13*
Education	0.07	-0.04	0.36*	0.08	-0.04	-0.21	0.04	-0.09	0.15	-0.02
HH-size	-0.06	-0.08	0.20	0.12	0.52***	0.30	-0.38**	-0.09	0.05	0.10
Child in HH	-0.05	0.12	0.99	0.86	-0.20	0.15	0.90**	0.79*	0.58	0.79
White	-0.03	0.08	-0.88	-0.78	-1.34**	-0.10	-0.49	-0.24	-0.36	-0.51
Hispanic	0.09	0.19	0.23	0.41	-0.23	0.42	-0.27	0.07	-0.03	-0.03
Constant	3.40***	4.54***	4.05***	5.03***	2.27**	2.16*	5.07***	5.17***	3.84***	2.77***

Note: HH=Household, AZ=Arizona-grown. *** indicates 1% level of significance, ** indicates 5% level of significance, * indicates 10% level of significance.

5. Conclusions

Results of our online consumer survey with 3,030 participants showed that 51% of shoppers buy pecans only a few times a year, and 18% never buy pecans. This indicates the potential to win them over as future buyers using some marketing strategies discussed below. A further opportunity is to increase the shopping patterns of those who currently buy pecans about once a month (16%) and every two weeks or at least once a week (8% each). However, it would be interesting to investigate further whether purchase frequency is low due to high quantity purchases or low consumption after all. In general, the frequency in which pecans are purchased and consumed are very similar.

Among the reasons why consumers do not buy pecans are high prices, a dislike of flavor, and a misperception regarding the health value of pecans. This means that marketing activities can be designed to educate consumers further about pecans and ultimately increase purchase and consumption. This is especially important because 73% of participants are only moderately knowledgeable or not knowledgeable at all with regards to pecans, and 57% indicated only moderate or slight familiarity with pecans. Almost half of the sample had never even heard of

Arizona-grown pecans before. Targeted information and education campaigns can be employed to alleviate this and increase knowledge and familiarity.

When presented with pecan information two-thirds of participants noted that they had only been aware of some of it, and 27% stated they were completely unaware of it. That said, they liked to learn more about pecans and thought that the most important information to know about pecans is related to nutritional benefits and production techniques. Hence, it is important to make such information available to consumers. Especially, because it could increase purchases of Arizona-grown pecans – 70% noted they would purchase Arizona-grown pecans after learning more about (Arizona-grown) pecans; and when asked how much they like pecans and Arizona-grown pecans, 63% and 41%, respectively said they liked them (very) much.

When it comes to shopping patterns, customers prefer to buy 8oz. packages of pecans in conventional grocery stores. Potential shoppers would prefer snack packs (1.5oz.). Hence, potential pecan consumers could be enticed to buy pecans by offering attractive snack-size packages. The majority of pecan consumers prefer to snack on pecans, but fewer prefer to use them in recipes, which means that recipes in-store and in magazines could encourage consumers to use them more often.

With regards to willingness to pay, we find that the premium for origin is rather low compared to premiums for production methods. The same holds for demand. Respondents were sensitive to price, and on average, demand went down by about 1oz. with a one-dollar increase in price.

6. Recommendations for Arizona-grown pecans Key Marketing Strategies to Ensure Sustainable Success

This research has yielded interesting and insightful findings about consumers' purchase and consumption behavior and their knowledge about pecans. Throughout the report, recommendations have been advanced to further develop effective marketing strategies to raise awareness, highlight the health benefits, and enhance the appeal of pecans. Here, we consolidate them into key points.

Specifically, we derive the following *Key Marketing Strategies*:

- 1. Educate on specific characteristics of pecans and Arizona-grown pecans**
- 2. Use user-imagery**
- 3. Position based on usage occasion**
- 4. Use storytelling**
- 5. Capitalize on pecan production methods**
- 6. Capitalize on current marketplace trends**
- 7. Enhance seasonal marketing**
- 8. Inform on proper storage**

6.1. Educate on specific characteristics of pecans and Arizona-grown pecans

When respondents were queried about their knowledge of pecans a significant percentage of respondents indicated that they were only slightly knowledgeable or not knowledgeable at all. This segment of consumers, who are unfamiliar or only slightly familiar with pecans, indicates a marketing opportunity. Innovative use of social media, using popular types of recipes (e.g., granola bars), can provide an opportunity to educate consumers on the taste, ease, and nutritional properties of pecans. Importantly, these forums are also highly visual, which allows consumers to see, up close, the pecan origins. A strategy could be to partner with influencers or chefs to create cooking demos that showcase the versatility of pecans in different cuisines. Visually representing the Arizona nut and the desert locale could be beneficial in enhancing the value that the nut has for the local economy and the importance of the nut for the livelihood of Arizona pecan farmers. It could also provide support for a pricing strategy as many of those who do not buy pecans mention them as “too expensive,” which could be purely a misperception.

6.2. Use user-imagery

Another recommendation pertains to the idea that “a picture is worth a thousand words.” Understanding consumer associations is important; it allows marketers an understanding of which associations can be exploited, and which need to be extinguished. Incorporating the ideal consumer (or user or symbols) of the brand allows marketers to provide an aesthetic appearance of the brand's core messaging. If pecans are about health and nature, the idea is to connect the right symbols to convey the brand's messages to the target audience. Imagery is the “visual language used to help users relate to a brand and their products.” Symbols (e.g., the U.S. flag to remind consumers about the only native nut from the U.S. or the Arizona flag for Arizona-grown pecans to highlight the Arizona origin), sponsorships (e.g., events, spokespeople, bloggers, influencers), bold branding, among other factors, contribute to the product position and positive consumer perceptions of pecans.

6.3. Position based on usage occasion -- Updated recipes that reflect current marketplace trends of health, wellness, on-the-go energy and snacking

Our data illustrated that a number of respondents associated health properties with pecans (e.g., pecans are a good source of healthy fat, fiber, and plant protein). Furthermore, consumers held strong associations with holidays, holiday desserts, and nostalgic trips to the Southern U.S. Hence, marketing activities can be targeted towards the different consumer groups, where some promotional activities play up the medicinal usefulness of pecans and others focus on nostalgia to increase consumption frequency.

Noting the high percentage of consumers who indicated associations of pecans with memories of holidays and special occasions, we believe there is a tremendous opportunity to capitalize on these positive feelings of nostalgia and broaden the consumption occasions associated with

pecans by promoting them in everyday desserts and usage occasions. Many of the desserts mentioned included those served during the holidays, e.g., pecan pie, pecan cookies, pecan ice cream. We believe an opportunity exists to capitalize on positive associations by promoting an expansion of the types of desserts and recipes that pecans can enhance.

It seems to be advantageous for pecan suppliers to be proactive, positioning their product as functional, natural, and nutritious, for instance, for use in granola bars, and shakes. In particular, we found little association between pecans and popular snack bars. This raised the question of whether consumers perceive snack bars as foods that contain pecans. Hence, future promotional activities could play up pecans as a healthy ingredient in snack bars.

6.4. Use storytelling

Our results indicate that consumers are willing to pay a premium for a label that ensures good conditions for farm workers; this finding offers an opportunity to enhance the cultural importance of pecan production for farmers in Arizona. Marketing efforts could craft a compelling brand story for pecans, emphasizing their origin, sustainability practices, and the people behind the production. Given the importance of pecans for Arizona, sharing stories of local pecan farmers and the importance for their communities could create a connection with consumers. This recommendation, in addition to the market trend of consumers preferring to buy local, could boost pecan purchases and knowledge among consumers.

6.5. Capitalizing on pecan production methods

Findings showed that information related to the use of pesticides and GMOs was very important for consumers. Pecans in Arizona are produced without GMOs, with low pesticides, and with technology that reduces water waste. Hence, this offers an opportunity to label the products as GMO-free and employ other environmental labels. The analysis of willingness to pay indicated a \$1.28 premium for pecans produced without GMOs. In addition, participants indicated that information about pecan production methods was important to them. This could also strengthen the argument for a “natural” food product when marketing pecans.

6.6. Capitalize on current marketplace trends

Current marketplace trends indicate that consumers are snacking more (Goldschmidt, 2021) and seeking healthier snacks (BNP Media, 2020). Prior to the COVID-19 pandemic, 70% of US adults snacked two or more times per day; post-pandemic, we have seen these behaviors rise (Chenarides et al., 2021). Healthy eating has also grown in importance with the pandemic (Mintel Reports, 2021). “Even if many consumers may not dramatically transform their diets in the short run, the awareness and sense of urgency brought by the pandemic creates opportunities for educating consumers and promoting the benefits of health-focused fare, especially nutrients and foods that can promote holistic wellness and boost overall immune health” (Mintel Reports,

2021). Additionally, even post-pandemic, a higher percentage of consumers have indicated they will continue to work more hours from home. Pecan marketers are in a position to take advantage of these marketplace trends.

Because pecans are a high-quality source of protein, high in nutrients, and contain unsaturated fats, they can have a protective effect of lowering total blood cholesterol when eaten moderately. This makes pecans a safer choice for people who are concerned about their cholesterol and heart diseases in general, as well as, for consumers seeking more natural ingredients and nutritious snacks. Because consumers continue to be working from home more, they are less interested in packaged snacks (Mintel Report, 2021). Instead, homemade snacks are rising in popularity. Social media has also fueled this trend (Oaklander, 2020; Drew, 2021). Platforms such as TikTok, Instagram, and Pinterest have become communities where consumers gather to share healthy and easy-to-make recipes (Williams, 2021). “According to TikTok’s 2020 trend report, the app’s recipe content was one of the four most popular categories of content for U.S. users last year” (Williams, 2021). The marketplace trends (1) consumer interest in health-focused foods and snacks, including those that are natural and healthy, and (2) the ease of social media reach, provide an excellent opportunity for easy, tasty, and interesting pecan recipes. Capitalizing on the strength of consumer associations of healthiness offers an opportunity to position pecans as an ideal food, providing energy, nutrition, and convenience.

6.7. *Enhance seasonal marketing*

Capitalizing on seasonal trends and holidays is a valuable marketing strategy, considering consumers' nostalgia for pecans. Special promotions or limited-time pecan products could enhance consumer memories of pecans. Additionally, aligning marketing efforts, advertisement, and in-store promotions with peak pecan harvest times to emphasize the freshness of the product can be beneficial.

6.8. *Inform on proper storage*

Given the high fat content of pecans, the taste is prone to changes if not stored properly. Informing consumers that they can safely store pecans in the fridge or freezer until they are using it to preserve high-quality taste can prevent negative experiences. It also allows consumers to extend the shelf life of a nutritious product that can be used for many dishes.

Note. References will be provided by the authors upon request.