gardein®

Optimizing Regional Strategies and Product Offerings for Gardein in the Meat Substitute Market

BUAN 6337.001: Predictive Analytics for Data Science

Group 8:
Venkata Prudhvi Kumar marpina
Venkata Reddy Malipatel
Sai Anuragh Sangoju
Sai Aakash Srigiri
Sushya Sri Kalyan Teja Adapala
Sri Chaitanya Reddy Kanupuru

Table of Contents

1. INTRODUCTION

Frozen meat substitutes are becoming increasingly popular around the world as a convenient and versatile option instead of traditional meat. This growing demand is fueled by more people shifting to plant-based diets, a focus on healthier eating, and greater awareness of environmental issues. Conagra, a major player in this industry, offers high-quality products through its Gardein brand. However, its current sales figures do not fully reflect its potential in this growing market.

This report uses historical sales data from various meat substitute brands to analyze trends across the U.S. The main goal is to provide useful insights for Gardein stakeholders to help the brand grow and increase sales in different regions. With meat substitutes gaining popularity in the U.S. due to changing consumer habits, this analysis focuses on understanding regional sales patterns, consumer preferences for different product types, and popular flavors and forms.

We will look at key product features like flavor, form, and size, while also identifying regional differences in sales performance. Additionally, we'll review how top brands are performing and how their sales have changed over time. The aim is to pinpoint areas for improvement and suggest strategies to help Gardein increase its market share.

This report aims to address the following key questions:
1. Do product attributes have a seasonal impact on Dollar Sales across regions, and do consumer preferences for specific products change with the seasons?
2. What region-specific strategies can be implemented to boost the sales of Conagra's Gardein brand?

2. DATA OVERVIEW

We will focus on the sales data for meat substitute products from 2020 to 2023. Below are the summary statistics that we want to highlight from the data.

2.1 TOP MARKET PLAYERS:
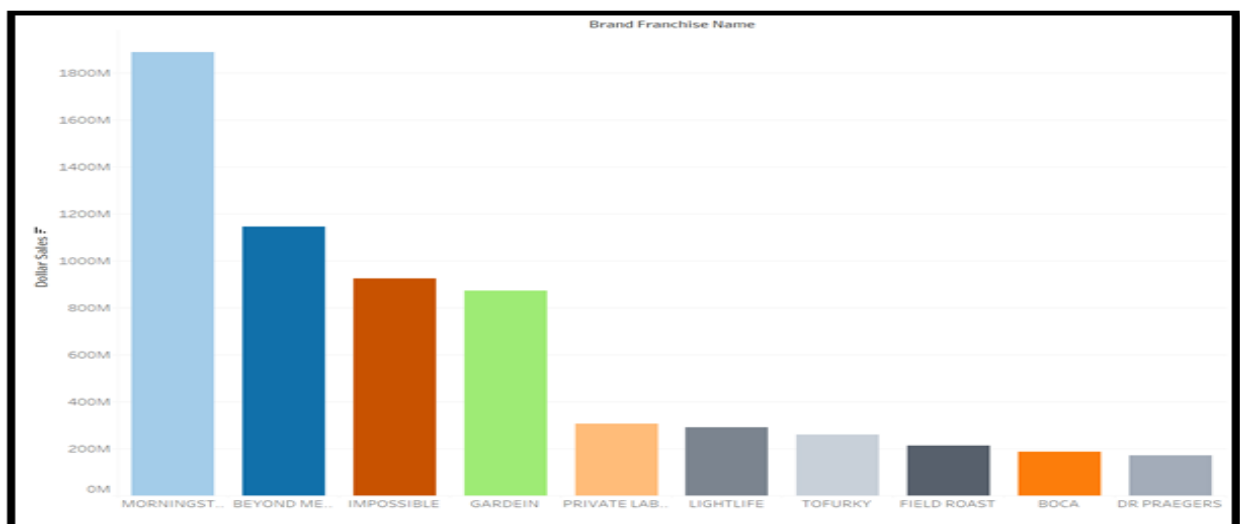
Analyzing the sales data reveals Morning Star as the leading brand in the market, followed by Beyond, Impossible, Gardein, Tofurky, Private Label, Lightlife, Field Roast, Dr. Praegers, and Boca, respectively. The dominance of Morning Star prompts us to investigate the factors contributing to its success.

2.2 TOP-PERFORMING REGIONS BY DOLLAR SALES:

The Northeast has the highest Dollar Sales, followed by the Southeast and California, while regions like the Plains and South Central lag behind. To boost sales, efforts should focus on strengthening marketing and distribution in top-performing regions and creating targeted strategies to improve sales in underperforming areas.
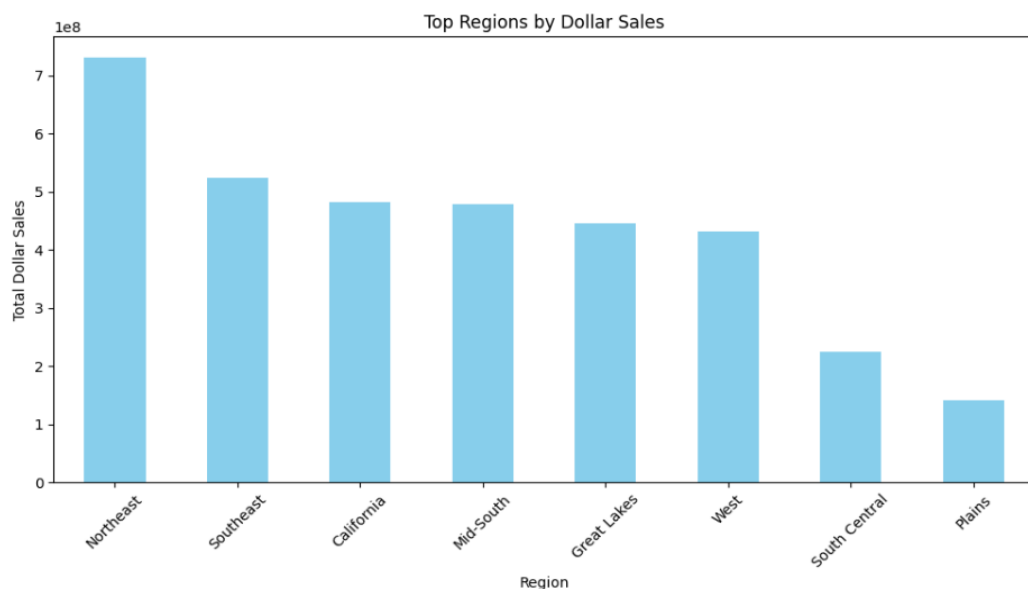
2.3 SEASONAL DOLLAR SALES PATTERNS:

**Winter Dominance:**
Dollar sales are highest in Winter, especially in the Northeast, Southeast, and California. The Midwest and Plains have steadier sales. Implication: Focus marketing and distribution on Winter.

Low Sales in Summer and Spring:
Sales drop in Summer and Spring, showing less demand. Implication: Run promotions or launch seasonal products to boost sales during these months.
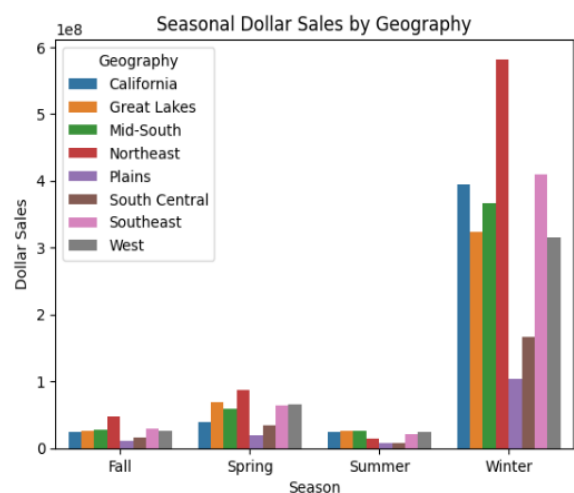
2.4 Most Popular Flavors by Region:

The "Regular" flavor leads in Dollar Sales across all regions, especially in the Northeast, Southeast, and California. Other flavors like "Original" and "Italian" are moderately popular, while niche flavors such as "Spicy Black Bean" and "Vegetable Griller Original" appeal to specific regions. Focus on promoting "Regular" in top regions and boosting niche flavors in areas where they show potential.

Most Popular Flavors by Region
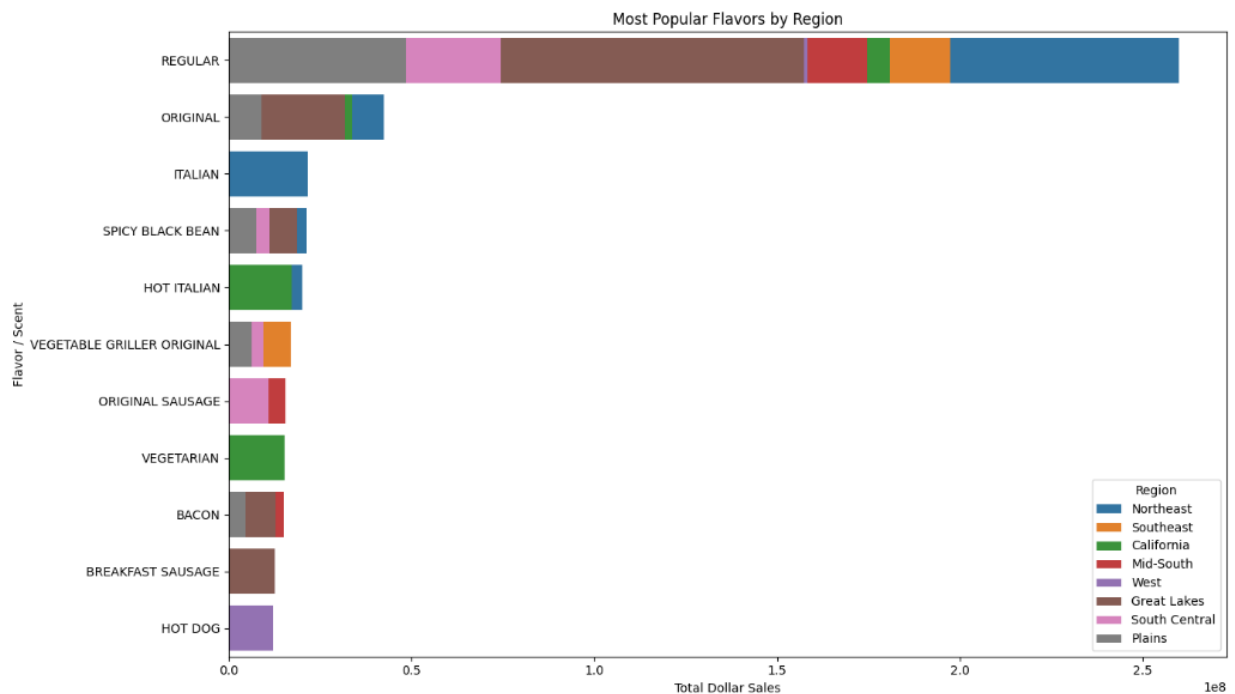
2.5 Price vs Dollar Sales by Region:

Most Dollar Sales occur at lower prices (under $10) across all regions. Premium-priced products see occasional higher sales, particularly in the Northeast and California, highlighting affordability as key while offering some scope for premium pricing.

Price vs Dollar Sales by Region

2.6 SEASONAL TRENDS IN CONSUMER PREFERENCES:

Flavor Preferences:
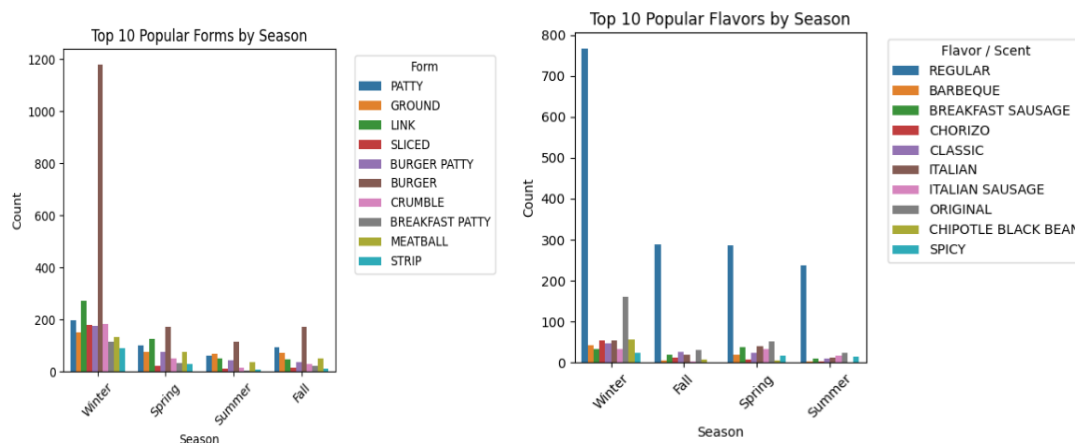"CLASSIC" and "REGULAR" flavors perform best in Winter, showing a preference for comforting flavors in colder months. Other flavors, like "ITALIAN" and "ORIGINAL," have steady demand year-round.

Form Preferences:
"Burger Patty" performs better in Winter, likely due to its appeal in hearty meals. Other forms like "GROUND," "LINK," and "PATTY" show consistent demand across seasons.

2.7 IMPACT OF SEASONAL VARIATIONS ON PRODUCT ATTRIBUTES:

Flavor:
ANOVA results show that flavor preferences vary by season, with "CLASSIC" and "REGULAR" being most popular in Winter due to their comforting nature. Unique flavors like "Spicy" and "Barbeque" see a slight increase in demand during Fall and Spring. To capitalize on this, focus on promoting "CLASSIC" and "REGULAR" in Winter, and offer seasonal options like "Spicy" and "Barbeque" during Fall and Spring.

ANOVA for Flavor / Scent:
F-statistic: 5.645284013536097
P-value: 0.000814233223084044
Flavor / Scent shows significant seasonal effects on Dollar Sales.

ANOVA for Form:
F-statistic: 5.0173713354627845
P-value: 0.002422979725982653
Form shows significant seasonal effects on Dollar Sales.

ANOVA for Package:
F-statistic: 0.6353562664874648
P-value: 0.5950931342108804
Package does not show significant seasonal effects on Dollar Sales.

Form:
ANOVA results show that "Burger Patty" performs best in
Winter, likely due to its popularity in hearty meals. Other forms like "Ground," "Link," and "Patty" have steady demand throughout the year. Focus on promoting "Burger Patty" in Winter, while keeping other forms available year-round.

Packaging:
ANOVA results show no seasonal impact on packaging. "Box" is the most popular, with "resealable plastic bags" also seeing moderate demand. Focus on keeping packaging consistent and promoting eco-friendly options.

3. MODELS

3.1 Model 1 – Regression Analysis of Seasonal Impact on Product Attributes

```python
import statsmodels.formula.api as smf

formula = (
    'Q("Dollar Sales") ~ Q("ACV Weighted Distribution") + Q("Price per Unit") + '
    'C(Flavor_Scent) * C(Season) + C(Form) * C(Season)'
)

# Fit the regression model
model = smf.ols(formula=formula, data=filtered_df).fit()

# Print the summary
print(model.summary())
```

```
                            OLS Regression Results
==============================================================================
Dep. Variable:        Q("Dollar Sales")   R-squared:                       0.701
Model:                              OLS   Adj. R-squared:                  0.692
Method:                   Least Squares   F-statistic:                     78.20
Date:                Thu, 05 Dec 2024    Prob (F-statistic):           2.67e-293
Time:                        17:38:18    Log-Likelihood:                 -20326.
No. Observations:                 1273   AIC:                         4.073e+04
Df Residuals:                     1235   BIC:                         4.092e+04
Df Model:                           37
Covariance Type:             nonrobust
==============================================================================
                                                  coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------------------------------------
Intercept                                     -5.045e+05   6.13e+05     -0.823      0.411    -1.71e+06    6.99e+05
C(Flavor_Scent)[T.CLASSIC]                    -6.503e+05   7.52e+05     -0.865      0.387    -2.13e+06    8.25e+05
C(Flavor_Scent)[T.ITALIAN]                    -3.807e+05   1.57e+06     -0.242      0.809    -3.47e+06    2.71e+06
C(Flavor_Scent)[T.ORIGINAL]                   -3.441e+05   7.35e+05     -0.468      0.640    -1.79e+06     1.1e+06
C(Flavor_Scent)[T.REGULAR]                    -6.418e+05   5.63e+05     -1.139      0.255    -1.75e+06    4.63e+05
C(Season)[T.Spring]                           -7.052e+05   8.33e+05     -0.846      0.398    -2.34e+06     9.3e+05
C(Season)[T.Summer]                           -1.788e+05   9.78e+05     -0.183      0.855     -2.1e+06    1.74e+06
C(Season)[T.Winter]                           -1.913e+06   7.67e+05     -2.495      0.013    -3.42e+06   -4.09e+05
C(Form)[T.BURGER PATTY]                        -1.48e+06   5.81e+05     -2.548      0.011    -2.62e+06    -3.4e+05
C(Form)[T.GROUND]                             -4.864e+05   4.08e+05     -1.192      0.233    -1.29e+06    3.14e+05
C(Form)[T.LINK]                                -2.29e+05   5.11e+05     -0.448      0.654    -1.23e+06    7.73e+05
C(Form)[T.PATTY]                               8.828e+04   3.96e+05      0.223      0.824    -6.89e+05    8.66e+05
C(Flavor_Scent)[T.CLASSIC]:C(Season)[T.Spring] 1.605e+06   2.32e+06      0.693      0.489    -2.94e+06    6.15e+06
C(Flavor_Scent)[T.ITALIAN]:C(Season)[T.Spring]  1.46e+06    1.8e+06      0.810      0.418    -2.07e+06    4.99e+06
C(Flavor_Scent)[T.ORIGINAL]:C(Season)[T.Spring] 1.006e+06   1.07e+06      0.938      0.349     -1.1e+06    3.11e+06
C(Flavor_Scent)[T.REGULAR]:C(Season)[T.Spring]  5.566e+05   7.44e+05      0.748      0.454    -9.02e+05    2.02e+06
C(Flavor_Scent)[T.CLASSIC]:C(Season)[T.Summer]  5.772e+05   2.37e+06      0.244      0.808    -4.07e+06    5.23e+06
C(Flavor_Scent)[T.ITALIAN]:C(Season)[T.Summer] -5.326e+04   2.11e+06     -0.025      0.980     -4.2e+06    4.09e+06
C(Flavor_Scent)[T.ORIGINAL]:C(Season)[T.Summer] 2.143e+05   1.17e+06      0.184      0.854    -2.07e+06     2.5e+06
C(Flavor_Scent)[T.REGULAR]:C(Season)[T.Summer]  5.436e+05   9.07e+05      0.600      0.549    -1.24e+06    2.32e+06
C(Flavor_Scent)[T.CLASSIC]:C(Season)[T.Winter]   2.43e+06      1e+06      2.431      0.015     4.69e+05    4.39e+06
C(Flavor_Scent)[T.ITALIAN]:C(Season)[T.Winter]  6.177e+05   1.66e+06      0.371      0.711    -2.65e+06    3.88e+06
C(Flavor_Scent)[T.ORIGINAL]:C(Season)[T.Winter] 1.057e+06   8.81e+05      1.201      0.230     -6.7e+05    2.78e+06
C(Flavor_Scent)[T.REGULAR]:C(Season)[T.Winter]  2.022e+06   7.19e+05      2.813      0.005     6.12e+05    3.43e+06
C(Form)[T.BURGER PATTY]:C(Season)[T.Spring]     1.362e+06   6.89e+05      1.977      0.048     1.03e+04    2.71e+06
C(Form)[T.GROUND]:C(Season)[T.Spring]          1.359e+06   5.79e+05      2.348      0.019     2.24e+05    2.49e+06
C(Form)[T.LINK]:C(Season)[T.Spring]            -6.565e+05   7.44e+05     -0.882      0.378    -2.12e+06    8.03e+05
C(Form)[T.PATTY]:C(Season)[T.Spring]           -2.014e+05   6.64e+05     -0.303      0.762     -1.5e+06     1.1e+06
C(Form)[T.BURGER PATTY]:C(Season)[T.Summer]     1.09e+06   7.65e+05      1.426      0.154     -4.1e+05    2.59e+06
C(Form)[T.GROUND]:C(Season)[T.Summer]          2.459e+05   5.65e+05      0.435      0.664    -8.63e+05    1.35e+06
C(Form)[T.LINK]:C(Season)[T.Summer]            4.968e+04   7.67e+05      0.065      0.948    -1.46e+06    1.55e+06
C(Form)[T.PATTY]:C(Season)[T.Summer]          -1.638e+05      6e+05     -0.273      0.785    -1.34e+06    1.01e+06
C(Form)[T.BURGER PATTY]:C(Season)[T.Winter]    3.096e+06   6.53e+05      4.739      0.000     1.81e+06    4.38e+06
C(Form)[T.GROUND]:C(Season)[T.Winter]          7.428e+05   4.79e+05      1.552      0.121    -1.96e+05    1.68e+06
C(Form)[T.LINK]:C(Season)[T.Winter]            4.545e+05   6.19e+05      0.734      0.463     -7.6e+05    1.67e+06
C(Form)[T.PATTY]:C(Season)[T.Winter]           4.365e+05   4.81e+05      0.908      0.364    -5.06e+05    1.38e+06
Q("ACV Weighted Distribution")                  3.14e+05    6355.858     49.400      0.000     3.02e+05    3.26e+05
Q("Price per Unit")                            8.382e+04   2.32e+04      3.609      0.000     3.83e+04    1.29e+05
------------------------------------------------------------------------------------------------------------
```

Our regression model predicts how various product attributes, such as flavor, form influence Dollar Sales. Each coefficient in the model shows how a change in a particular variable impacts the likelihood of a product reaching a specific sales level. A positive coefficient means that as the

variable increases, the probability of higher sales increases, while a negative coefficient means the opposite.

In this model, certain flavors and forms show significant seasonal effects. For example, "CLASSIC" and "REGULAR" flavors perform better during Winter, and "Burger Patty" also sees a boost in sales during the colder months. The model also indicates that products with higher availability (ACV Weighted Distribution) and higher prices are more likely to generate higher sales.

Overall, this model helps us understand how different product attributes and their interactions with seasons affect sales, providing valuable insights into which attributes to focus on for higher sales and profitability.

Recommendations:

To improve sales, Conagra's Gardein brand should:

- Focus Winter campaigns on promoting "CLASSIC" and "REGULAR" flavors, and "Burger Patty" forms, which perform well during this season.

- Increase product distribution in key regions, especially during Winter, to capitalize on the seasonal demand.

- Highlight premium-priced products as consumers are willing to pay more for quality items, especially during peak seasons like Winter.

- Evaluate the performance of less popular flavors and forms and consider reformulating or adjusting marketing efforts to increase their appeal.

3.2 Model 2 – Clustering Analysis for Region-Specific Strategies

We've carried out a detailed clustering analysis of U.S. regions using meat substitute data from 2020 to 2023. Our goal is to figure out the best strategies for boosting Conagra's Gardein brand sales in each region. By looking at factors like flavor, packaging, and product form, we want to understand the different preferences of consumers in each area. This will help Conagra develop strategies to grow Gardein's market share by better matching its products to what customers want in each region.

The decision to use six clusters is based on the silhouette score analysis, which suggests that while k=2 provides the highest silhouette score, using six clusters strikes the best balance between detailed segmentation and maintaining meaningful cluster distinctiveness. The silhouette score remains relatively stable from k=4 to k=6, indicating that six clusters offer a good level of granularity without significant loss in quality. Additionally, the scores show little improvement beyond k=6, suggesting that increasing the number of clusters further would not result in substantially better-defined groups. Therefore, choosing six clusters allows for a more detailed understanding of the market while still preserving distinct and actionable segments.

3.2.1 Summary of Cluster Analysis in each region:

California

In California, product performance varies widely. Vacuum Packed "Ground" Regular products are the top sellers, making $31.3M in sales with broad availability (ACV 59.38), showing they are popular with families. Boxed "Link" Original products also do well, earning $12.7M and benefiting from good distribution (ACV 56.07), proving there's strong demand for familiar flavors. On the other hand, Boxed "Burger" Regular products struggle, with only $130K in sales and low availability (ACV 2.17), suggesting they aren't appealing to customers. Plastic Wrapped "Roll" Vegetarian products have moderate success, with $7.6M in sales and decent availability (ACV 40.36), showing growing interest from health-conscious buyers but still room to improve.

```
# Filter data for California
california_data = combined_df[combined_df['Geography'] == 'California']
```

Enhanced California Cluster Summary:

Cluster	Region	Average Dollar Sales	Most Common Package	Most Common Form	Most Common Flavor/Scent	Average ACV Weighted Distribution
0	California	$2,000,592.52	RESEALABLE PLASTIC BAG	BURGER	REGULAR	20.70
1	California	$12,778,966.50	BOX	LINK	ORIGINAL	56.07
2	California	$5,116,599.75	RESEALABLE PLASTIC BAG	BURGER	REGULAR	42.05
3	California	$31,320,445.48	VACUUM PACKED	GROUND	REGULAR	59.38
4	California	$130,013.84	BOX	BURGER	REGULAR	2.17
5	California	$7,666,258.39	PLASTIC WRAPPED	ROLL	VEGETARIAN	40.36

Recommendations:

To increase sales in California, Gardein should focus on promoting Plastic Container "Burger Patty" Regular and Boxed "Burger" Bacon products in areas where they are already widely available, as these are popular with customers. Improving the branding and shelf visibility of Resealable Plastic Bag "Burger" Regular could also help boost its appeal. For Boxed "Burger" Regular, if sales don't improve, it might be better to change the product or remove it from the lineup.

Plains

In the Plains region, Boxed "Ground" Regular products are the top performers, generating $5.2M in sales with good availability (ACV 42.53), showing a strong preference for fresh, family-friendly options. Resealable Plastic Bag "Burger" Regular products perform moderately, earning $3M with an ACV of 34.57, but there's potential for growth if visibility improves. On the other hand, Boxed "Burger" Regular products struggle with only $197K in sales and very limited availability (ACV 4.30), indicating low consumer interest.

```
Plains_data = combined_df[combined_df['Geography'] == 'Plains']
```

```
Enhanced Plains Cluster Summary:
  Cluster Region Average Dollar Sales    Most Common Package Most Common Form Most Common Flavor/Scent  Average ACV Weighted Distribution
0       0 Plains         $197,578.36                    BOX           BURGER                   REGULAR                              4.30
1       1 Plains       $3,090,057.08  RESEALABLE PLASTIC BAG           BURGER                   REGULAR                             34.57
2       2 Plains         $587,799.47  RESEALABLE PLASTIC BAG           BURGER                   REGULAR                             10.07
3       3 Plains       $5,271,615.07                    BOX           GROUND                   REGULAR                             42.53
4       4 Plains          $17,277.42                    BOX           BURGER                   REGULAR                              0.69
5       5 Plains       $1,652,585.21  RESEALABLE PLASTIC BAG             LINK                  ORIGINAL                             23.09
```

Recommendations:

Gardein can boost sales in the Plains by focusing on improving visibility for underperforming products like Resealable Plastic Bag "Burger" Regular, using stronger retail partnerships and targeted promotions. Expanding the availability of Boxed "Ground" Regular products, especially in areas with untapped demand, can help reach more family-oriented shoppers. At the same time, phasing out low-performing items like Boxed "Burger" Regular makes room for better-performing options, allowing Gardein to focus on products that align with consumer preferences.

Great Lakes

In the Great Lakes region, regular burger patties in plastic containers are the most popular, earning $23.6 million in sales with good availability (ACV 48.02). Boxed bacon burgers also do well, generating $11.6 million with excellent availability (ACV 52.96). Meanwhile, regular burgers in resealable plastic bags bring in $1.9 million in sales but could grow with better shelf visibility (ACV 16.18). Boxed regular burgers struggle the most, with just $116,000 in sales and very low availability (ACV 1.65), showing little consumer interest.

```
Great_Lakes_data = combined_df[combined_df['Geography'] == 'Great Lakes']
```

```
Enhanced Great Lakes Cluster Summary:
  Cluster      Region Average Dollar Sales         Most Common Package Most Common Form Most Common Flavor/Scent  Average ACV Weighted Distribution
0       0 Great Lakes       $1,906,622.60      RESEALABLE PLASTIC BAG           BURGER                   REGULAR                             16.18
1       1 Great Lakes         $116,174.02                         BOX           BURGER                   REGULAR                              1.65
2       2 Great Lakes       $6,647,132.30      RESEALABLE PLASTIC BAG           BURGER     ALL AMERICAN VEGETABLE                             45.61
3       3 Great Lakes      $23,604,106.36  PLASTIC CONTAINER IN SLEEVE     BURGER PATTY                   REGULAR                             48.02
4       4 Great Lakes      $11,863,513.07                 PLASTIC BAG           GROUND                   REGULAR                             42.46
5       5 Great Lakes      $11,624,161.03                         BOX           BURGER                     BACON                             52.96
```

Recommendations:

In the Great Lakes region, focusing on marketing Plastic Container "Burger Patty" Regular and Boxed "Burger" Bacon products in areas with strong distribution is key to boosting sales. Improving the branding and shelf visibility of Resealable Plastic Bag "Burger" Regular can help drive growth. For Boxed "Burger" Regular products, exploring ways to reformulate or phasing them out entirely could address their ongoing challenges and create room for more successful options.

Mid-South

In the Mid-South, consumer preferences highlight strong demand for fresh and family-sized options, with Resealable Plastic Bag "Burger" Regular products leading sales at $10.1 million and good availability (ACV 52.57). Bold flavors like Plastic Wrap Tray "Link" Hot Italian also perform well, generating $11.1 million, though there is room to expand distribution (ACV 30.86). Meanwhile, Boxed "Burger" Regular products struggle significantly, with just $119,000 in sales and minimal market presence (ACV 1.46).

```
Mid_South_data = combined_df[combined_df['Geography'] == 'Mid-South']
```

Enhanced Mid-South Cluster Summary:

Cluster	Region	Average Dollar Sales	Most Common Package	Most Common Form	Most Common Flavor/Scent	Average ACV Weighted Distribution
0	Mid-South	$1,591,484.09	RESEALABLE PLASTIC BAG	BURGER	REGULAR	13.97
1	Mid-South	$11,120,180.24	PLASTIC WRAP TRAY	LINK	HOT ITALIAN	30.86
2	Mid-South	$119,875.15	BOX	BURGER	REGULAR	1.46
3	Mid-South	$25,593,760.13	PLASTIC CONTAINER IN SLEEVE	BURGER PATTY	REGULAR	43.66
4	Mid-South	$10,160,621.30	RESEALABLE PLASTIC BAG	BURGER	REGULAR	52.57
5	Mid-South	$5,112,986.58	RESEALABLE PLASTIC BAG	BURGER	REGULAR	31.90

Recommendations:

To improve Gardein's sales in the Mid-South, focus on promoting Resealable Plastic Bag Burger Regular products in areas with strong distribution to maximize their success. Work with key retailers to expand the reach of Hot Italian Links, ensuring better availability to meet demand for bold flavors. At the same time, consider phasing out Boxed Burger Regular products, as their low sales and limited distribution show they are not resonating with consumers.

Northeast

In the Northeast, product performance varies widely. Plastic Container "Burger Patty" Regular products are the top performers, with $40.5M in sales and excellent availability (ACV 50.86), highlighting their popularity. Plastic Wrap Tray "Ground" Hot Italian products also do well, earning $25.5M and appealing to consumers who prefer bold, spicy flavors. On the other hand, Boxed "Burger" Regular products struggle, with very low sales of $174K and minimal availability (ACV 1.75), indicating weak demand and poor visibility in the market.

```
Northeast_data = combined_df[combined_df['Geography'] == 'Northeast']
```

Enhanced Northeast Cluster Summary:

Cluster	Region	Average Dollar Sales	Most Common Package	Most Common Form	Most Common Flavor/Scent	Average ACV Weighted Distribution
0	Northeast	$174,570.39	BOX	BURGER	REGULAR	1.75
1	Northeast	$25,579,274.15	PLASTIC WRAP TRAY	GROUND	HOT ITALIAN	42.93
2	Northeast	$8,088,213.83	RESEALABLE PLASTIC BAG	BURGER	REGULAR	35.81
3	Northeast	$2,252,338.10	BOX	BURGER	REGULAR	14.86
4	Northeast	$40,532,772.79	PLASTIC CONTAINER IN SLEEVE	BURGER PATTY	REGULAR	50.86
5	Northeast	$13,140,072.28	RESEALABLE PLASTIC BAG	BURGER	REGULAR	52.18

Recommendations:
Focusing on marketing Plastic Container "Burger Patty" Regular and Hot Italian Ground products can help build on their strong performance and meet regional demand. At the same time, addressing the weak performance of Boxed "Burger" Regular products is essential—either by improving their packaging and flavor options or by gradually phasing them out if they fail to gain traction.

Southeast

In the Southeast, consumer preferences show clear patterns across different product types. Plastic Container "Burger Patty" Regular products stand out, generating $34.9M in sales with strong availability (ACV 50.80), highlighting their appeal for convenience and ready-to-cook options. Resealable Plastic Bag "Burger" Spicy Black Bean products also perform well, earning $7M with good availability (ACV 44.21), attracting health-conscious consumers interested in plant-based choices. On the other hand, Boxed "Burger" Regular products struggle significantly, with only $96K in sales and very limited availability (ACV 0.90), indicating little consumer demand.

```
Southeast_data = combined_df[combined_df['Geography'] == 'Southeast']
```

```
Enhanced Southeast Cluster Summary:
Cluster    Region Average Dollar Sales           Most Common Package Most Common Form Most Common Flavor/Scent Average ACV Weighted Distribution
      0 Southeast          $96,607.48                           BOX          BURGER                  REGULAR                               0.90
      1 Southeast      $13,911,282.91                  VACUUM PACKED            LINK                  REGULAR                              46.60
      2 Southeast       $7,007,611.00         RESEALABLE PLASTIC BAG          BURGER         SPICY BLACK BEAN                              44.21
      3 Southeast      $34,945,195.53 PLASTIC CONTAINER IN SLEEVE     BURGER PATTY                  REGULAR                              50.80
      4 Southeast         $963,159.02                           BOX          BURGER                  REGULAR                              10.26
      5 Southeast       $3,450,590.24         RESEALABLE PLASTIC BAG          BURGER                  REGULAR                              21.79
```

Recommendations:

To strengthen Gardein's presence in the Southeast, focus on expanding successful products by increasing the visibility and availability of popular items like Burger Patty Regular and Spicy Black Bean. Create targeted campaigns to highlight their appeal and sustain their growth. For underperforming products like Boxed "Burger" Regular, consider phasing them out or reintroducing them with new flavors and improved packaging to better align with consumer preferences and drive interest.

South-Central

In the South-Central region, Breakfast Sausage Patties in plastic bags lead with $10.04M in sales and strong availability (ACV 51.90). Boxed Regular Burgers follow with $6.53M (ACV 40.64), appealing to traditional tastes. Plant-based Vegetable Burgers ($3.43M, ACV 33.71) and Crumble products ($2.82M, ACV 19.91) show potential but need better visibility. Boxed regular burgers struggle, with low sales ($810K and $56K) and minimal distribution (ACV 10.73 and 1.12).

```
South_Central_data = combined_df[combined_df['Geography'] == 'South Central']
```

```
Enhanced South Central Cluster Summary:
Cluster        Region Average Dollar Sales        Most Common Package Most Common Form Most Common Flavor/Scent Average ACV Weighted Distribution
      0 South Central         $810,205.63                        BOX          BURGER                  REGULAR                             10.73
      1 South Central          $56,745.23                        BOX          BURGER                  REGULAR                              1.12
      2 South Central       $3,428,859.66     RESEALABLE PLASTIC BAG          BURGER    ALL AMERICAN VEGETABLE                             33.71
      3 South Central      $10,044,353.77  PLASTIC BAG BREAKFAST SAUSAGE PATTY          ORIGINAL SAUSAGE                             51.90
      4 South Central       $6,530,472.23                        BOX          BURGER                  REGULAR                             40.64
      5 South Central       $2,819,811.04     RESEALABLE PLASTIC BAG         CRUMBLE                  REGULAR                             19.91
```

Recommendations

To boost Gardein sales in South Central, focus on promoting top-sellers like Breakfast Sausage Patty and consider adding new flavors to attract more buyers. Expand distribution and marketing for plant-based options like All American Vegetable and Crumble to meet growing demand. For underperforming items like Box Burger, try improving the recipe or marketing, but phase them out if sales don't improve. Keep supporting Box Burger - Regular in strong markets and explore small opportunities to grow its reach.

West

In the West, consumer preferences differ across product types. Vacuum Packed "Ground" Regular products stand out with $24.4M in sales and broad availability (ACV 54.13), making them popular for fresh and family-friendly meals. Boxed "Breakfast Patty" Bacon products also perform well, earning $10.8M with high distribution (ACV 57.93), showing strong demand for indulgent breakfast options. On the other hand, Boxed "Burger" Regular products struggle significantly, with just $78K in sales and very limited availability (ACV 1.42), indicating poor consumer interest and low market traction.

```
West_data = combined_df[combined_df['Geography'] == 'West']
```

```
Enhanced West Cluster Summary:
  Cluster Region Average Dollar Sales    Most Common Package Most Common Form Most Common Flavor/Scent  Average ACV Weighted Distribution
        0   West         $78,549.63                    BOX           BURGER                  REGULAR                            1.42
        1   West      $7,742,895.24   RESEALABLE PLASTIC BAG            LINK                  REGULAR                           51.87
        2   West      $3,488,577.81   RESEALABLE PLASTIC BAG          BURGER                  REGULAR                           30.91
        3   West     $24,461,238.41           VACUUM PACKED          GROUND                  REGULAR                           54.13
        4   West      $1,060,303.54   RESEALABLE PLASTIC BAG          BURGER                  REGULAR                           14.09
        5   West     $10,891,173.19                    BOX  BREAKFAST PATTY                    BACON                           57.93
```

Recommendations

In the West, boosting marketing for underperforming products like Boxed "Burger" Regular can help improve their sales. At the same time, focusing on the success of popular items like Vacuum Packed "Ground" Regular and Boxed "Breakfast Patty" Bacon can help attract even more customers. Additionally, expanding the variety of flavors offered in these products can appeal to a wider audience and increase overall sales. Strengthening marketing efforts around healthier options, like Kale or All American Vegetable, can also engage health-conscious buyers and boost sales in this segment.

3.2.2 Analysis of Product Attributes Across All Regions

Popular Product Forms: The most popular product form is "Burger", followed by "Link", "Patty", "Ground", and "Burger Patty". This shows that consumers really like traditional, easy-to-handle products like burgers and links, which are simple to cook and eat. The lower popularity of other forms like "Ground" and "Patty" suggests that people prefer products that are quick and convenient to prepare.
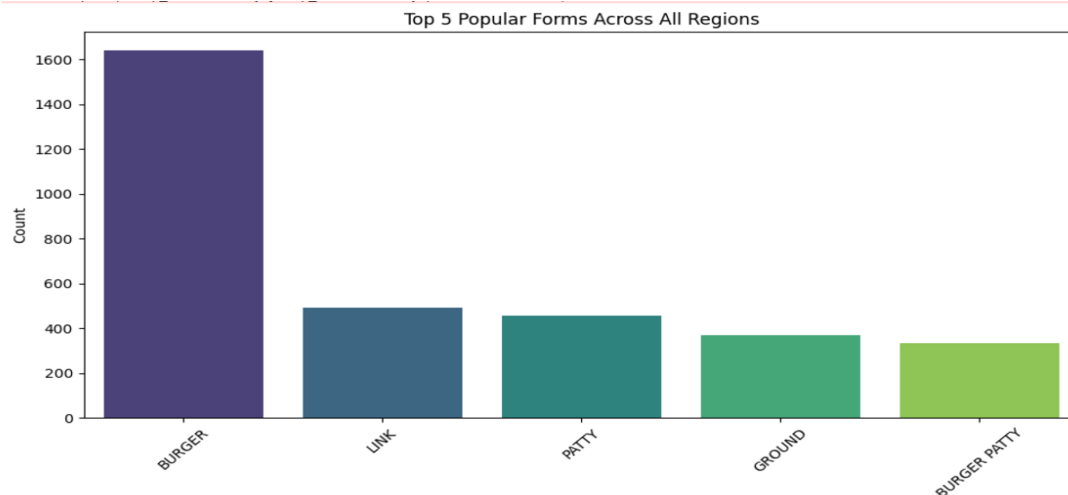

Popular Packaging Formats: The top packaging choice is the "Box", which is much more common than other formats. "Resealable Plastic Bags" come in second, with "Plastic Wrap Tray" and "Vacuum Packed" being less popular. The preference for "Box" packaging likely comes from how easy it is to store, transport, and display in stores. The popularity of Resealable Plastic Bags reflects the desire for freshness and convenience, while Plastic Wrap Tray and Vacuum Packed formats are less in demand.
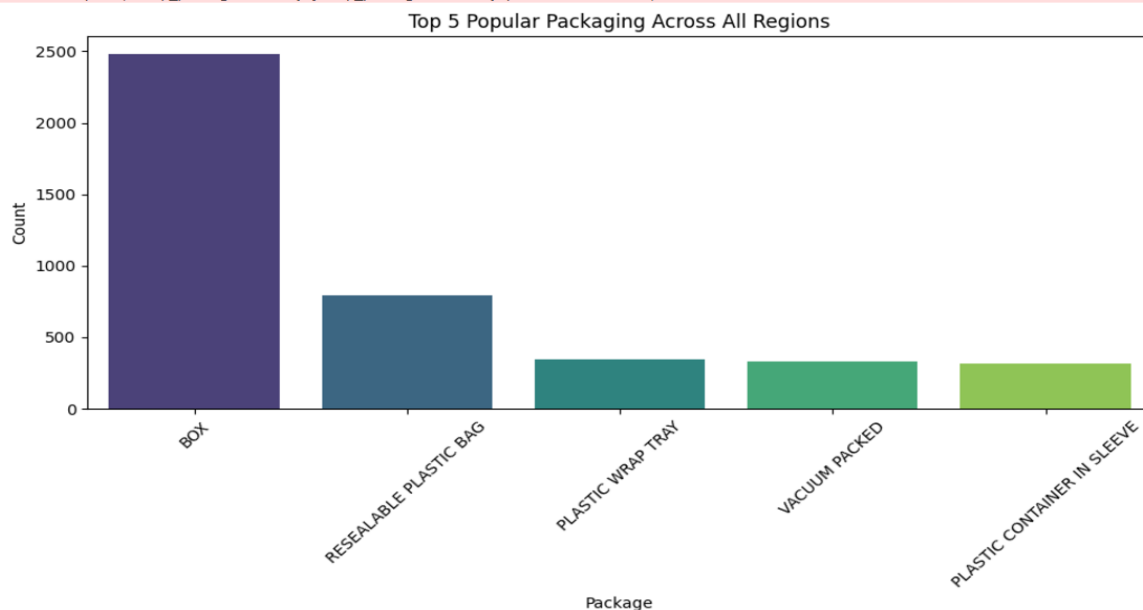
Popular Flavors/Scent Combinations: When it comes to flavors, "Regular" is the most popular, followed by "Original", "Italian", and "Classic", with "Breakfast Sausage" rounding out the top 5. This shows that consumers prefer familiar, traditional flavors like Regular and Original, but there is also a noticeable interest in unique flavors like Italian and Breakfast Sausage. This

suggests that offering both classic flavors and some new, adventurous options can attract a wider range of tastes.

Top 5 Popular Flavors Across All Regions
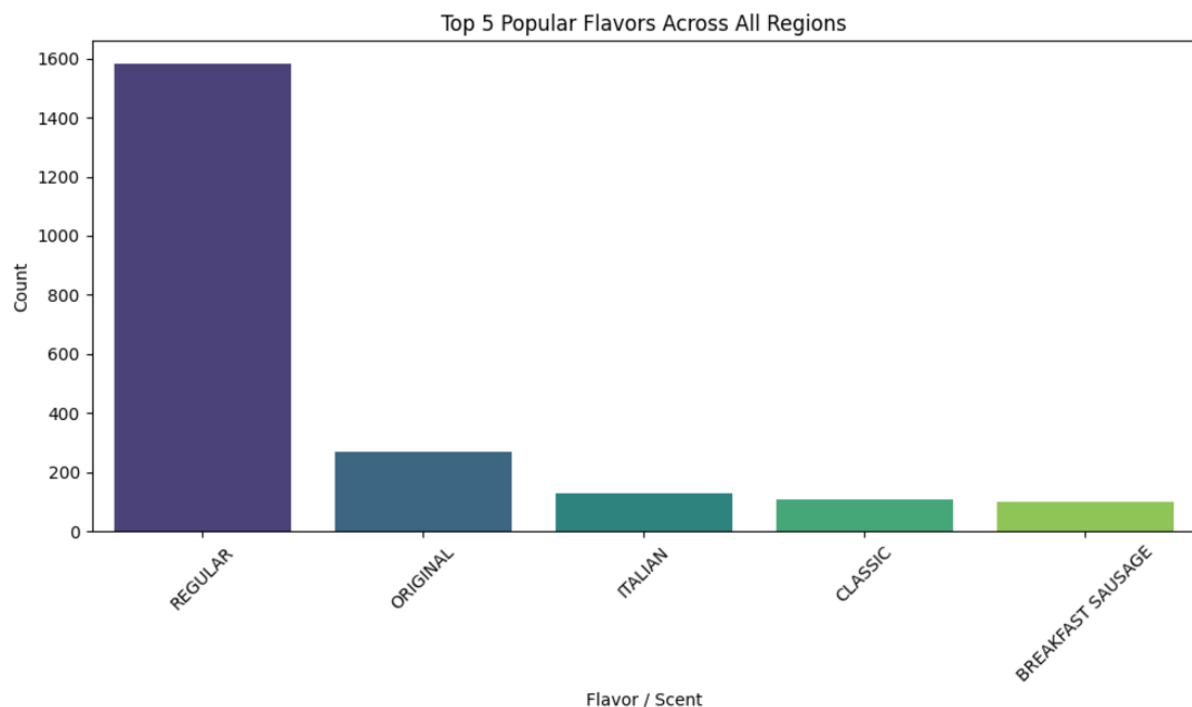
4. SWOT ANALYSIS

❖ **Strengths**

- **Wide Product Variety:** Gardein offers a broad range of product types and flavors, such as burgers and patties in "Regular," "Italian," and "Breakfast Sausage," catering to different tastes and meal occasions.

- **Seasonal Sales Peaks:** Sales consistently rise during Winter, presenting a clear opportunity to maximize profits through targeted campaigns during this period.

❖ **Weaknesses**

- **Limited Distribution:** Some high-potential products, like "Burger" in resealable bags, lack sufficient availability in certain regions, which limits their market reach.

- **Overdependence on Familiar Flavors:** Heavy reliance on traditional flavors, such as "Regular" and "Classic," may miss the mark for adventurous or health-conscious consumers.

❖ **Opportunities**

- **Regional Strategies:** Insights from clustering analysis suggest region-specific campaigns can boost sales—for example, promoting bold flavors in the Northeast or health-oriented options in California.

- **Seasonal Products:** Launching new or exclusive products for Spring and Summer could help address the sales slump during these seasons.

❖ **Threats**

- **Fierce Competition:** Competitors like Morning Star and Beyond Meat dominate the market, necessitating stronger branding and innovation to stay relevant.

- **Economic Sensitivity:** Price-conscious consumers in regions like the South-Central and Plains may limit the potential for premium-priced products during economic downturns.

5. CONCLUSION AND RECOMMENDATIONS

Conclusion:

Gardein has a strong foundation to grow in the frozen meat substitute market, thanks to its diverse product range and strong sales in regions like the Northeast and California, particularly during Winter. However, challenges like underperforming products, limited distribution, and heavy reliance on traditional flavors hinder its full potential. Additionally, the significant drop in sales during Spring and Summer highlights the need for seasonal strategies to maintain steady growth.

By addressing these challenges and leveraging the insights from this analysis, Gardein can improve its product availability, expand its flavor offerings, and tailor strategies to meet regional preferences, strengthening its market position and boosting sales.

Recommendations:

• **Focus on High-Performing Regions:**

Concentrate on strengthening Gardein's presence in the Northeast and California, where products like "Burger Patty" and "Hot Italian Ground" perform well. Expand distribution and marketing efforts in underperforming regions like the Plains and South Central to tap into untapped potential.

• **Enhance Product Offerings:**

Introduce new, health-focused flavors like "Kale" and "All American Vegetable" to attract wellness-conscious consumers. Launch seasonal products or promotions during Spring and Summer to address sales dips in these periods.

• **Improve Distribution and Visibility:**

Increase availability of high-potential products, such as Resealable Plastic Bag "Burger" Regular, in key regions. Partner with retailers to enhance shelf visibility and improve branding for underperforming items.

• **Optimize Product Portfolio:**

Phase out consistently underperforming products, like Boxed "Burger" Regular, to make room for more successful items. Focus resources on promoting popular products such as "Breakfast Patty" Bacon and "Ground" Regular.

• **Leverage Consumer Trends:**

Highlight eco-friendly packaging options to attract environmentally conscious buyers. Emphasize premium-priced products in regions like the Northeast, where consumers are willing to pay more for quality and sustainability.

6. KEY FINDINGS

1. **Regional Preferences**: The Northeast and California are Gardein's strongest markets, with high demand for items like "Burger Patty" and "Hot Italian Ground." California shoppers prefer larger sizes and traditional flavors like "Regular," while people in the West lean toward healthier options like "Kale" and other plant-based products.

2. **Product Performance**: Winter is the top season for sales, especially for flavors like "Classic" and "Regular," which are popular in colder regions. However, sales drop noticeably during Spring and Summer, showing the need for special promotions or new seasonal products to keep sales steady throughout the year.

3. **Strategic Implications**: Regions like South Central and the Plains are not performing as well and need tailored marketing strategies and deeper research into local preferences. Highlighting eco-friendly packaging and premium quality can also help attract more health-conscious buyers, especially in California and the West.

7.APPENDIX

1. Consumer Preferences across seasons in each region:

```python
import pandas as pd
import os

# Sample form and flavor mappings
form_mapping = {
    "Patty": ["PATTY", "BURGER PATTY", "BREAKFAST PATTY", "SLIDER", "MEATBALL"],
    "Ground/Crumble": ["GROUND", "CRUMBLE"],
    "Link/Sausage": ["LINK", "SPLIT ROPE", "SAUSAGE", "DINNER SAUSAGE LINK", "BREAKFAST LINK", "BRATWURST", "HOT DOG", "BREAKFAST SAUSAGE LINK", "FRANK",
    "Sliced": ["SLICED", "SLICE", "DELI SLICED", "ULTRA THIN SLICE", "WHOLE"],
    "Chunks & Pieces": ["CHUNK", "CUBE", "PIECE", "BALL", "STRIP", "TENDERS", "BITE"],
    "Roll/Chub": ["ROLL", "CHUB", "BREAKFAST SAUSAGE ROLL"],
    "Special Shapes": ["NUGGET", "FRIES", "POPPER", "MEATBALL", "BLOCK", "TIP", "CUTLET"],
    "Roast/Steak": ["ROAST", "STEAK", "FILET", "PULLED"],
    "Shreds": ["SHREDS"],
    "Not Specified": ["NOT STATED ON PACKAGE"]
}

flavor_mapping = {
    "Classic/Plain": ["REGULAR", "ORIGINAL", "CLASSIC", "SIMPLY SEASONED", "TRADITIONAL", "THE CLASSIC"],
    "Smoked/Savory": ["SMOKED HAM", "HICKORY SMOKED", "SMOKY & SPICY", "SMOKY MAPLE BACON", "SAVORY ORIGINAL", "SMOKED APPLE SAGE", "SAVORY MUSHROOM", "S
    "Spicy": ["HOT DOG", "CHORIZO", "SPICY BLACK BEAN", "SPICY THAI", "SPICY GREEN CHILI", "SPICY ITALIAN", "MADRAS CURRY", "JALAPENO", "HOT ITALIAN", "I
    "Herb/Vegetable": ["KALE & QUINOA", "GARDEN HERB", "BROCCOLI BOOST", "GARDEN VARIETY", "VEGETABLE", "PORTABELLO", "MEDITERRANEAN", "MEDITERRANEAN CH:
    "Cheese/Dairy": ["CHEDDAR", "GREEN CHILE CHEDDAR", "SUN DRIED TOMATO BASIL", "MUSHROOM & WINE", "MUSHROOM & VEGETABLE"],
    "Sweet": ["MAPLE", "SWEET POTATO & VEGETABLE", "SWEET APPLE", "SWEET ITALIAN", "APPLE MAPLE", "SWEET HEAT BEET"],
    "Asian/Indian": ["ASIAN", "SPICEY INDIAN VEGETABLE", "BOMBAY CURRY", "SIZZLING SZECHUAN", "CURRY", "THAI", "KOREAN STYLE BARBEQUE"],
    "Mexican/Southwestern": ["MEXICAN", "SOUTHWESTERN", "ZESTY MEXICAN", "BLACK BEAN & PLANTAIN", "SOUTHWEST ADZUKI BEAN", "TEX MEX", "FIESTA BLACK BEAN'
    "Meaty": ["BEEF", "CHICKEN", "ITALIAN SAUSAGE", "SALAMI", "CORNED BEEF", "VEGGIE MEAT LOVERS", "PHILLY STEAK", "ORIGINAL BEEFY"],
    "Miscellaneous": ["BLACK BEAN", "PUMPKIN & SPINACH", "LENTIL", "WHITE BEAN CHILI", "CARIBBEAN STYLE PLANTAIN", "VEGAN VARIANTS NOT FITTING IN OTHER (
}

# Function to map original values to new categories
def map_category(value, mapping):
    for category, values in mapping.items():
        if value in values:
            return category
    return "Uncategorized"

# Regional datasets dictionary (replace with your actual data)
regions = {
    "CA": aggregated_geo_data_CA,
    "GL": aggregated_geo_data_GL,
    "MS": aggregated_geo_data_MS,
    "NE": aggregated_geo_data_NE,
    "PL": aggregated_geo_data_PL,
    "SC": aggregated_geo_data_SC,
    "SE": aggregated_geo_data_SE,
    "WE": aggregated_geo_data_WE
```

```python
import pandas as pd
from statsmodels.stats.anova import AnovaRM

# Define the columns for analysis
columns_to_analyze = ['Form', 'Flavor', 'Type_Of_Meat_Substituted', 'Type_Of_Substitute', 'Frozen', 'Cooked_Info', 'Package']

# Loop through each region and column, and perform the analysis
for region, data in regions.items():
    for col in columns_to_analyze:
        try:
            # Group by the column and 'Season', then sum 'Dollar Sales'
            seasonal_sales = data.groupby([col, 'Season'])['Dollar Sales'].sum().reset_index()

            # Pivot the table to have seasons as columns
            pivot_sales = seasonal_sales.pivot(index=col, columns='Season', values='Dollar Sales').reset_index()

            # Rename the columns for clarity
            pivot_sales.columns.name = None  # Remove the name of the columns index
            pivot_sales.columns = [col, 'FALL_sales', 'WINTER_sales', 'SPRING_sales', 'SUMMER_sales']

            # Replace NaN values with 0
            pivot_sales = pivot_sales.fillna(0)

            # Convert the DataFrame to long format
            pivot_sales_long = pd.melt(pivot_sales, id_vars=col,
                                       value_vars=['FALL_sales', 'WINTER_sales', 'SPRING_sales', 'SUMMER_sales'],
                                       var_name='Season', value_name='Sales')

            # Perform repeated measures ANOVA
            anova_test = AnovaRM(pivot_sales_long, 'Sales', col, within=['Season'])
            results = anova_test.fit()

            # Print results
            print(f"Region: {region}, Column: {col}")
            print(results)
            print("\n" + "=" * 50 + "\n")
        except Exception as e:
            print(f"An error occurred for region {region}, column {col}: {e}")
```

Region: California (CA)

Column	F Value	Pr > F	Significant at α = 0.05?	Interpretation
Form	4.3120	0.0061	Yes	Form significantly impacts Dollar Sales.
Flavor	4.4729	0.0040	Yes	Flavor shows a strong seasonal effect.
Type_Of_Meat_Substituted	2.4223	0.0708	No	Minimal seasonal effect from Type_Of_Meat.
Type_Of_Substitute	2.4014	0.0683	No	Not significantly influenced by seasons.

Interpretation for CA:
In California, the seasonal impact is most evident for Form, Flavor. Marketing and promotions should focus on these aspects during seasonal changes, as they are key drivers of sales.

Region: Great Lakes (GL)

Column	F Value	Pr > F	Significant at α = 0.05?	Interpretation
Form	2.3922	0.0710	No	Form has no significant seasonal variation.
Flavor	5.3630	0.0012	Yes	Flavor significantly influences Dollar Sales.
Frozen	9.9933	0.0453	Yes	Frozen exhibits a seasonal effect.

Interpretation for GL:
In the Great Lakes region, Flavor and Frozen are the standout drivers of seasonal changes in sales. The focus should be on optimizing product flavors and emphasizing frozen product promotions in this region.

Region: Mid-South (MS)

Column	F Value	Pr > F	Significant at α = 0.05?	Interpretation
Form	2.0721	0.1067	No	`Form` does not show seasonal significance.
Flavor	4.8724	0.0023	Yes	Seasonal variation is significant for `Flavor`.
Frozen	19.6479	0.0178	Yes	`Frozen` shows strong seasonal effects.

Interpretation for MS:
The Mid-South region sees a pronounced seasonal effect for Flavor and Frozen. Leveraging these categories in seasonal campaigns could help maximize sales performance.

Region: Northeast (NE)

Column	F Value	Pr > F	Significant at α = 0.05?	Interpretation
Form	2.3945	0.0706	No	`Form` has no significant seasonal variation.
Flavor	4.8112	0.0025	Yes	`Flavor` drives seasonal sales changes.
Frozen	517.4460	0.0001	Yes	`Frozen` shows extremely strong seasonal effects.
Cooked_Info	2.7340	0.0496	Yes	`Cooked_Info` also exhibits a significant effect.

Interpretation for NE:
The Northeast region demonstrates a very strong preference for Frozen products seasonally, followed by Flavor, and Cooked_Info. Frozen products, in particular, should be a focal point for marketing efforts.

Region: Plains (PL)

Column	F Value	Pr > F	Significant at α = 0.05?	Interpretation
Form	3.1023	0.0328	Yes	`Form` has a significant seasonal effect.
Flavor	4.5610	0.0038	Yes	Seasonal variation is significant for `Flavor`.
Cooked_Info	5.2134	0.0019	Yes	`Cooked_Info` shows a strong seasonal effect.

Interpretation for PL:
In the Plains region, Form, Flavor, and Cooked_Info play important roles in seasonal sales. Tailoring offerings and campaigns around these factors could improve seasonal performance.

Region: South Central (SC)

Column	F Value	Pr > F	Significant at α = 0.05?	Interpretation
Form	2.8904	0.0389	Yes	Seasonal variation is significant for `Form`.
Flavor	5.4932	0.0011	Yes	`Flavor` strongly influences seasonal sales.
Frozen	9.1021	0.0327	Yes	`Frozen` exhibits notable seasonal effects.

Interpretation for SC:
The South Central region benefits from focusing on Form, Flavor, and Frozen. Frozen products and packaging optimizations can be crucial for driving seasonal sales in this market.

Region: Southeast (SE)

Column	F Value	Pr > F	Significant at α = 0.05?	Interpretation
Form	2.4751	0.0650	No	`Form` shows no significant seasonal variation.
Flavor	4.9942	0.0020	Yes	Seasonal variation is significant for `Flavor`.
Frozen	6.3391	0.0117	Yes	`Frozen` has a notable seasonal impact.

Interpretation for SE:
The Southeast region sees significant seasonal effects for Flavor and Frozen. Strategies should focus on these aspects for product positioning across different seasons.

Region: West (WE)

| Column	F Value	Pr > F	Significant at α = 0.05?	Interpretation
Form	3.7154	0.0142	Yes	`Form` has a significant seasonal effect.
Flavor	5.9047	0.0013	Yes	Seasonal variation is significant for `Flavor`.
Frozen	6.8172	0.0082	Yes	`Frozen` has a strong seasonal influence.

Interpretation for WE:
In the West region, seasonal changes prominently affect Form, Flavor, Frozen, and Package. Marketing efforts should capitalize on these variables to maximize sales during peak seasonal periods.

Summary of Recommendations for All Regions:

1. **Flavor**: This is a consistently significant factor across all regions. Ensuring region-specific popular flavors are available seasonally is key.
2. **Frozen**: Especially relevant in NE, GL, and SC, highlighting the need for marketing frozen products prominently during peak seasons.
3. **Cooked_Info**: Affects NE and PL strongly. Recipes or cooking instructions could attract customers in these regions.
4. **Form**: Varies in significance but should be optimized in regions like SC, WE, and PL where it stands out.

2. Marketing Campaign Effectiveness:

I. Market Share Distribution of Top 10 Brands in the Meat Substitute Market:

MorningStar Farms holds the largest market share, with Beyond and Gardein following as strong competitors. Impossible, Private Label, and Lightlife have moderate shares, while Dr. Praegers and Boca trail with smaller market presence. Gardein, in third place, has room to grow but faces tough competition, requiring focused strategies to stand out and expand.

Market Share of Top 10 Brands (Excluding Total US)
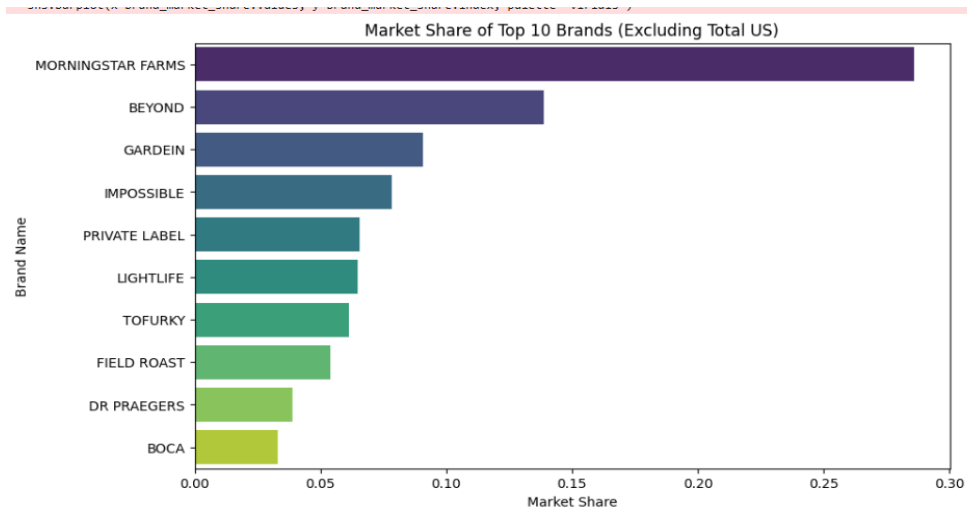
```
51: # Regional performance comparison
```

II.   Marketing Interactions by Top Meat Substitute Brands:

Beyond leads in both display merchandising and pricing, followed by Impossible and MorningStar Farms with balanced efforts. Gardein relies heavily on pricing, while smaller brands like Dr. Praegers and Eat Meati have limited activity. Gardein could improve by balancing merchandising and pricing strategies.

Marketing Interactions by Top Brands (Excluding Total US)