In [ ]:
```
import pandas as pd
import numpy as np
from sklearn.model_selection import train_test_split
from sklearn.ensemble import RandomForestRegressor
from sklearn.metrics import mean_squared_error, mean_absolute_percentage_error, r2_score
import matplotlib.pyplot as plt

# Load data from CSV file
df = pd.read_csv('/Users/danteschrantz/Desktop/UNAV/2024-2025/Modeling Trabajo Final/CSV/dairy.csv')
df.head()
```

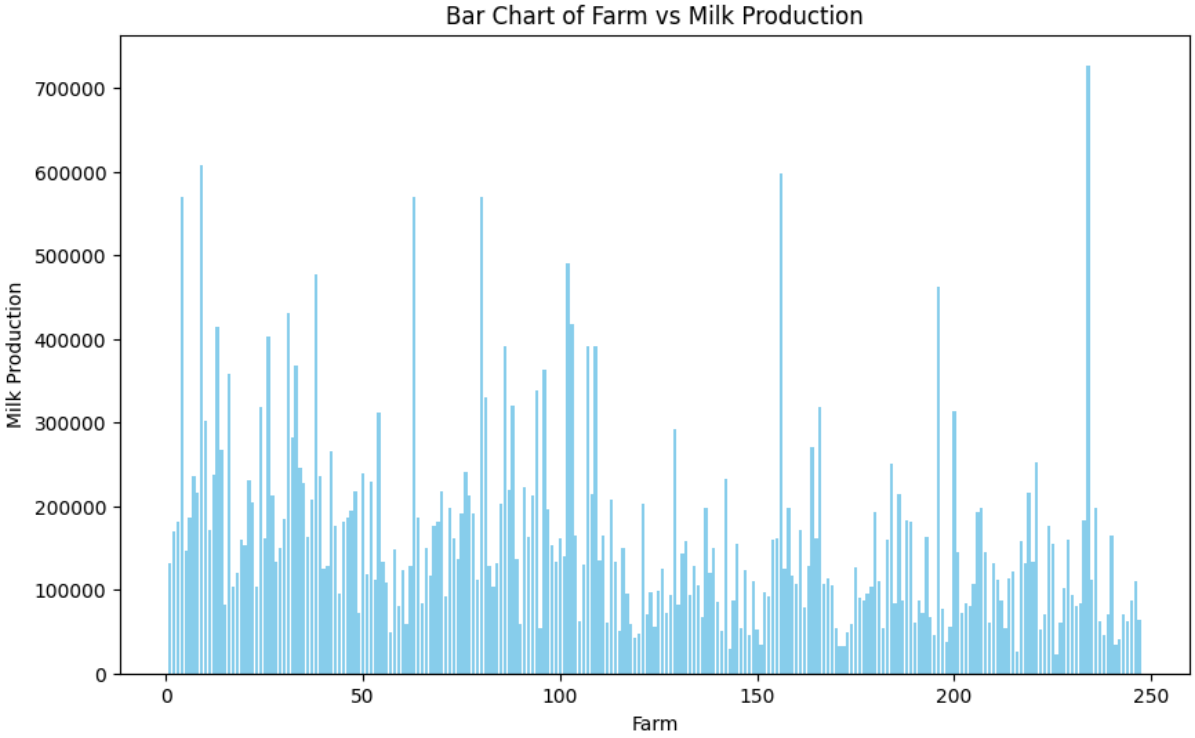
Out[ ]:

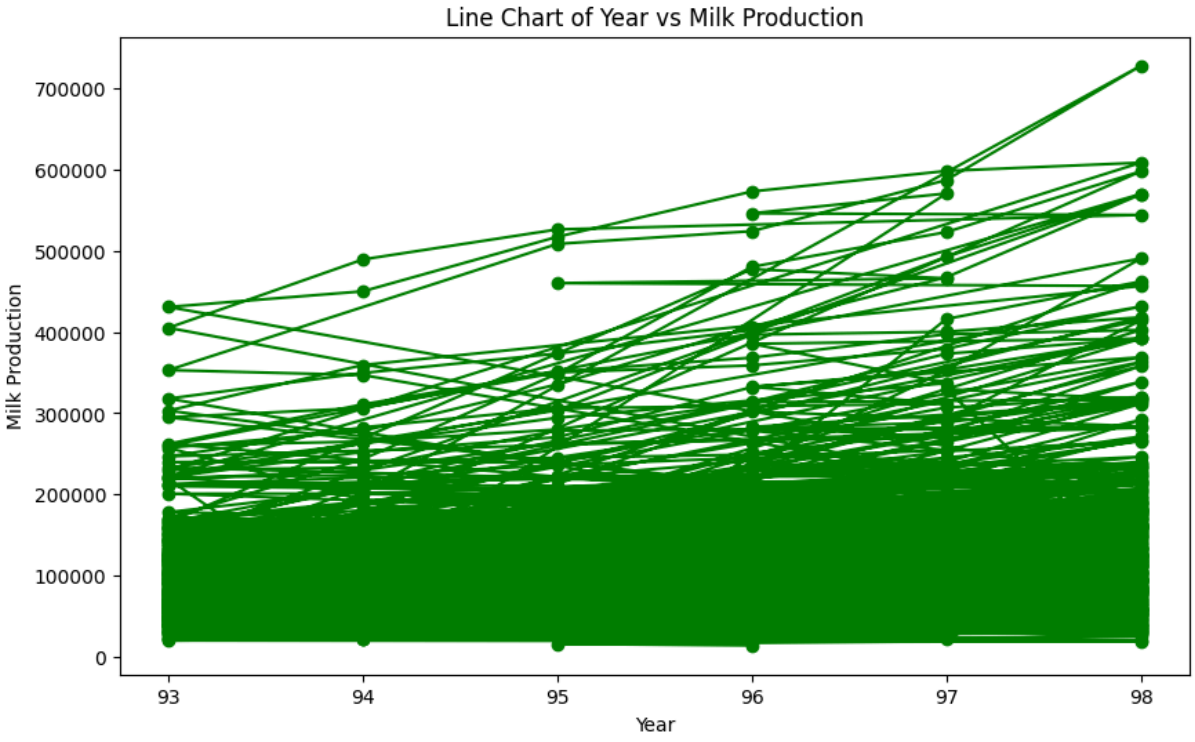
	FARM	YEAR	COWS	LAND	MILK	LABOR	FEED	YIT	X1	X2	...	X14	X23	X24	X34	YEAR93
0	1	93	15.3	8.0	73647	2.0	33435.738	11.207039	-0.250847	-0.381269	...	0.067232	-0.090008	0.102187	-0.063272	1
1	1	94	18.1	8.0	91260	2.0	36869.040	11.421468	-0.082788	-0.381269	...	0.014096	-0.090008	0.064919	-0.040197	0
2	1	97	17.1	7.0	110419	2.0	51013.578	11.612037	-0.139622	-0.514801	...	-0.021564	-0.121532	-0.079510	0.036461	0
3	1	96	17.3	8.0	111454	2.0	50711.570	11.621367	-0.127994	-0.381269	...	-0.019008	-0.090008	-0.056622	0.035060	0
4	1	95	17.8	8.0	118498	2.0	54153.586	11.682651	-0.099502	-0.381269	...	-0.021311	-0.090008	-0.081660	0.050563	0

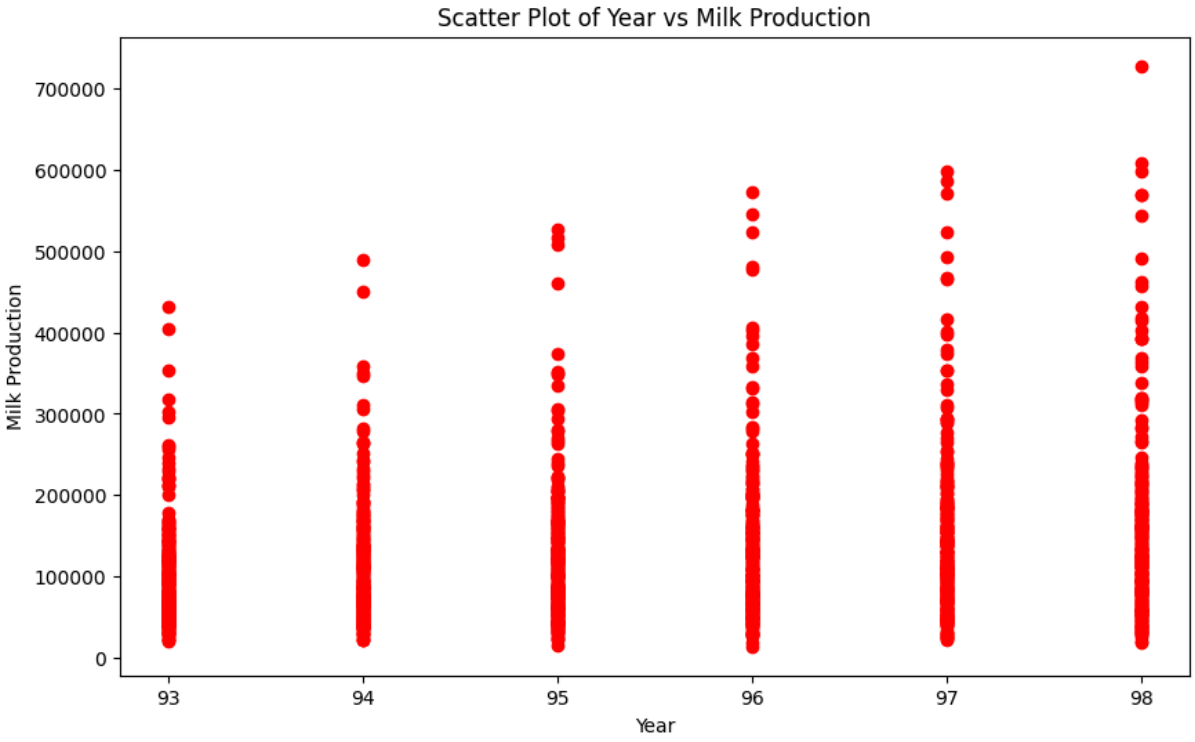
5 rows × 28 columns

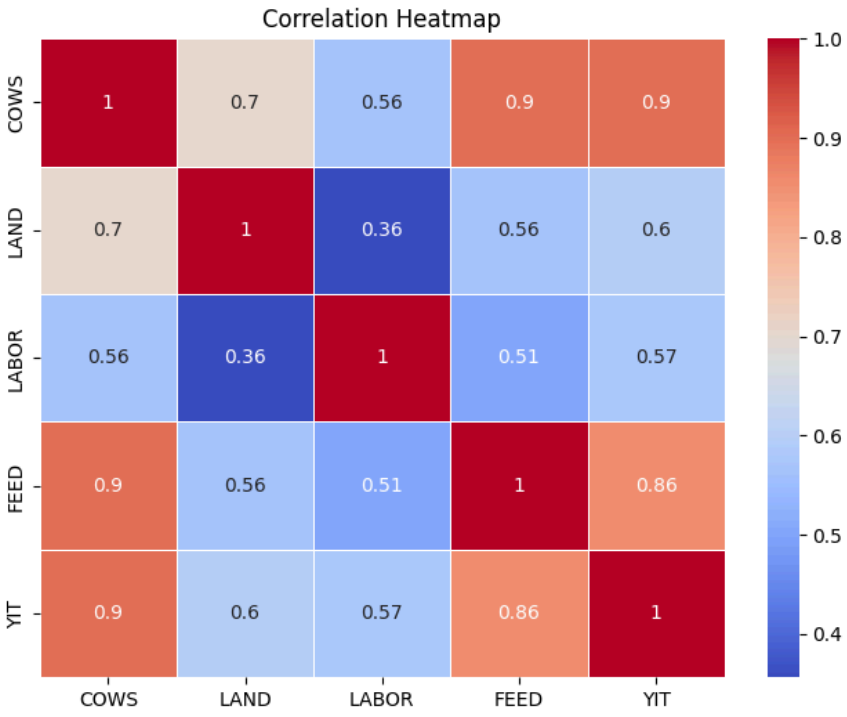
Gráficos en Python

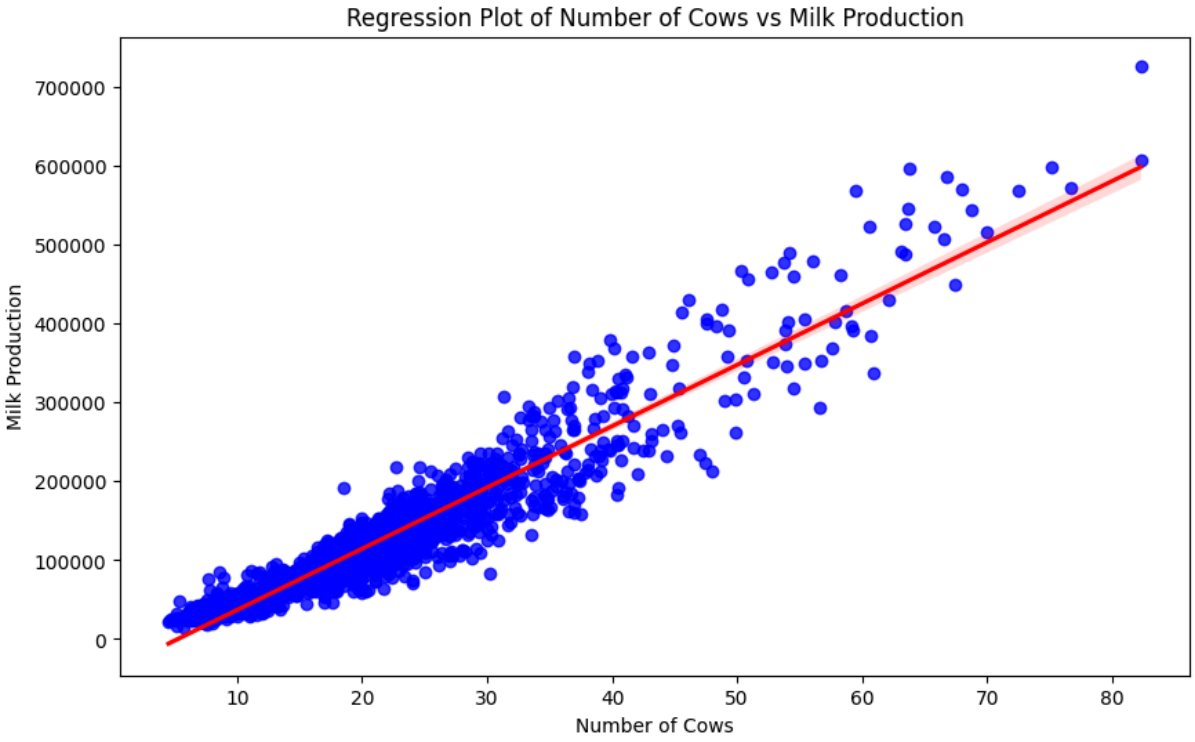
In [ ]:
```
# Bar Chart
def plot_bar_chart(df):
    plt.figure(figsize=(10, 6))
    plt.bar(df['FARM'], df['MILK'], color='skyblue')
    plt.xlabel('Farm')
    plt.ylabel('Milk Production')
    plt.title('Bar Chart of Farm vs Milk Production')
    plt.show()

# Line Chart
def plot_line_chart(df):
    plt.figure(figsize=(10, 6))
    plt.plot(df['YEAR'], df['MILK'], marker='o', linestyle='-', color='green')
    plt.xlabel('Year')
    plt.ylabel('Milk Production')
    plt.title('Line Chart of Year vs Milk Production')
    plt.show()

# Scatter Plot
def plot_scatter_chart(df):
    plt.figure(figsize=(10, 6))
    plt.scatter(df['YEAR'], df['MILK'], color='red')
    plt.xlabel('Year')
    plt.ylabel('Milk Production')
    plt.title('Scatter Plot of Year vs Milk Production')
    plt.show()

# Correlation Heatmap
def plot_heatmap(df):
    plt.figure(figsize=(8, 6))
    sns.heatmap(df[['COWS', 'LAND', 'LABOR', 'FEED', 'YIT']].corr(), annot=True, cmap='coolwarm', linewidths=0.5)
    plt.title('Correlation Heatmap')
    plt.show()

# Regression Plot
def plot_regression(df):
    plt.figure(figsize=(10, 6))
    sns.regplot(x='COWS', y='MILK', data=df, scatter_kws={'color': 'blue'}, line_kws={'color': 'red'})
    plt.xlabel('Number of Cows')
    plt.ylabel('Milk Production')
    plt.title('Regression Plot of Number of Cows vs Milk Production')
    plt.show()

# Function Calls
plot_bar_chart(df)
plot_line_chart(df)
plot_scatter_chart(df)
plot_heatmap(df)
plot_regression(df)
```


Bar Chart of Farm vs Milk Production
Milk Production
Farm
0
100000
200000
300000
400000
500000
600000
700000
0
50
100
150
200
250


Line Chart of Year vs Milk Production
Milk Production
Year
0
100000
200000
300000
400000
500000
600000
700000
93
94
95
96
97
98


Scatter Plot of Year vs Milk Production
Milk Production
Year
0
100000
200000
300000
400000
500000
600000
700000
93
94
95
96
97
98

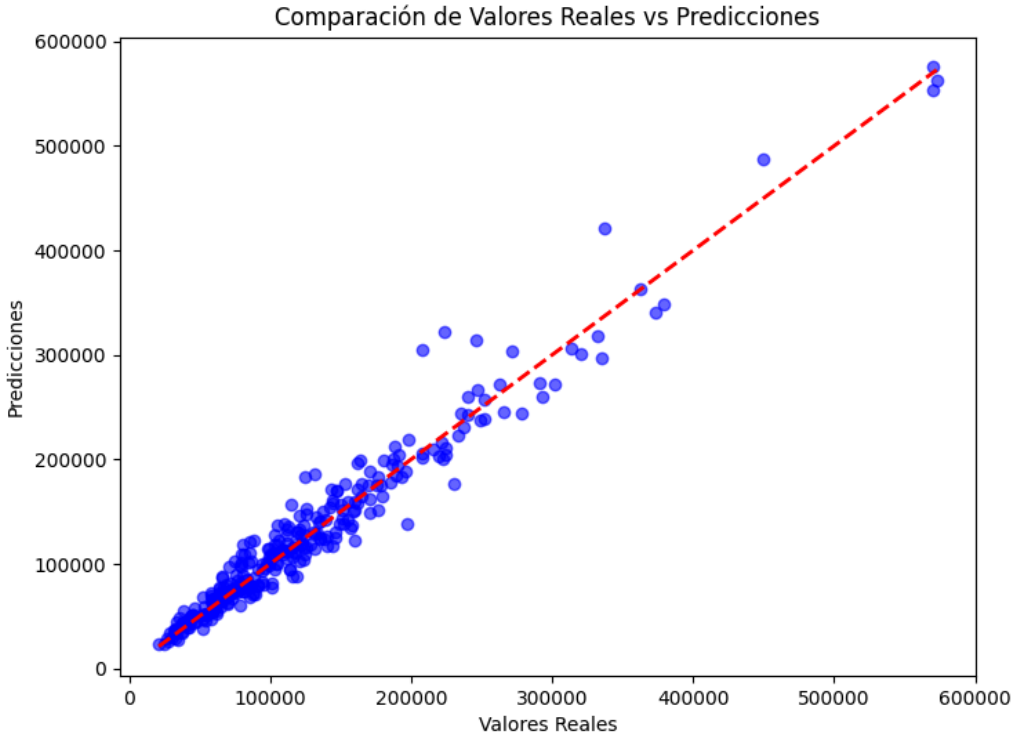

Correlation Heatmap
COWS
LAND
LABOR
FEED
YIT
1
0.7
0.56
0.9
0.9
0.7
1
0.36
0.56
0.6
0.56
0.36
1
0.51
0.57
0.9
0.56
0.51
1
0.86
0.9
0.6
0.57
0.86
1
1.0
0.9
0.8
0.7
0.6
0.5
0.4



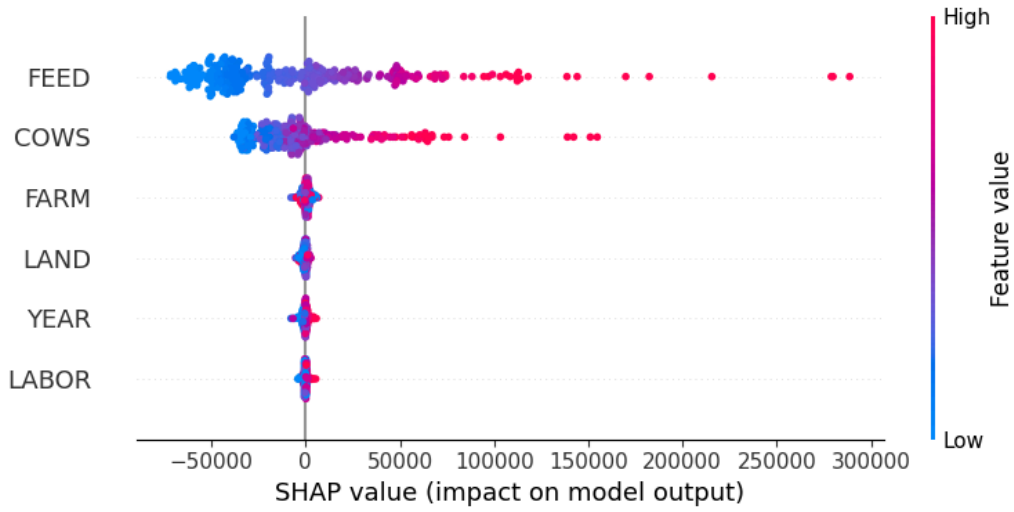
Modelo de Machine Learning con Random Forest

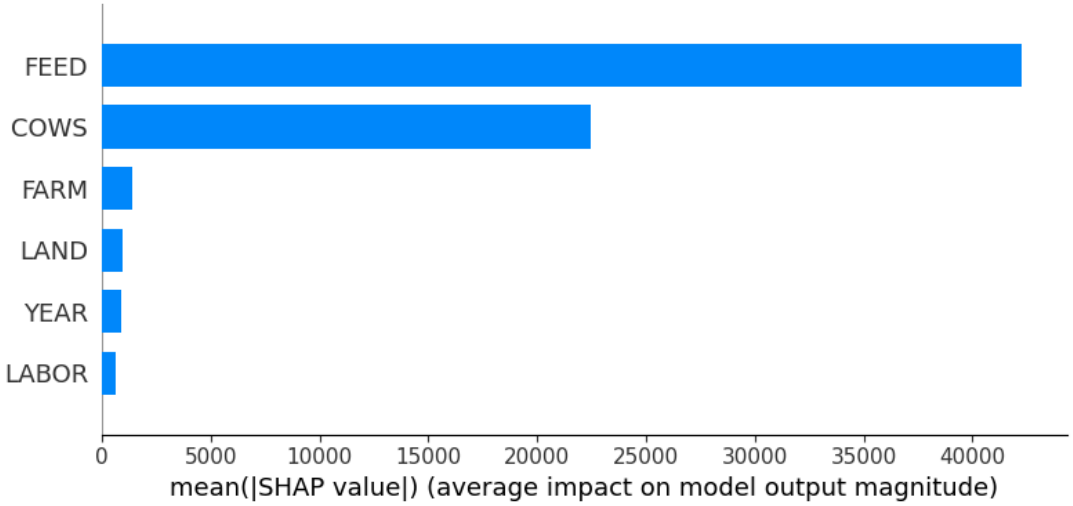
In [ ]:
```
# También eliminar variables relacionadas con años si no aportan información relevante
X = df.drop(columns=['MILK', 'YIT', 'X1', 'X2', 'X3', 'X4', 'X11', 'X12', 'X13', 'X14', 'X22', 'X33', 'X44', 'X23', 'X24', 'X34', 'YEAR
y = df['MILK']  # 'MILK' como objetivo

# Dividir los datos en conjuntos de entrenamiento y prueba
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)

# Crear y ajustar el modelo Random Forest
model = RandomForestRegressor(n_estimators=100, random_state=42)
model.fit(X_train, y_train)

# Predecir en el conjunto de prueba
y_pred = model.predict(X_test)

# Evaluar el modelo
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mape = mean_absolute_percentage_error(y_test, y_pred) * 100
r2 = r2_score(y_test, y_pred)

print(f"Error Cuadrático Medio (MSE): {mse}")
print(f"Raíz del Error Cuadrático Medio (RMSE): {rmse}")
print(f"Porcentaje de Error Promedio (MAPE): {mape:.2f}%")
print(f"Coeficiente de Determinación (R²): {r2}")

# Visualizar Predicciones vs Valores Reales
plt.figure(figsize=(8, 6))
plt.scatter(y_test, y_pred, color="blue", alpha=0.6)
plt.plot([y_test.min(), y_test.max()], [y_test.min(), y_test.max()], 'r--', linewidth=2)
plt.xlabel("Valores Reales")
plt.ylabel("Predicciones")
plt.title("Comparación de Valores Reales vs Predicciones")
plt.show()
```

```
Error Cuadrático Medio (MSE): 349563140.22904617
Raíz del Error Cuadrático Medio (RMSE): 18696.607719825704
Porcentaje de Error Promedio (MAPE): 11.12%
Coeficiente de Determinación (R²): 0.9520491058859036
```



In [ ]:
```python
# ---- Explicabilidad del Modelo con SHAP ----
import shap
# Crear un objeto explainer para el modelo Random Forest
explainer = shap.TreeExplainer(model)

# Calcular los valores SHAP para el conjunto de datos de prueba
shap_values = explainer.shap_values(X_test)

# Resumen de los valores SHAP
shap.summary_plot(shap_values, X_test)  # Gráfico de resumen

# Gráfico de barras con la importancia media de las características
shap.summary_plot(shap_values, X_test, plot_type="bar")
```




FEED
COWS
FARM
LAND
YEAR
LABOR
0
5000
10000
15000
20000
25000
30000
35000
40000
mean(|SHAP value|) (average impact on model output magnitude)