

```
In [54]: import numpy as np
import pandas as pd
from sklearn.neighbors import KNeighborsClassifier
from matplotlib import pyplot as plt
from scipy.interpolate import make_interp_spline
from pylab import rcParams
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
from sklearn.metrics import accuracy_score as acc
from sklearn.metrics import confusion_matrix, ConfusionMatrixDisplay
import seaborn as sns

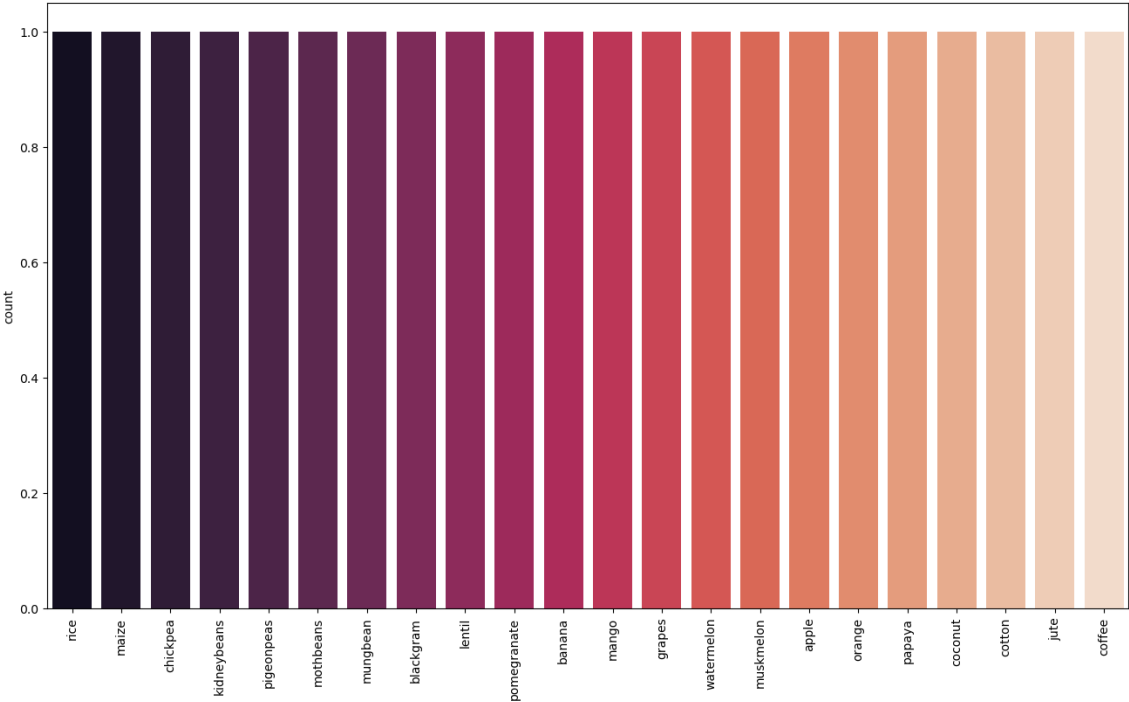
import warnings
warnings.filterwarnings('ignore')
```

```
In [55]: data = pd.read_csv("C:/Users/saiteja143/Downloads/Crop_recommendation.csv")
col = list(data.columns)
classes = data["label"].unique()
from sklearn.preprocessing import LabelEncoder
le=LabelEncoder()
trans=['N','P','K','temperature','humidity','ph','rainfall']
for i in trans:
    data[i]=le.fit_transform(data[i])
data

xdata = data.iloc[:, 0:7].values
ydata = data.iloc[:, 7].values

plt.figure(figsize = (16, 9))
sns.countplot(classes, palette = 'rocket')
plt.xticks(rotation=90)
```

```
Out[55]: (array([ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12, 13, 14, 15, 16,
                17, 18, 19, 20, 21]),
 [Text(0, 0, 'rice'),
  Text(1, 0, 'maize'),
  Text(2, 0, 'chickpea'),
  Text(3, 0, 'kidneybeans'),
  Text(4, 0, 'pigeonpeas'),
  Text(5, 0, 'mothbeans'),
  Text(6, 0, 'mungbean'),
  Text(7, 0, 'blackgram'),
  Text(8, 0, 'lentil'),
  Text(9, 0, 'pomegranate'),
  Text(10, 0, 'banana'),
  Text(11, 0, 'mango'),
  Text(12, 0, 'grapes'),
  Text(13, 0, 'watermelon'),
  Text(14, 0, 'muskmelon'),
  Text(15, 0, 'apple'),
  Text(16, 0, 'orange'),
  Text(17, 0, 'papaya'),
  Text(18, 0, 'coconut'),
  Text(19, 0, 'cotton'),
  Text(20, 0, 'jute'),
  Text(21, 0, 'coffee')])
```



```
In [56]: data
```

Out[56]:

	N	P	K	temperature	humidity	ph	rainfall	label
0	90	37	38	360	1234	1211	2074	rice
1	85	53	36	436	1085	1753	2128	rice
2	60	50	39	582	1262	2117	2174	rice
3	74	30	35	1278	1067	1710	2153	rice
4	78	37	37	306	1201	2055	2171	rice
...	...	...	...	...	...	...	...	...
2195	107	29	27	1327	763	1523	1920	coffee
2196	99	10	22	1441	483	666	1666	coffee
2197	118	28	25	788	793	1012	1895	coffee
2198	117	27	29	1236	387	1493	1663	coffee
2199	104	13	25	693	555	1521	1723	coffee

2200 rows × 8 columns

```
In [57]: data.shape
```

Out[57]: (2200, 8)

In [58]: data.info()

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2200 entries, 0 to 2199
Data columns (total 8 columns):
#   Column          Non-Null Count  Dtype
---  -
0    N                2200 non-null   int64
1    P                2200 non-null   int64
2    K                2200 non-null   int64
3    temperature      2200 non-null   int64
4    humidity         2200 non-null   int64
5    ph               2200 non-null   int64
6    rainfall         2200 non-null   int64
7    label            2200 non-null   object
dtypes: int64(7), object(1)
memory usage: 137.6+ KB
```

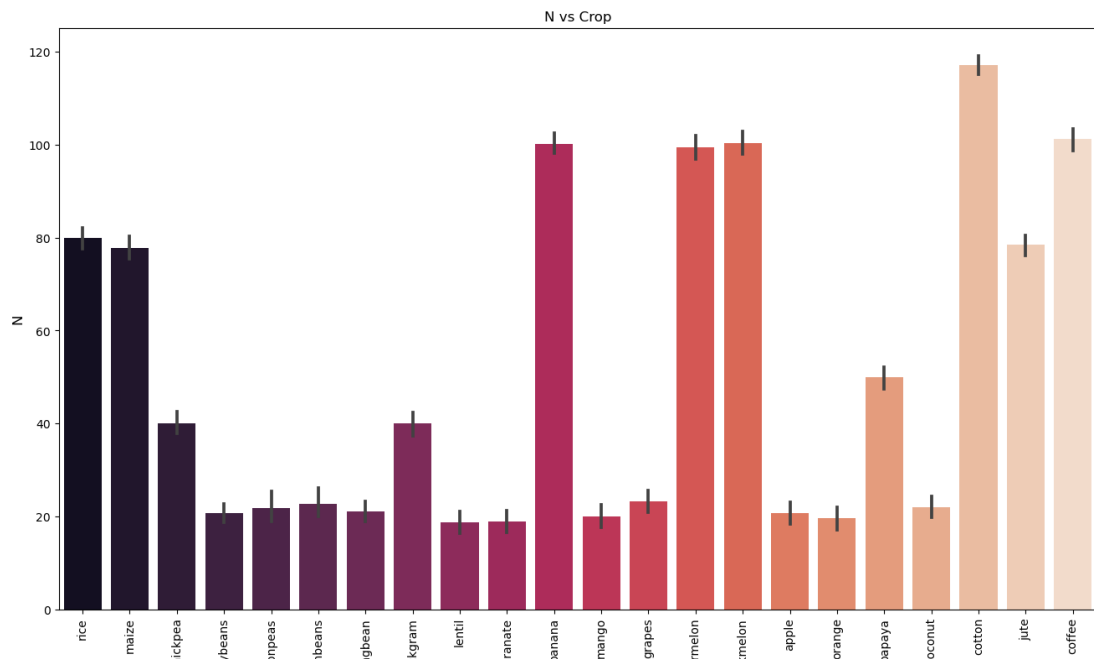
In [59]: data.describe()

Out[59]:

	N	P	K	temperature	humidity	ph	r
count	2200.000000	2200.000000	2200.000000	2200.000000	2200.000000	2200.000000	2200.000000
mean	50.630000	46.241818	30.700909	1099.499545	1099.500000	1099.500000	1099.500000
std	36.927241	28.122979	18.065758	635.228831	635.229617	635.229617	635.229617
min	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
25%	21.000000	23.000000	15.000000	549.750000	549.750000	549.750000	549.750000
50%	37.000000	46.000000	27.000000	1099.500000	1099.500000	1099.500000	1099.500000
75%	85.000000	63.000000	44.000000	1649.250000	1649.250000	1649.250000	1649.250000
max	137.000000	117.000000	73.000000	2198.000000	2199.000000	2199.000000	2199.000000

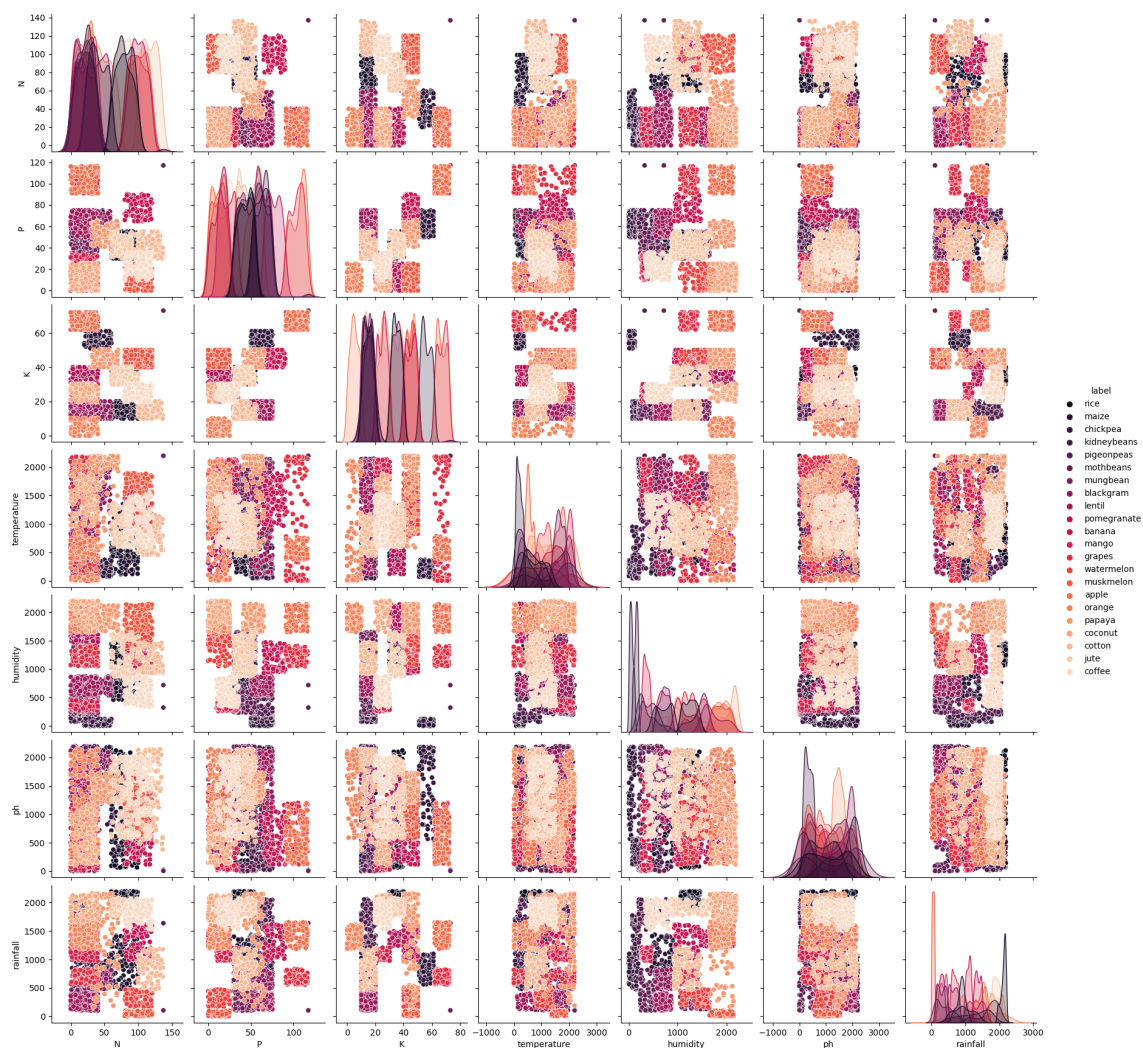
```
In [60]: all_col = data.columns[:-1]

for col in all_col:
    plt.figure(figsize = (16, 9))
    sns.barplot(x = 'label', y = col, data = data, palette = 'rocket')
    plt.xlabel('label', fontsize = 12)
    plt.ylabel(col, fontsize = 12)
    plt.xticks(rotation=90)
    plt.title(f'{col} vs Crop')
    plt.show()
```



```
In [61]: plt.figure(figsize = (10, 17))
sns.pairplot(data, hue = 'label', palette = 'rocket')
plt.show()
```

<Figure size 1000x1700 with 0 Axes>



```
In [62]: xtrain, xtest, ytrain, ytest = train_test_split(xdata, ydata, test_size=0.2)
x_st = StandardScaler()
xtrain = x_st.fit_transform(xtrain)
xtest = x_st.fit_transform(xtest)
```

```
In [63]: acc_list = []
err_rate = []

neighbors = np.linspace(1, 50, 50)
neighbors = neighbors.astype(int)

for K in neighbors:
    classifier = KNeighborsClassifier(n_neighbors = K)
    classifier.fit(xtrain, ytrain)
    y_pred = classifier.predict(xtest)

    accuracy = round(acc(ytest, y_pred)*100, 3)

    acc_list.append(accuracy)
    err_rate.append(np.mean(y_pred != ytest))

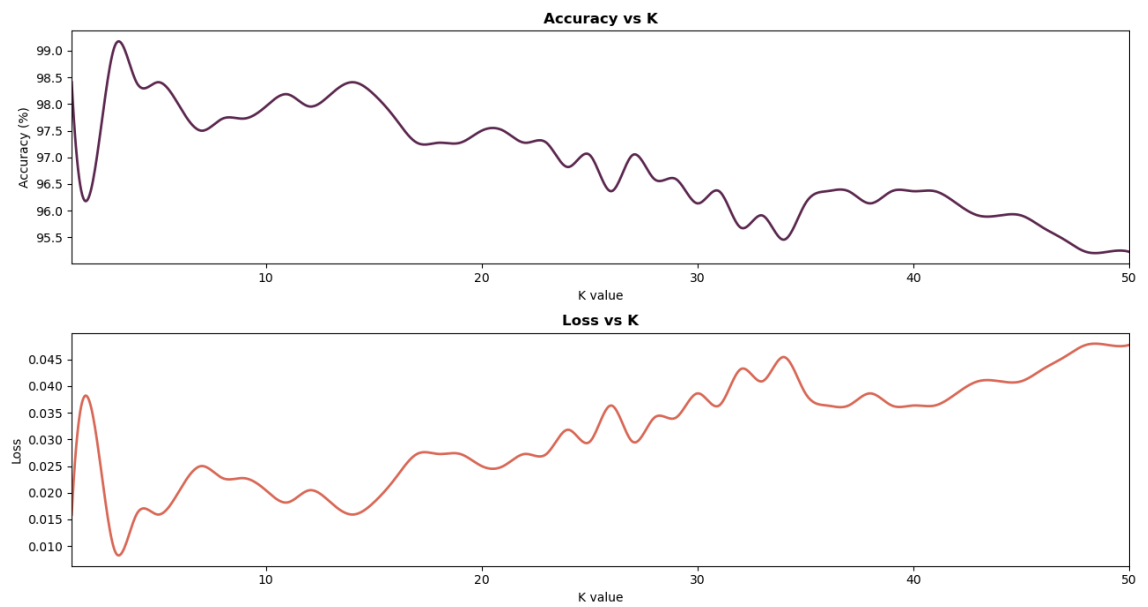
xy = make_interp_spline(neighbors, acc_list)
xz = make_interp_spline(neighbors, err_rate)
x = np.linspace(1, 50, 1000)
y = xy(x)
z = xz(x)

plt.figure(figsize = (13, 7))
plt.subplot(2, 1, 1)
sns.lineplot(x, y, linewidth = 2, color = '#5C284F')
plt.xlabel('K value')
plt.ylabel('Accuracy (%)')
plt.title('Accuracy vs K', fontweight = 'bold')
plt.xlim(min(neighbors), max(neighbors))

plt.subplot(2, 1, 2)
sns.lineplot(x, z, linewidth = 2, color = '#D96856')
plt.xlabel('K value')
plt.ylabel('Loss')
plt.title('Loss vs K', fontweight = 'bold')
plt.xlim(min(neighbors), max(neighbors))

plt.tight_layout()
plt.show()

K_opt = acc_list.index(max(acc_list))
print('\nOptimal value of K = ', K_opt)
```



Optimal value of K = 2

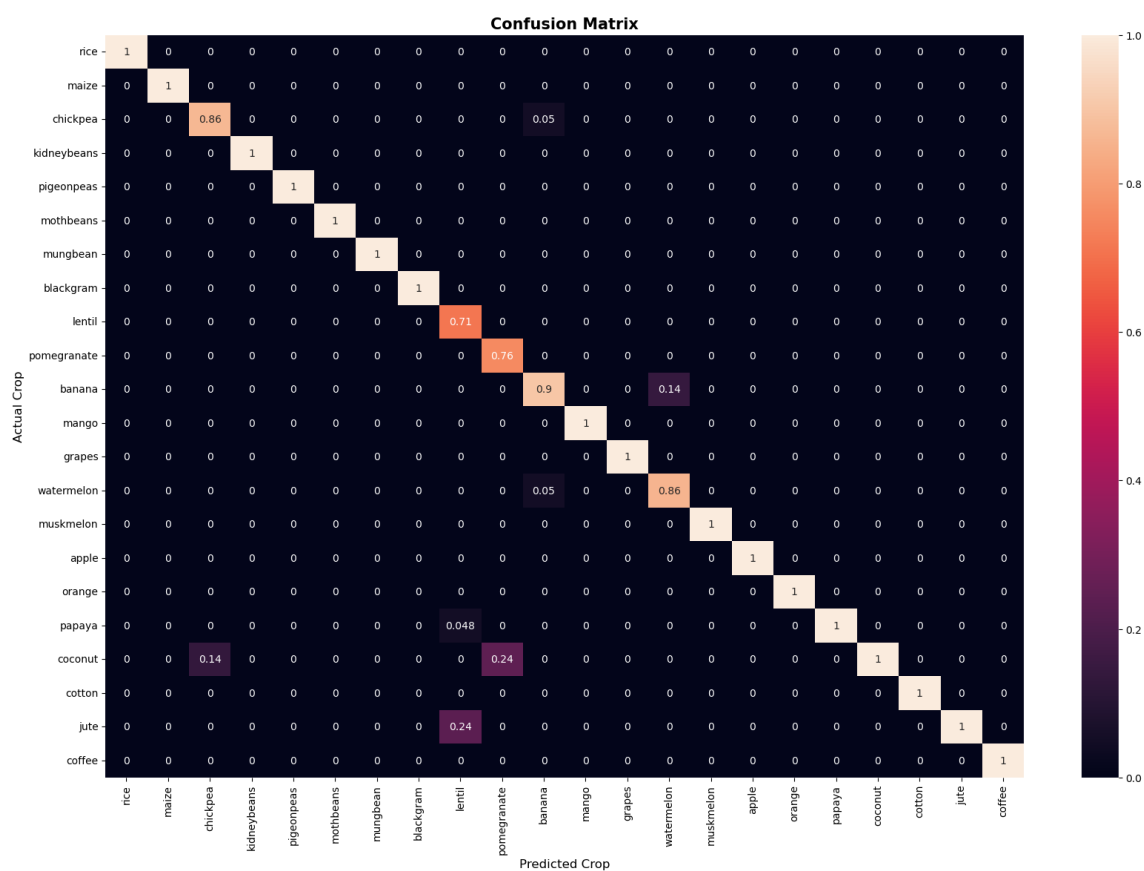


```
In [64]: cm = confusion_matrix(ytest, y_pred, normalize = 'pred')

fig, ax = plt.subplots(figsize=(20,13))
sns.heatmap(cm, annot = True)
plt.xlabel('Predicted Crop', fontsize = 12)
plt.ylabel('Actual Crop', fontsize = 12)
plt.title('Confusion Matrix', fontweight = 'bold', fontsize = 15)

plt.xticks(rotation=90)
plt.yticks(rotation=0)

ax.xaxis.set_ticklabels(classes)
ax.yaxis.set_ticklabels(classes)
plt.show()
```



In [65]: y\_pred

```

Out[65]: array(['muskmelon', 'muskmelon', 'coffee', 'muskmelon', 'kidneybeans',
                'pomegranate', 'maize', 'coffee', 'jute', 'cotton', 'muskmelon',
                'mungbean', 'grapes', 'watermelon', 'blackgram', 'banana',
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                'kidneybeans', 'coffee', 'maize', 'grapes', 'mothbeans',
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                'muskmelon', 'blackgram', 'blackgram', 'coconut', 'coconut',
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                'blackgram', 'chickpea', 'kidneybeans', 'chickpea', 'coconut',
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                'maize', 'orange', 'kidneybeans', 'chickpea', 'rice', 'pigeonpeas',
                'rice', 'chickpea', 'jute', 'chickpea', 'pigeonpeas', 'muskmelon',
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                'kidneybeans', 'coffee', 'apple', 'cotton', 'blackgram',
                'kidneybeans', 'cotton', 'kidneybeans', 'mango', 'coconut',
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                'kidneybeans', 'blackgram', 'lentil', 'muskmelon', 'papaya',
                'pomegranate', 'mungbean', 'muskmelon', 'maize', 'coconut',
                'banana', 'pigeonpeas', 'mothbeans', 'mungbean', 'rice', 'coconut',
                'mothbeans', 'banana', 'chickpea', 'kidneybeans', 'kidneybeans',
                'coffee', 'papaya', 'lentil', 'chickpea', 'orange', 'kidneybeans',
                'mango', 'papaya', 'lentil', 'papaya', 'kidneybeans', 'blackgram',
                'cotton', 'mungbean', 'muskmelon', 'cotton', 'coffee', 'banana',
                'muskmelon', 'apple', 'apple', 'maize', 'kidneybeans',

```

```
'pigeonpeas', 'coffee', 'lentil', 'mango', 'pomegranate', 'papaya',  
'rice', 'blackgram', 'coconut', 'muskmelon', 'mango', 'lentil',  
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'coconut', 'pomegranate', 'mothbeans', 'muskmelon', 'kidneybeans',  
'watermelon', 'coffee', 'muskmelon', 'orange', 'banana', 'jute',  
'mango', 'mungbean', 'maize', 'coconut', 'coconut', 'mango'],  
dtype=object)
```

In [66]: ytest

```

Out[66]: array(['muskmelon', 'muskmelon', 'coffee', 'muskmelon', 'kidneybeans',
                'pomegranate', 'maize', 'coffee', 'jute', 'cotton', 'muskmelon',
                'mungbean', 'grapes', 'watermelon', 'blackgram', 'banana',
                'watermelon', 'grapes', 'grapes', 'coffee', 'grapes',
                'kidneybeans', 'coffee', 'maize', 'grapes', 'mothbeans',
                'pigeonpeas', 'papaya', 'cotton', 'rice', 'watermelon', 'banana',
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                'pomegranate', 'pigeonpeas', 'mango', 'rice', 'orange',
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                'coconut', 'pomegranate', 'coffee', 'mango', 'lentil', 'mango',
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                'jute', 'banana', 'rice', 'muskmelon', 'mango', 'pomegranate',
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                'pomegranate', 'mungbean', 'muskmelon', 'maize', 'coconut',
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                'cotton', 'mungbean', 'muskmelon', 'cotton', 'coffee', 'banana',
                'muskmelon', 'apple', 'apple', 'maize', 'pigeonpeas', 'pigeonpeas',

```

```
'coffee', 'lentil', 'mango', 'pomegranate', 'papaya', 'rice',
'blackgram', 'coconut', 'muskmelon', 'mango', 'mothbeans',
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'mungbean', 'muskmelon', 'mothbeans', 'mungbean', 'blackgram',
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'banana', 'mango', 'mungbean', 'jute', 'kidneybeans', 'watermelon',
'rice', 'cotton', 'rice', 'lentil', 'kidneybeans', 'papaya',
'coconut', 'pomegranate', 'mothbeans', 'muskmelon', 'pigeonpeas',
'watermelon', 'coffee', 'muskmelon', 'orange', 'banana', 'rice',
'mango', 'mungbean', 'maize', 'coconut', 'coconut', 'mango'],
dtype=object)
```

```
In [67]: classifier = KNeighborsClassifier(n_neighbors=K_opt+1)
classifier.fit(xtrain, ytrain)
y_pred = classifier.predict(xtest)

accuracy = acc(ytest, y_pred)*100
print('Accuracy of the training Model : ', round(accuracy, 3), '%')
```

Accuracy of the training Model : 99.091 %

```
In [68]: from sklearn.ensemble import RandomForestClassifier
rfc = RandomForestClassifier(n_estimators=200)
rfc.fit(xtrain, ytrain)
```

Out[68]: RandomForestClassifier(n\_estimators=200)

```
In [69]: s=rfc.predict(xtest)
s
```



```

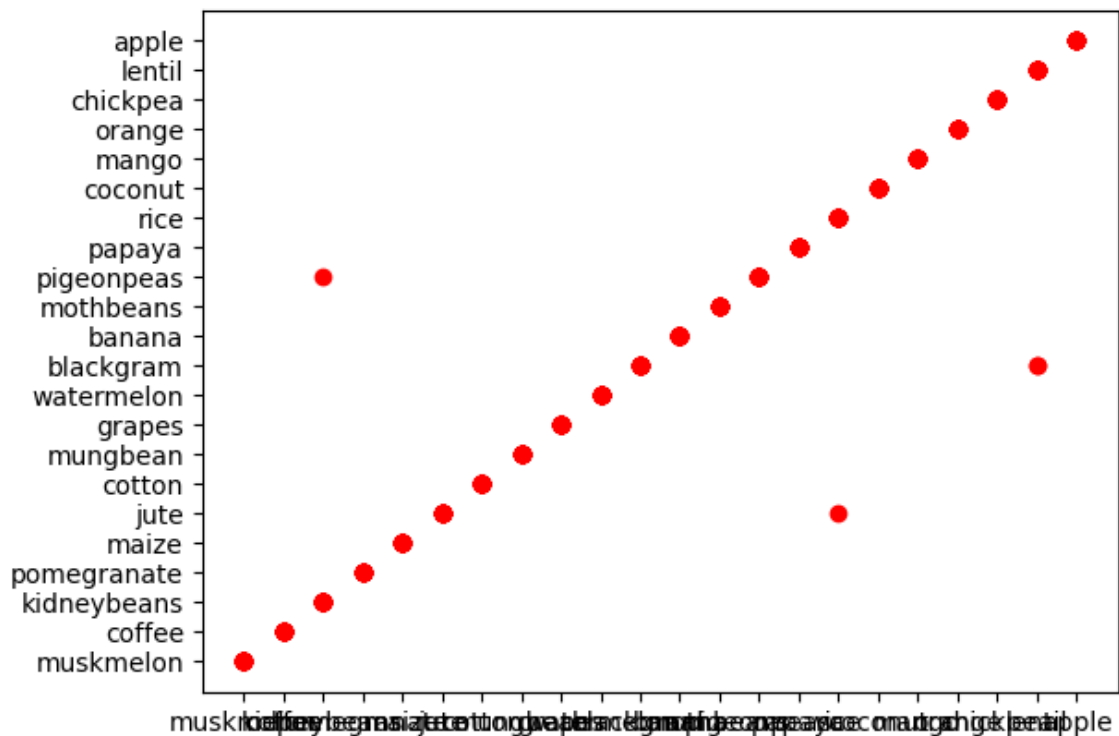
Out[69]: array(['muskmelon', 'muskmelon', 'coffee', 'muskmelon', 'pigeonpeas',
                'pomegranate', 'maize', 'coffee', 'jute', 'cotton', 'muskmelon',
                'mungbean', 'grapes', 'watermelon', 'blackgram', 'banana',
                'watermelon', 'grapes', 'grapes', 'coffee', 'grapes',
                'kidneybeans', 'coffee', 'maize', 'grapes', 'mothbeans',
                'pigeonpeas', 'papaya', 'cotton', 'rice', 'watermelon', 'banana',
                'muskmelon', 'blackgram', 'blackgram', 'coconut', 'coconut',
                'pomegranate', 'pigeonpeas', 'mango', 'rice', 'orange',
                'muskmelon', 'blackgram', 'chickpea', 'kidneybeans', 'chickpea',
                'coconut', 'pomegranate', 'coffee', 'mango', 'lentil', 'mango',
                'mango', 'maize', 'orange', 'pigeonpeas', 'chickpea', 'rice',
                'pigeonpeas', 'rice', 'chickpea', 'jute', 'chickpea', 'pigeonpeas',
                'muskmelon', 'pomegranate', 'blackgram', 'coconut', 'pigeonpeas',
                'grapes', 'mungbean', 'papaya', 'blackgram', 'jute', 'cotton',
                'cotton', 'maize', 'pigeonpeas', 'coffee', 'banana', 'maize',
                'jute', 'banana', 'rice', 'muskmelon', 'mango', 'pomegranate',
                'chickpea', 'maize', 'jute', 'mothbeans', 'lentil', 'mango',
                'coconut', 'maize', 'jute', 'apple', 'maize', 'rice', 'coffee',
                'maize', 'papaya', 'blackgram', 'orange', 'kidneybeans', 'banana',
                'grapes', 'coconut', 'pigeonpeas', 'papaya', 'coffee', 'coconut',
                'pigeonpeas', 'coffee', 'apple', 'cotton', 'blackgram',
                'pigeonpeas', 'cotton', 'pigeonpeas', 'mango', 'coconut', 'lentil',
                'lentil', 'papaya', 'banana', 'cotton', 'cotton', 'banana',
                'coffee', 'pigeonpeas', 'cotton', 'kidneybeans', 'coconut',
                'apple', 'grapes', 'lentil', 'banana', 'muskmelon', 'orange',
                'kidneybeans', 'pomegranate', 'mango', 'muskmelon', 'banana',
                'chickpea', 'banana', 'grapes', 'rice', 'pomegranate',
                'kidneybeans', 'lentil', 'pigeonpeas', 'apple', 'jute', 'banana',
                'papaya', 'rice', 'cotton', 'mungbean', 'pomegranate',
                'watermelon', 'watermelon', 'chickpea', 'grapes', 'jute', 'coffee',
                'watermelon', 'watermelon', 'kidneybeans', 'mungbean', 'lentil',
                'grapes', 'rice', 'chickpea', 'banana', 'watermelon',
                'pomegranate', 'orange', 'banana', 'chickpea', 'apple',
                'kidneybeans', 'maize', 'kidneybeans', 'mungbean', 'banana',
                'apple', 'cotton', 'maize', 'mungbean', 'banana', 'rice',
                'pigeonpeas', 'chickpea', 'grapes', 'blackgram', 'watermelon',
                'pomegranate', 'mango', 'mungbean', 'cotton', 'coconut',
                'blackgram', 'chickpea', 'rice', 'blackgram', 'cotton',
                'watermelon', 'coconut', 'mango', 'lentil', 'banana', 'maize',
                'cotton', 'lentil', 'chickpea', 'papaya', 'lentil', 'maize',
                'banana', 'muskmelon', 'pomegranate', 'cotton', 'watermelon',
                'coffee', 'orange', 'lentil', 'coffee', 'muskmelon', 'pomegranate',
                'lentil', 'chickpea', 'apple', 'chickpea', 'pigeonpeas', 'papaya',
                'blackgram', 'banana', 'muskmelon', 'watermelon', 'chickpea',
                'pigeonpeas', 'grapes', 'banana', 'orange', 'apple', 'mothbeans',
                'grapes', 'grapes', 'rice', 'mothbeans', 'orange', 'chickpea',
                'orange', 'kidneybeans', 'chickpea', 'rice', 'maize', 'muskmelon',
                'grapes', 'coconut', 'blackgram', 'chickpea', 'lentil',
                'muskmelon', 'jute', 'coffee', 'banana', 'cotton', 'maize',
                'apple', 'grapes', 'cotton', 'grapes', 'mango', 'mungbean',
                'muskmelon', 'blackgram', 'coconut', 'banana', 'pigeonpeas',
                'jute', 'blackgram', 'cotton', 'mango', 'jute', 'cotton',
                'watermelon', 'mango', 'mothbeans', 'orange', 'maize', 'chickpea',
                'cotton', 'cotton', 'mungbean', 'mothbeans', 'pigeonpeas',
                'blackgram', 'lentil', 'muskmelon', 'papaya', 'pomegranate',
                'mungbean', 'muskmelon', 'maize', 'coconut', 'banana',
                'pigeonpeas', 'mothbeans', 'mungbean', 'rice', 'coconut',
                'mothbeans', 'banana', 'chickpea', 'pigeonpeas', 'kidneybeans',
                'coffee', 'papaya', 'lentil', 'chickpea', 'orange', 'pigeonpeas',
                'mango', 'papaya', 'lentil', 'papaya', 'pigeonpeas', 'blackgram',
                'cotton', 'mungbean', 'muskmelon', 'cotton', 'coffee', 'banana',

```

```
'muskmelon', 'apple', 'apple', 'maize', 'pigeonpeas', 'pigeonpeas',
'coffee', 'lentil', 'mango', 'pomegranate', 'papaya', 'rice',
'blackgram', 'coconut', 'muskmelon', 'mango', 'mothbeans',
'grapes', 'watermelon', 'banana', 'pigeonpeas', 'coconut', 'mango',
'lentil', 'pomegranate', 'grapes', 'coffee', 'mothbeans', 'apple',
'pigeonpeas', 'cotton', 'pigeonpeas', 'pigeonpeas', 'coconut',
'jute', 'lentil', 'banana', 'pigeonpeas', 'chickpea',
'kidneybeans', 'apple', 'coffee', 'chickpea', 'banana', 'orange',
'mungbean', 'kidneybeans', 'jute', 'rice', 'cotton', 'kidneybeans',
'papaya', 'mango', 'blackgram', 'maize', 'papaya', 'chickpea',
'rice', 'apple', 'banana', 'mungbean', 'mothbeans', 'coconut',
'mungbean', 'muskmelon', 'mothbeans', 'mungbean', 'blackgram',
'watermelon', 'mungbean', 'pomegranate', 'mungbean', 'rice',
'banana', 'mango', 'mungbean', 'jute', 'pigeonpeas', 'watermelon',
'rice', 'cotton', 'rice', 'lentil', 'pigeonpeas', 'papaya',
'coconut', 'pomegranate', 'mothbeans', 'muskmelon', 'pigeonpeas',
'watermelon', 'coffee', 'muskmelon', 'orange', 'banana', 'jute',
'mango', 'mungbean', 'maize', 'coconut', 'coconut', 'mango'],
dtype=object)
```

```
In [70]: plt.scatter(ytest,y_pred,color='red',label=True)
```

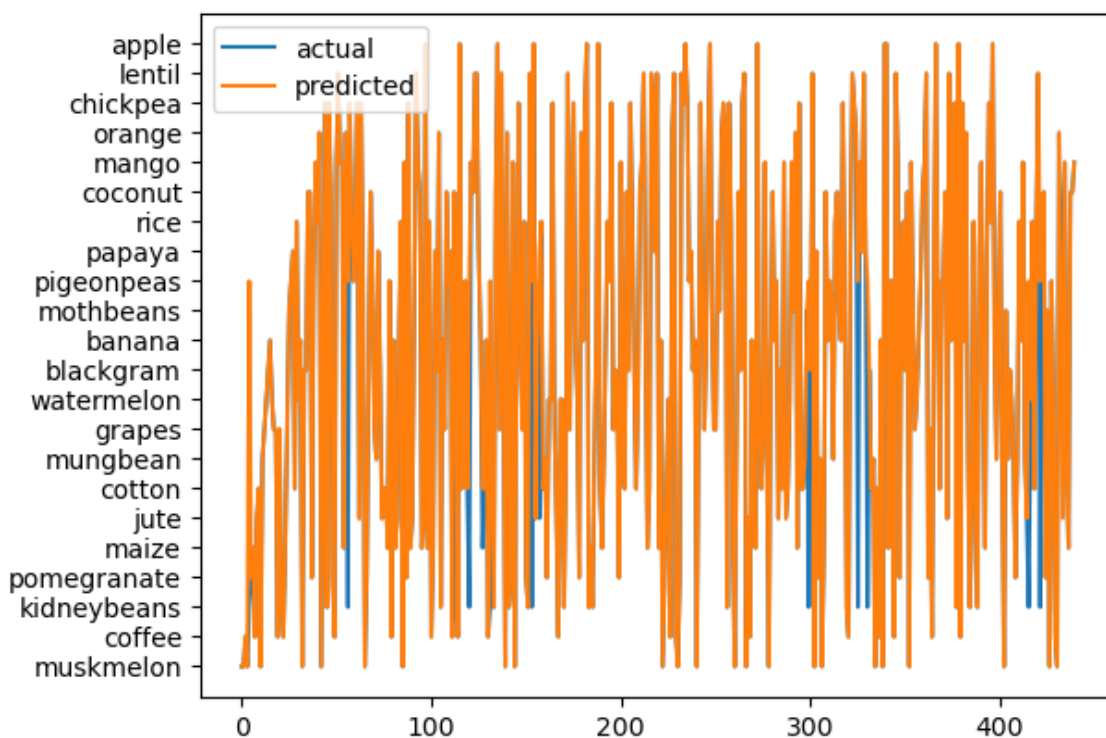
```
Out[70]: <matplotlib.collections.PathCollection at 0x2576fd3f820>
```



```
In [71]: import matplotlib.pyplot as plt

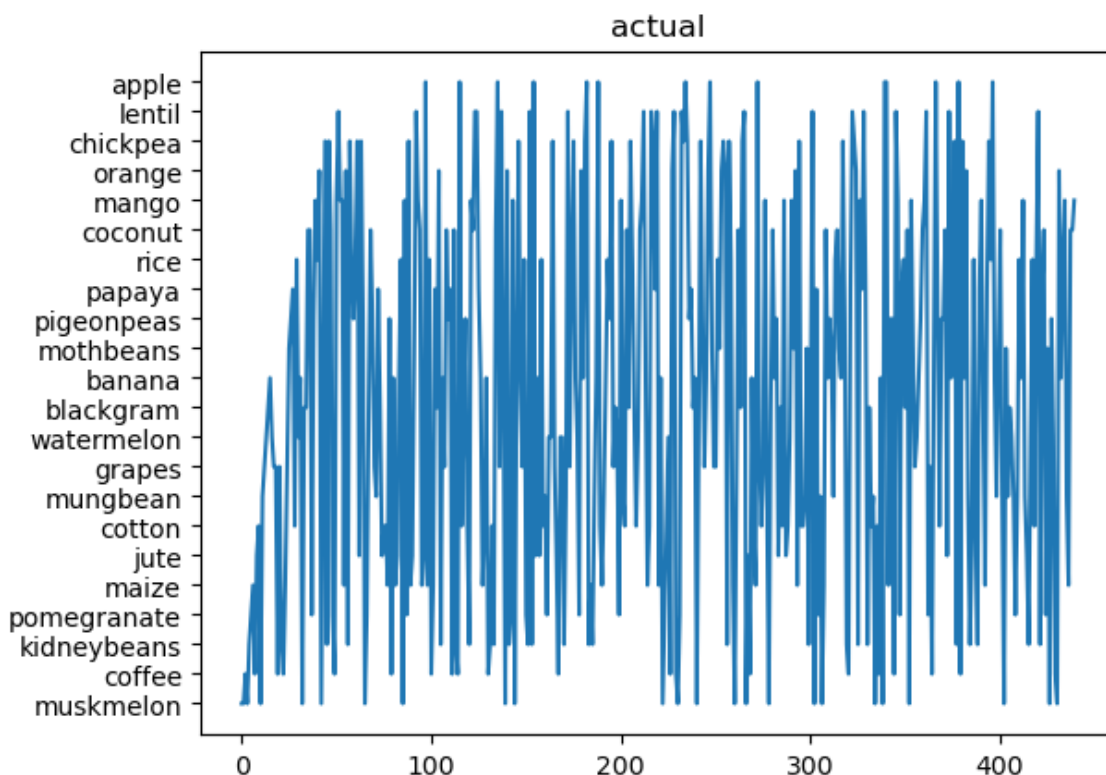
plt.plot(np.arange(0,len(ytest)),ytest,label='actual')
plt.plot(np.arange(0,len(ytest)),rfc.predict(xtest),label='predicted')
plt.legend()
```

Out[71]: <matplotlib.legend.Legend at 0x2576afdb1f0>



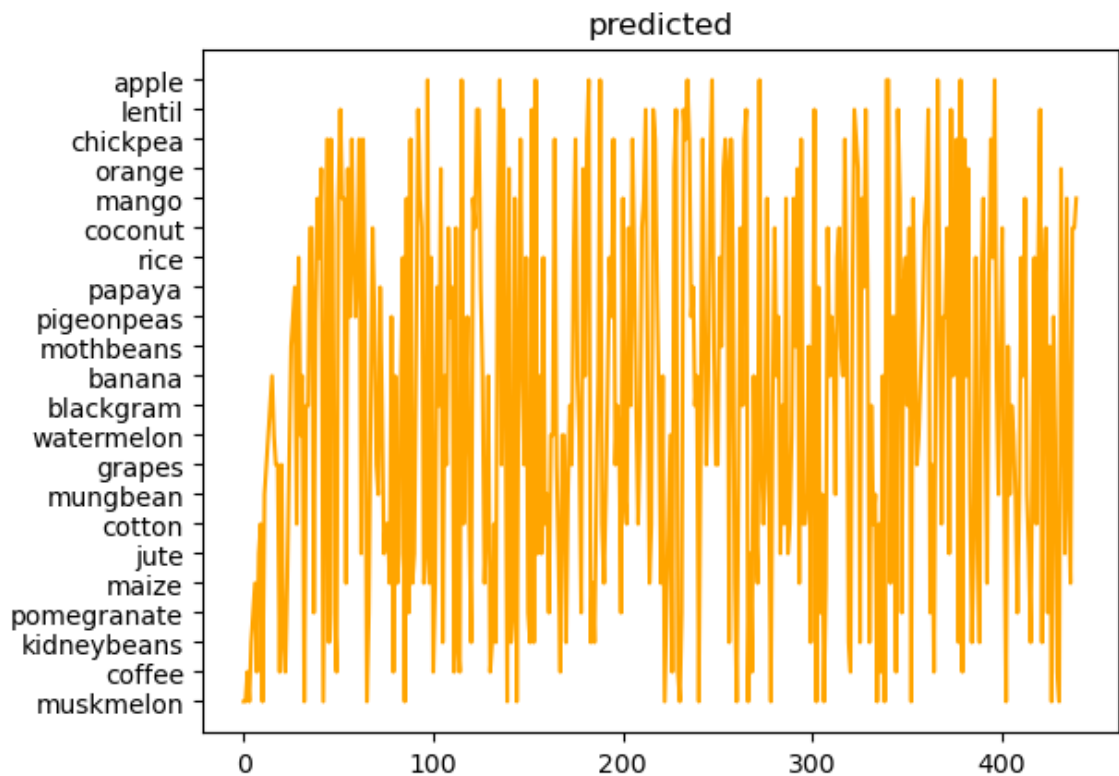
```
In [72]: plt.plot(ytest)
plt.title('actual')
```

Out[72]: Text(0.5, 1.0, 'actual')



```
In [73]: plt.plot(y_pred,color='orange')
plt.title('predicted')
```

```
Out[73]: Text(0.5, 1.0, 'predicted')
```



```
In [74]: from sklearn.metrics import accuracy_score
accuracy_score(s,ytest)
```

```
Out[74]: 0.9681818181818181
```

```
In [75]: classifier.predict([[85,58,41,21.770462,80.319644,7.038096,226.655537]])[0]
```

```
Out[75]: 'papaya'
```

```
In [77]: import pickle
path='C:/Users/saiteja143/Desktop/streamlit/crop_pred.sav'
bo=pickle.dump(classifier,open(path,"wb"))
```

```
In [ ]: # open("diab_pred.sav", "wb")
```

```
In [78]: pickle.load(open(path,'rb'))
```

```
Out[78]: KNeighborsClassifier(n_neighbors=3)
```

```
In [ ]: xtest
```

```
In [ ]: xtest[:36,:]
```

In [ ]: