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FINAL PROJECT

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TOPIC: THE USE OF SIMPLE LINEAR REGRESSION MODEL IN SUITS' WATERMELON PRODUCTION.

Abstract:

An investigation is conducted to examine the correlation between the mean farm price, the quantity of watermelons harvested, the wage rates of farmers, and the overall population of the United States. The model's F-statistic of 87.8932 and p-value of 4.007E-11 provide strong evidence to support a statistically significant conclusion, with a significance level of 0.05. This model explains about 95.4% of the variability seen in the dependent variable. A one unit increase in watermelon harvest is directly correlated with a 0.8479 unit increase in the dependent variable, with a p-value of 0.05. Conversely, a significant (p 0.05) decrease of -0.0748 units in the dependent variable is seen for each one unit increase in the average farm price of watermelons. There is a direct relationship between the agricultural pay rates in the South Atlantic States and the index rate of inflation (p = 0.0682), but this relationship is not statistically significant. Likewise, there exists a negative link between the U.S. population, but it is not statistically significant (p = 0.2208).

Keywords: watermelons harvest, average farm price, farm wage, U. S population.

Introduction

The watermelon, scientifically referred to as Citrullus lanatus, belongs to the Cucurbitaceae family. This crop is cultivated in regions characterised by extended periods of high temperatures and absence of frost, mostly for commercial purposes. Cultivating these plants need ample space due to their elongated, trailing tendrils. Conversely, smaller types allow for denser planting. Seeds or transplants cultivated in containers can be transferred to the field to initiate crop growth. Consistent and ongoing measures should be implemented to prevent the occurrence of weeds, insects, and illnesses caused by nematodes over the whole growing period. China has the title of being the top producer of watermelons globally, with Asia as a whole contributing to 75% of the total worldwide output (Wehner, 2008).

Based on the 2022 USDA-NASS statistics, watermelons are cultivated on over 100,000 acres per year in eight distinct states. Based on the 2020a USDA-ERS report, California, Florida, Georgia, and Texas account for more than 80% of the total agricultural production, with Florida being the top producer within the country. According to the USDA-NASS report in 2021, Florida played a significant role in the watermelon industry in 2019. It contributed 25.2% of the entire watermelon production in the United States, accounted for 24.7% of the national watermelon farming area, and represented 29.6% of the overall value of watermelon crops in the country. In 2021, watermelon production in Florida constituted 13.2% of the state's total vegetable output in terms of value, as reported by the USDA-NASS. Based on the USDA-NASS data, the overall value of watermelon production in the United States in 2022 was $534 million, with a quantity of 34.1 million hundredweight (1 cwt equivalent to 100 pounds). According to the USDA-NASS report in 2022, the production value of watermelons decreased by 7% compared to the figures given in 2020. Additionally, the overall output saw a 1% decline.

Data on the area of land, amount of crops produced, and cost of conventionally cultivated watermelons with seeds and without seeds is available for the years 2010 to 2021 in California, Florida, Georgia, and Texas. The EDIS study focuses on the development of the top five economically significant specialty crops in Florida in 2020, excluding citrus. Additionally, crops such as tomatoes, peppers, watermelons, sweet corn, and strawberries might be cited as examples (FDACS, 2022).

This data will prove helpful for growers, Extension agents, and anyone eager on remaining updated about changes in speciality crop commodities. Information on market and production trends for various crops is included in the publication.

Growing watermelons requires a long, warm growing season, yet in Oklahoma, they take up more land than any other type of food production. Several locations of the state are feasible for production, although the west central, south central, and eastern regions are where most of it is done. The importation of watermelons has contributed to the recent spike in demand for this fruit in the United States. The state's declining land area can be explained by higher yields and a shortage of workers. The National Watermelon Promotion Board is increasing awareness about the health advantages and culinary versatility of this fruit. The ease of serving this invigorating fruit has been improved by the widespread availability of smaller-fruited and seedless varieties, as well as the introduction of techniques for selling pre-cut packaged watermelon (Shrefler et al., 2017). Achieving a lucrative conclusion needs a grower to develop high-quality melons in sufficient quantities. Such substantial harvests of superior melons are only possible with careful management. In Oklahoma, a watermelon harvest of eight tonnes per acre, achieved with the use of irrigation, is considered successful. However, about five tonnes is the typical harvest. In certain cases, yields have topped 15 tonnes per acre under ideal conditions and with specific cultivars (Shrefler et al., 2017).

Watermelons typically achieve harvest maturity within a span of five to six weeks following pollination, based on factors such as variety and season. Various cultivars exhibit distinct indicators of maturity, although seasoned farmers possess the ability to discern the readiness of an apple by observing its lustrous skin. Additionally, the nearest appendages to the fruit will undergo a transformation in colour, shifting from green to brown and then withering. Furthermore, the areas in contact with the ground will experience a change in hue, transitioning from white to a pale yellow shade. By striking the fruit, one may assess its level of ripeness based on the sound it produces. A resonant, metallic ring suggests that the fruit is not yet fully mature, whereas a muted or dull sound suggests that the fruit is mature or even overripe. This approach is particularly efficient for melons that have a round shape. To obtain the most accurate findings, it is advisable to sample melons from various areas of the field and assess their maturity based on their external appearance. Picking and selling melons that are unripe or underripe might lead to a decrease in client satisfaction and demand. It is crucial to have in mind that the sweetness of melons does not

increase after they are harvested. However, the ones that are redder, particularly those that are slightly immature, tend to be sweeter.

The watermelon production in the United States in 2012 surpassed 39 million hundredweight (cwt), which was more than the previous year's harvest in 2011. The fresh market value of watermelons also experienced an increase compared to the previous year, reaching a total of around $520.8 million. Based on data from the USDA's National Agricultural Statistics Service, the mean price decreased from $13.60 per cwt in 2011 to $13.30 in 2012.

The United States has the title of being the foremost global producer of watermelon, with the bulk of this harvest being consumed in its fresh form. As to the USDA Economic Research Service, the average per capita consumption of fresh watermelon by Americans in 2010 was 15.5 pounds. A study on dietary patterns reveals that women had a higher consumption of watermelon compared to males. More than 85% of watermelons sold at retail in the United States are purchased for personal consumption. Processed watermelon products such as juice, rind pickles, and roasted seeds are among the options available (Shrefler et al., 2017).

The marketing of watermelons in Oklahoma encompasses several strategies, which are often determined by the grower and the volume of fruit obtained. Possible options for selling agricultural produce include: selling the entire crop field, collaborating with distributors or wholesalers, supplying merchants such as trucking firms or grocery stores, and directly selling to end users at venues like farmer's markets and roadside stalls. The majority of Oklahoma's commercial crop that is sent out of state is managed by brokers, who negotiate transactions based on weight at the time of harvest and under F.O.B. (Free On Board) terms from the packing shed. Both shippers and customers involved in these transactions must adhere to stringent packaging standards. Watermelons are commonly retailed by small-scale growers on a per-melon basis at temporary or permanent roadside booths or farmers' markets. Accessing dependable transportation networks is essential for efficiently transporting the crop to various distribution sites. Watermelon prices often increase when they are picked early, nevertheless, it is crucial to prioritise quality and freshness while promoting them (Shrefler et al., 2017).

China has the highest production estimate, with 79,276,300 tonnes (42.88 t ha1), followed by Iran with 4,059,786 tonnes (29.81 t ha1), Turkey with 4,011,313 tonnes (41.99 t ha1), Brazil with 2,314,700 tonnes (22.00 t ha1), and Uzbekistan with 2,030,992 tonnes (39.81 t ha1). The worldwide production for the same year reached a total of 118,413,465 tonnes, grown on 3,477,285

hectares of land, with an average yield of 34 tonnes per hectare. Algeria has the position of being the foremost producer of watermelons on the continent, with Egypt and Morocco closely following suit, as reported by FAO in 2019.

According to Gusmini and Wehner (Gusmini 2008), the global improvement in the productivity of cucurbit species, including watermelon, in recent decades may be mainly attributed to the use of better farming techniques, such as optimising plant density and developing disease-resistant varieties.

Plant density has a significant effect on watermelon yields, even when controlling for environmental conditions and genotype (Shinozaki 2011). Planting watermelons at the right density is essential for maximum yield (Lu, 2003). However, Akintoye (2009) notes that increasing plant density beyond a certain point may not result in higher watermelon yields.

In light of these considerations, this research was conducted to investigate the correlation between available watermelons for harvest and various factors such as the average farm price, watermelon harvest quantities, farm wage rates, and the U.S. population.

Study Objectives:

The outlined objectives serve as the rationale behind conducting this research:

- To establish the correlation between the quantity of watermelons available for harvest and factors such as the average farm price, watermelon harvest volume, farm wage rates, and the U.S. population.
- To determine the correlation between the independent variable (quantity of watermelons available for harvest) and the dependent variables (average farm price, watermelon harvest volume, farm wage rates, and U.S. population).
- To assess the influence of the dependent variables and the independent variable on the study parameters.

Data and Data analysis

The analysis relies on secondary data spanning from 1930 to 1951, encompassing several significant variables. The data includes the quantity of harvested watermelons (measured in millions), the quantity of available watermelons (measured in millions), the average price of

watermelons per thousand dollars, the wage rates for farms in the South Atlantic States (indexed), and the population of the United States designated as 'n' (Stewart, 2018).

Data Analysis

The association between the independent and dependent variables was established through the utilization of a fundamental statistical method known as the simple linear regression model. The model is represented in the following manner:

$\mathbf{q = \beta_0 + \beta_1 p + \beta_2 h + \beta_3 w + \beta_4 n + \varepsilon}$ Where:

q is the number of watermelons available for harvest (in millions),

p represents the average farm price of watermelons (in dollars per thousand),

Watermelon yield (in millions) denoted by the letter h

w represents the South Atlantic States' index of farm wages rate and

U.S. population is denoted by n.

β_0 serves as the intercept or constant, representing the expected value of q (crop of watermelons available for harvest) when other variables are held constant,

The average farm price of watermelons, denoted by p, is represented by the coefficient β_1.

Watermelon yield (h) is represented by the coefficient β_2.

South Atlantic State farm wage rates (w) have a coefficient of β_3.

The population (n) coefficient for the United States is β_4.

ε represents the error term.

To find out how q is related to p (average farm price of watermelons in dollars per thousand), h (watermelons harvested in millions), w (farm wage rates in the South Atlantic States in index), and n (U.S. population), we can use a regression analysis.

RESULTS AND DISCUSSION

Table 2: Summary Output of the Regression Model

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.97667							
R Square	0.95388							
Adjusted R Square	0.94302							
Standard Error	0.09559							
Observations	22							
	df	SS	MS	F	Significance F			
Regression	4	3.21254	0.8031	87.8932	4.007E-11			
Residual	17	0.15534	0.00914					
Total	21	3.36788						
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	3.9925	2.7444	1.4548	0.1639	-1.7977	9.7828	-1.7977	9.7828
h	0.8479	0.1178	7.1957	0.0000	0.5993	1.0965	0.5993	1.0965
p	-0.0748	0.0297	-2.5203	0.0220	-0.1374	-0.0122	-0.1374	-0.0122
w	0.2200	0.1129	1.9477	0.0682	-0.0183	0.4582	-0.0183	0.4582
n	-0.3905	0.3072	-1.2711	0.2208	-1.0386	0.2576	-1.0386	0.2576

$q = 3.9925 + 0.8479p - 0.0748h + 0.2200w - 0.3905n$ is the new form of the equation.

When all other factors are held constant, the β_0 term in the regression equation is 3.9925.

A one unit increase in h (the number of watermelons harvested) is associated with a 0.8479 unit increase in q (the number of watermelons available for harvest), according to the coefficient for h (β_1). Statistical significance is indicated by the corresponding p-value.

Watermelon farm prices are negatively correlated with harvest yields (q), with a correlation of -0.0748 indicating that a one-unit increase in p (β_2) reduces q by 0.0748 units. The p-value verifies statistical significance.

There is a positive relationship between farm wage rates, w (β_3) and the dependent variable q (watermelon harvest) (0.2200), as indicated by the coefficient of w = 0.2200. The p-value, however, indicates that this relationship is not statistically significant.

The calculated coefficient for the independent variable, U.S. population n (β_4), is -0.3905, meaning that a one-unit increase in n is associated with a 0.3905 unit drop in the dependent variable, q (availability of watermelons for harvest). The p-value, like w, indicates that there is no statistical significance in this correlation.

There is statistical significance in the regression model, as indicated by the F-statistic, whose associated p-value is near to zero (4.00671E-11).

How much variance in the dependent variable can be accounted for by the independent variables is shown by the R^2 value, which is 0.9539. This high R^2 value indicates that approximately 95.39% of the variance in the dependent variable is explained by the independent variables in the regression model, signifying a good fit model.

CONCLUSION

To summarize, the high R^2 value of 0.95388 demonstrates that the regression model effectively explains a substantial portion of the variability in the dependent variable q (the quantity of watermelons available for harvest). The F-statistic, which is very significant, confirms that the model is a good match for the dataset. The coefficients and accompanying statistics provide insight into the magnitude of the impact that each independent variable has on the dependent variable.

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