Black Sea Journal of Agriculture
doi: 10.47115/bsagriculture.1138860

Open Access Journal
e-ISSN: 2618 – 6578

Research Article
Volume 6 - Issue 1: 8-15 / January 2023

# INVESTIGATION OF VEGETABLE PRODUCTION AMOUNT AND THE SIZE OF CULTIVATION AREAS IN KAHRAMANMARAŞ WITH THE ECONOMETRIC MODEL

**İsmail GÖK[1]*, Mustafa ŞAHİN[2]**

[1]*Kahramanmaraş Sütçü İmam University, Faculty of Agriculture, Department of Bioengineering, 46100, Kahramanmaraş, Türkiye*
[2]*Kahramanmaraş Sütçü İmam University, Faculty of Agriculture, Department of Agricultural Biotechnology, 46100, Kahramanmaraş, Türkiye*

**Abstract:** This study aims to determine the relationship between the size of the agricultural land planted between 2016 and 2020 and its average yield in Afşin, Andırın, Dulkadiroğlu, Ekinözü, Elbistan, Göksun, Nurhak, Onikişubat, Pazarcık, Türkoğlu and Çağlayancerit districts of Kahramanmaraş province. For this, according to the data obtained from TUIK, 5 products selected in grain, which are thought to be produced more widely in the region, are respectively; Wheat, corn, barley, chickpea and sugar beet, while the others are probably 5 products selected in fruit, respectively; Apple, cherries, strawberries, mulberries and walnuts and the other 5 selected vegetables, which are thought to be produced more than others, are respectively; pepper, cucumber, acrid, tomato and garlic. According to the estimation results obtained in the research, it has been determined that there is a harmony relationship between the size of agricultural land and the amount of yield in selected crops in Kahramanmaraş districts between 2016 and 2020, and as a result of the vector autoregressive model (VAR) analysis, the most appropriate delay size is the 10th delay.

**Keywords:** Land, Cereals, Fruit and vegetables

***Corresponding author:** Kahramanmaraş Sütçü İmam University, Faculty of Agriculture, Department of Bioengineering, 46100, Kahramanmaraş, Türkiye
**E mail:** gkisoo1995@gmail.com (İ. GÖK)
İsmail GÖK https://orcid.org/0000-0002-0759-1187
Mustafa ŞAHİN https://orcid.org/0000-0003-3622-4543

**Received:** June 30, 2022
**Accepted:** October 10, 2022
**Published:** January 01, 2023

**Cite as:** Gök İ, Şahin M. 2023. Investigation of vegetable production amount and the size of cultivation areas in Kahramanmaraş with the econometric model. BSJ Agri, 6(1): 8-15.

## 1. Introduction

Soil, which is one of the sine qua non of life like air and water, is a natural entity that cannot be reproduced, produced and has definite lines. The soil, forests and pastures are the growing area, an important nutrient store in plants, as well as the main material of certain industries and an area for residential and industrial settlements. For this reason, soil is an indispensable production element for agricultural sectors, as well as an equally important element in non-agricultural areas (Topçu, 2012).

Land is known in legal language as a part of the earth whose boundaries are determined by legal and geometric methods; it cannot be destroyed, transferred, and cannot be reduced or reproduced. It is a source of wealth due to the raw materials and ores it contains, as the establishments determine the places of establishment, obtain economic values and create the main space of human living spaces and activities (Yomralıoğlu and Çete, 2005; Tanrıvermiş, 2016). Agricultural lands, on the other hand, are known as the most effective economic resource in rural areas as crop and animal production is carried out on them, and land capital is among the most important elements of farm capital, which is seen as the basic element of income (Bayramoğlu, 2014). For people residing in rural areas, agricultural lands can be seen as collateral value, social reputation and security in extraordinary situations (Awasti, 2014).The structure of the land, the amount of soil fertility, the climatic conditions of the region and the frequency of natural disasters such as erosion and flooding can have an impact on income and yield (Karakayacı, 2005). Agricultural lands; Various studies have been conducted on its size, yield, and average productivity per 1 hectare area (Zeren et al., 1995; Akıncı et al., 1997; Özden et al., 2005; Yılmaz et al., 2006; Keleş, 2015; Özkan et al., 2019). According to these studies, the aim of this study is to determine the relationship between the size of the agricultural land planted between 2016 and 2020 and its average yields in Afşin, Andırın, Dulkadiroğlu, Ekinözü, Elbistan, Göksun, Nurhak, Onikişubat, Pazarcık, Türkoğlu and Çağlayancerit districts of Kahramanmaraş province and the specified years.

The aim of this study is to determine the two most cultivated areas in cereals, fruits and vegetables, which are thought to have more cultivation areas than the others in the districts, respectively.

## 2. Materials and Methods

### 2.1. Materials

The data of this research are based on the databases of the agricultural land size and average yields planted between 2016 and 2020 in the Afşin, Andırın, Dulkadiroğlu, Ekinözü, Elbistan, Göksun, Nurhak, Onikisubat, Pazarcık, Türkoğlu and Çağlayancerit districts of Kahramanmaraş province) was obtained from. According to the data obtained, 5 products selected in grain, which are thought to be produced more widely in the region, are respectively; Wheat, corn, barley, chickpea and sugar beet, while the others are probably 5 products selected in fruit, respectively; Apple, cherries, strawberries, mulberries and walnuts and the other 5 selected vegetables, which are thought to be produced more than others, are respectively; pepper, cucumber, tomato and garlic, and the econometric program was used to determine the relationship between the size of the cultivated land and the amount of yield in the districts by years.

### 2.2. Methods

#### 2.2.1. Vector autoregressive model (VAR)

Tested values must be stationary series so that the relationships between values can be of good quality. For this, the stationarity test of the values can be determined with Dickey Fuller (DF) analysis (Tarı, 2012). The Dickey Fuller (DF) test is given in the following Equation 1:

$$\Delta\gamma_t = \mu + \beta_t + \delta\gamma_{t-1} + \varepsilon_t \quad (1)$$

Here $\Delta_{Y_t}$ time series tested for stationarity $\mu$ and $\beta_t$ the coefficients determining t and $\varepsilon$ t in testing a structural trend in the analyzed time series represents the random error term. With the Dickey Fuller (DF) test $H_0: \delta = 0$ (there is a unit root) hypothesis is analyzed, $H_0$ If the hypothesis is not accepted, it means that there is no unit root in the test of stationarity in the series and that the series is stationary. The most important detail in the Dickey Fuller (DF) analysis phase is to determine the number of delays suitable for the series. Akaike information criterion (AIC) or Schwarz information criterion (SIC) can be used to determine the appropriate number of delays. The model that gives the smallest AIC or SIC value can be determined as the most appropriate model (Fuller, 1996).

In econometric studies, it is inevitable to use the simultaneous equation system in case the links between the link sizes are multilateral and complex. One of the methods developed as a solution method of simultaneous equations is Vector Autoregressive Models (VAR). Vector autoregressive model (VAR) (Equation 2):

$$y_t = A_1 y_{t-1} + \cdots + A_p y_{t-1} + B_{x_t} + \varepsilon_t \quad (2)$$

is shown as (Johansen, 1995).

Vector autoregressive models (VAR) are used for time series as they do not impede the systematic model and do not need to distinguish between extrinsic and intrinsic values. In addition, vector autoregressive models (VAR) models have lagged values of dependent values, making it possible to make better and stronger predictions for the future. Since the coefficients calculated with the vector autoregressive models (VAR) model are quite complex and difficult to interpret, variance decomposition and impulse-response analysis methods are mostly used (Gacener, 2005). While variance decomposition tries to explain how many % of the change in the variance of each of the analyzed values has its own delay and what percentage of the other values are excluded, impulse-response analysis tries to explain what happens when the other value or values cause a one-unit effect on any of the values. Tries to explain how much he is affected (Tari, 2012).

In this study, it was determined that the 10th lag length was the most appropriate in the analysis applied in the vector autoregressive model (VAR) to the data that became stationary after taking the first differences.

## 3. Results and Discussion

According to the results of the research, it has been determined that there is a 0.99 correlation between the size of agricultural land and the amount of yield in selected crops in Kahramanmaraş districts between 2016 and 2020, and as a result of the vector autoregressive model (VAR) analysis, the most appropriate delay size is the 10th delay. In addition, according to the data obtained, the 5 products selected in the cereals that are thought to be produced more widely in the region are respectively; Wheat, corn, barley, chickpea and sugar beet, while the others are probably 5 products selected in fruit, respectively; Apple, cherries, strawberries, mulberries and walnuts and the other 5 selected vegetables, which are thought to be produced more than others, are respectively; pepper, cucumber, acrid, tomato and garlic. 61.50% wheat and 21.94% barley in fruit; 50.47% walnut and 45.23% apple and vegetable; It was determined that 51.39% tomatoes and 34.86% garlic. The first two crops planted in Andırın, respectively, by years: in grain; 80.56% wheat and 13.56% corn in fruit; 50.3% cherry and 46.09% walnut, also in vegetables; it was determined that 44% tomato and 35.89% cucumber. The first two crops planted in Dulkadiroğlu, respectively, are: in grain; 68.01% wheat and 22.01% corn, in fruit; 61.34% walnut and 22.24% cherry, also in vegetables; it was determined that 35.17% tomato and 24.07% cucumber. The first two crops planted in Ekinözü, respectively, by years: in grain; 54.69% wheat and 38.52% barley in fruit; 64.86% apple and 29.59% walnut, also in vegetables; it was determined that 74.06% tomatoes and 13.88% peppers. The two most planted crops in Elbistan, respectively, by year: in grain; 57.93% wheat and 20.90% barley in fruit; 76.54% apple and 18% walnut, also in vegetables; 38.40% pepper and 26.34% tomato were determined. The two most planted crops in Göksun by year, respectively: in grain; 71.90% wheat and 19.39% barley in fruit; 87.81% apple and 6.76% walnut, also in vegetables; it was determined that 72.05% tomato

and 11.29% garlic. The two most planted crops in Nurhak, respectively, by year: in grain; 77.95% wheat and 16.48% barley in fruit; 51.51% apple and 43.15% walnut, also in vegetables; It was determined that there were 34.01% tomato and 30.07% pepper. The first two crops planted the most in order by year in February, are in grain; 76.33% wheat and 12.55% corn in fruit; 69.06% walnut and 20.01% apple, also in vegetables; 49.05% tomato and 20.37% cucumber were determined. The two most planted crops in Pazarcık, respectively, by year: in grain; 56% wheat and 22.27% corn in fruit; 67.84% walnut and 20.63% apple, also in vegetables; It is stated that there are 34.10% garlic and 32.06% pepper. The first two crops planted in Türkoğlu, respectively, by years: in grain; 63.66% wheat and 31.84% corn in fruit; 58.38% walnut and 16.89% strawberry, also in vegetables; it was determined that 43.94% cucumber and 28.56% tomato. The first two crops planted the most in Çağlayancerit, respectively, by year: in grain; 56.34% wheat and 30.42% barley in fruit; 76.52% walnut and 20.68% apple, also in vegetables; Average productivity of 69.05% tomatoes and 22.08% peppers on a total cultivated land of 1 decare for selected years is 0.6909 in Afşin, 0.4397 in Andırın, 0.6732 in Dulkadiroğlu, 0.4057 in Ekinözü, 0.6371 in Elbistan, 0.5208 in Göksun, and Nurhak. It was determined that it was 0.3068 tons in Türkiye, 0.5542 tons in Onikisubat, 0.5891 tons in Pazarcık, 0.6827 tons in Türkoğlu and 0.6046 tons in Çağlayancerit.

As a result of the data obtained from the Turkish Statistical Institute (TUIK), keeping the time interval determined to obtain better results and choosing the products that are thought to have more cultivation areas in the region, compared to the products that are likely to have cultivation areas everywhere in the country, especially in grain. More local products should be preferred and more diversified. In order to avoid these and similar disruptions in future articles or thesis research, the specified period should be kept wider and regions or regions dealing with agriculture should be preferred. In order to apply the vector autoregressive model (VAR) method in this research, firstly, the series were tested for stationarity. Table 1 and Table 2 showed the stationarity result after taking the first difference of the series. Since the probability value in Table 1 is less than 0.05, the series is stationary.

**Table 1.** The result of the stability analysis after taking the first differences of the size of the cultivated land in the districts according to the years.

| Augmented Dickey-Fuller fullness test statistics | |
|---|---|
| %1 Level | -3.588509 |
| %5 Level | -2.929734 |
| %10 Level | -2.603064 |
| t | -10.94162 |
| Probability | 0.0000 |

**Table 2.** The result of the stability analysis after taking the first differences of the productivity of the cultivated land in the districts by years.

| Augmented Dickey-Fuller fullness test statistics | |
|---|---|
| %1 Level | -3.587504 |
| %5 Level | -2.928731 |
| %10 Level | -2.601067 |
| t | -19.39069 |
| Probability | 0.0001 |

Since the probability value in Table 2 is less than 0.05, the series is stationary. In Figure 1, it was determined that the data set is stationary since all the points are inside the circle.

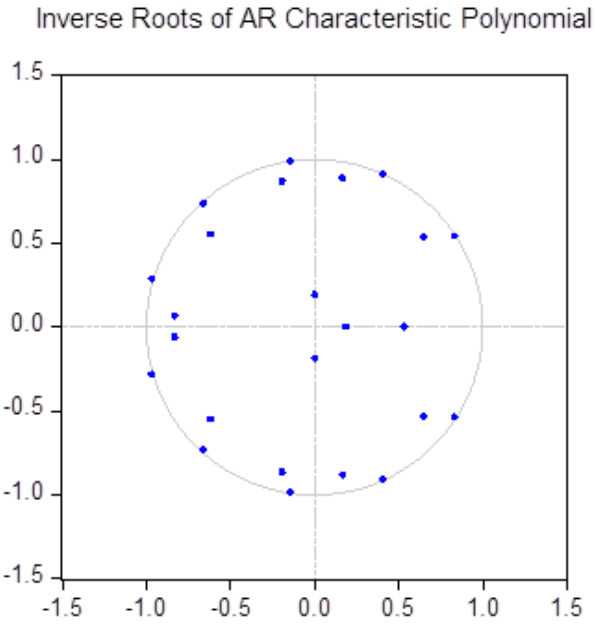


**Figure 1.** Vector autoregressive model (VAR) stationarity analysis result.

In order to determine the most appropriate lag length from the vector autoregressive model (VAR) analysis during the back of the stationarity test, the most appropriate lag length result is given in Table 3.

In Table 3, the 10th lag length, where '*' is the most and Akaike information criterion (AIK) is the smallest, has been determined as the most appropriate lag length in the data set. Table 4 and the vector autoregressive model (VAR) analysis result is given in Table 5.

In Table 6, it has been determined that a 1% change in the total area planted in the districts by years in R2 affects the yield amount by 0.993146 and a 1% change in the amount of yield over the years in $R^2$ affects the total area planted in the districts by 0.991494. The corrected $R^2$ in Table 6, on the other hand, restores $R^2$ back with a probability of 0.987187 due to the increase in $R^2$ if an independent variable that is not relevant is added to the equation in the total area planted by years, while it does not relate to the subject in the amount of yield according to years.

**Table 3.** The result of the Vector Autoregressive Model (VAR) analysis to determine the most appropriate lag length

| Latency length | Logarithmic value | LR test statistic | Final prediction error | Akaike knowledge criteria | Schwarz information criterion | Hannan-Quinn knowledge criterion |
|---|---|---|---|---|---|---|
| 0 | -1139.819 | NA | 1.19e+20 | 51.90084 | 51.98194 | 51.93092 |
| 1 | -1123.025 | 31.29635 | 6.65e+19 | 51.31934 | 51.56263 | 51.40956 |
| 2 | -1111.463 | 20.49610 | 4.72e+19 | 50.97561 | 51.38111 | 51.12599 |
| 3 | -1098.554 | 21.71106 | 3.16e+19 | 50.57065 | 51.13834 | 50.78117 |
| 4 | -1093.477 | 8.077437 | 3.03e+19 | 50.52168 | 51.25158 | 50.79236 |
| 5 | -1089.426 | 6.076502 | 3.05e+19 | 50.51936 | 51.41146 | 50.85019 |
| 6 | -1073.483 | 22.46492 | 1.80e+19 | 49.97650 | 51.03080 | 50.36749 |
| 7 | -1067.493 | 7.896351 | 1.68e+19 | 49.88603 | 51.10253 | 50.33717 |
| 8 | -1064.980 | 3.083952 | 1.85e+19 | 49.95363 | 51.33232 | 50.46492 |
| 9 | -1062.854 | 2.415306 | 2.09e+19 | 50.03884 | 51.57973 | 50.61028 |
| 10 | -993.4590 | 72.54976* | 1.12e+18* | 47.06632* | 48.76941* | 47.69791* |

* indicates the delay order selected by the criterion.

**Table 4.** Vector autoregressive model (VAR) analysis result

| | Area cultivated in districts by years | Yield amount in districts by years |
|---|---|---|
| Total Sown Area (1) | -0.915492 | -0.025792 |
| | (0.14629) | (0.10838) |
| | [-6.25818] | [-0.23799] |
| Total Sown Area (2) | -0.802975 | -0.019253 |
| | (0.19468) | (0.14423) |
| | [-4.12464] | [-0.13349] |
| Total Sown Area (3) | -0.799230 | -0.076459 |
| | (0.23771) | (0.17611) |
| | [-3.36216] | [-0.43416] |
| Total Sown Area (4) | -0.279988 | -0.023169 |
| | (0.26183) | (0.19398) |
| | [-1.06934] | [-0.11944] |
| Total Sown Area (5) | -0.403859 | -0.058272 |
| | (0.26777) | (0.19837) |
| | [-1.50824] | [-0.29375] |
| Total Sown Area (6) | -0.531717 | -0.112912 |
| | (0.27162) | (0.20123) |
| | [-1.95759] | [-0.56112] |
| Total Sown Area (7) | -0.515238 | -0.030996 |
| | (0.25937) | (0.19215) |
| | [-1.98647] | [-0.16131] |
| Total Sown Area (8) | -0.650249 | -0.145196 |
| | (0.22628) | (0.16764) |
| | [-2.87364] | [-0.86613] |
| Total Sown Area (9) | -0.387310 | -0.025223 |
| | (0.16967) | (0.12570) |
| | [-2.28268] | [-0.20066] |
| Total Sown Area (10) | -0.286068 | -0.072832 |
| | (0.07597) | (0.05628) |
| | [-3.76549] | [-1.29404] |

**Table 5.** Vector autoregressive model (VAR) analysis result

| | Area cultivated in districts by years | Yield amount in districts by years |
|---|---|---|
| Yield Amount (1) | -0.134470 | -1.033691 |
| | (0.24536) | (0.18177) |
| | [-0.54805] | [-5.68668] |
| Yield Amount (2) | -0.264639 | -1.031715 |
| | (0.34338) | (0.25439) |
| | [-0.77068] | [-4.05558] |
| Yield Amount (3) | -0.294383 | -1.022776 |
| | (0.41631) | (0.30842) |
| | [-0.70713] | [-3.31620] |
| Yield Amount (4) | -1.146508 | -1.072790 |
| | (0.47110) | (0.34901) |
| | [-2.43369] | [-3.07382] |
| Yield Amount (5) | -0.978519 | -0.957798 |
| | (0.47041) | (0.34850) |
| | [-2.08013] | [-2.74834] |
| Yield Amount (6) | -0.831246 | -0.887965 |
| | (0.45938) | (0.34033) |
| | [-1.80951] | [-2.60917] |
| Yield Amount (7) | -0.836485 | -0.921764 |
| | (0.43109) | (0.31937) |
| | [-1.94040] | [-2.88621] |
| Yield Amount (8) | -0.571741 | -0.750121 |
| | (0.36760) | (0.27233) |
| | [-1.55534] | [-2.75444] |
| Yield Amount (9) | -0.978320 | -0.894654 |
| | (0.28430) | (0.21062) |
| | [-3.44118] | [-4.24773] |
| Yield Amount (10) | -1.131674 | -0.819523 |
| | (0.13112) | (0.09714) |
| | [-8.63108] | [-8.43684] |

It has been determined that if an independent variable is added to the equation, it will restore $R^2$ with a probability of 0.984097 due to the increase in $R^2$. In Table 6, it was determined that the data set was significant since the F statistic was 166.6437 in the area sown in the districts by years, the F statistic was 134.0484 in the amount of yield in the districts according to the years, and the F statistic at the 0.05 confidence level was much higher than the F table value. In order to help analyze the goodness of fit and model complexity of the model by making a relative estimation in Table 6, the Akaike Information Criterion and the total area planted in the districts by years were determined as 23.88000 and the yield amount in the districts by years was determined as 23.28006.

In addition, the average yield per decare planted in the districts by years is given in Table 7.

**Table 6.** $R^2$, $\overline{R}^2$, F and Akaike information criterion (AIK) results in vector autoregressive model (VAR) analysis

| | By years planted in districts area | Yield amount in districts by years |
|---|---|---|
| $R^2$ | 0.993146 | 0.991494 |
| $\overline{R}^2$ | 0.987187 | 0.984097 |
| F | 166.6437 | 134.0484 |
| AIK | 23.88000 | 23.28006 |

AIK= akaike information criteria.

The average percentage size of the total cultivated area in cereals in the districts according to the years determined in Table 8 (the grain area determined during the year / the total cereal area in the year), the average percentage size of the total planted area in fruits in the districts according to the years determined in the Table 9 fruit area determined during the year / total fruit area in the year) and the average percentage size of the total planted area for vegetables in the districts (vegetable area determined during the year / total vegetable area in the year) according to the years determined in Table 10.

**Table 7.** Average yield amount in 1 decare area in districts by years (ton/decare)

| Districts | Average yield amount in 1 decare area in districts by years (ton/decare) | | | | |
|---|---|---|---|---|---|
| | 2016 | 2017 | 2018 | 2019 | 2020 |
| Afşin | 0.7560 | 0.7569 | 0.7813 | 0.4788 | 0.6819 |
| Andırın | 0.4355 | 0.4536 | 0.4329 | 0.4551 | 0.4216 |
| Dulkadiroğlu | 0.6128 | 0.7280 | 0.6247 | 0.6650 | 0.7359 |
| Ekinözü | 0.4618 | 0.5090 | 0.3353 | 0.4051 | 0.3177 |
| Elbistan | 0.6909 | 0.6574 | 0.6717 | 0.5705 | 0.5954 |
| Göksun | 0.5216 | 0.5057 | 0.5369 | 0.4984 | 0.5415 |
| Nurhak | 0.2832 | 0.3422 | 0.3331 | 0.3208 | 0.2548 |
| Onikişubat | 0.4952 | 0.5335 | 0.5577 | 0.6218 | 0.5630 |
| Pazarcık | 0.6720 | 0.5442 | 0.5979 | 0.4910 | 0.6406 |
| Türkoğlu | 0.4788 | 0.5859 | 0.6397 | 0.7430 | 0.9665 |
| Çağlayancerit | 0.3305 | 0.7630 | 0.7137 | 0.6709 | 0.5449 |

**Table 8.** Average percentage size of total cultivated area in cereals in districts by determined years (determined cereal area in the year / total cereal area in the year)

| Districts | Average percentage size of sown areas | | | | | Average size of sown areas |
|---|---|---|---|---|---|---|
| | Wheat | Maize | Barley | Chickpeas | Sugar Beet | |
| Afşin | %61.50 | %5.74 | %21.94 | %5.38 | %5.44 | 426790 decare |
| Andırın | %80.56 | %13.56 | %5.65 | %0.23 | %0.00 | 110519 decare |
| Dulkadiroğlu | %68.01 | %22.01 | %4.64 | %4.05 | %1.29 | 128869 decare |
| Ekinözü | %54.69 | %0.43 | %38.52 | %3.99 | %2.37 | 32287 decare |
| Elbistan | %57.93 | %11.59 | %20.90 | %4.07 | %5.51 | 590336 decare |
| Göksun | %71.90 | %0.43 | %19.39 | %6.65 | %1.63 | 256308 decare |
| Nurhak | %77.95 | %0.35 | %16.48 | %5.22 | %0.00 | 17504 decare |
| Onikişubat | %76.33 | %12.55 | %5.74 | %5.38 | %0.00 | 137997 decare |
| Pazarcık | %56.00 | %22.27 | %16.83 | %4.49 | %0.41 | 207831 decare |
| Türkoğlu | %63.66 | %31.84 | %3.29 | %0.66 | %0.55 | 136202 decare |
| Çağlayancerit | %56.34 | %0.48 | %30.42 | %12.74 | %0.00 | 16313 decare |

**Table 9.** Average percentage size of total cultivated area in fruits in districts according to determined years (determined fruit area in the year / total fruit area in the year)

| Districts | Average percentage size of sown areas | | | | | Average size of sown areas |
|---|---|---|---|---|---|---|
| | Apple | Cherry | Strawberry | Berry | Walnut | |
| Afşin | %45.23 | %2.89 | %1.16 | %0.25 | %50.47 | 9098 decare |
| Andırın | %3.39 | %50.3 | %0.22 | %0 | %46.09 | 14284 decare |
| Dulkadiroğlu | %15.69 | %22.24 | %0.73 | %0 | %61.34 | 8812 decare |
| Ekinözü | %64.86 | %5.55 | %0 | %0 | %29.59 | 7617 decare |
| Elbistan | %76.54 | %5.46 | %0 | %0 | %18 | 6743 decare |
| Göksun | %87.81 | %3.46 | %1.97 | %0 | %6.76 | 35455 decare |
| Nurhak | %51.51 | %3.77 | %1.57 | %0 | %43.15 | 1575 decare |
| Onikişubat | %20.01 | %4.78 | %6.15 | %0 | %69.06 | 15953 decare |
| Pazarcık | %20.63 | %11.53 | %0 | %0 | %67.84 | 4509 decare |
| Türkoğlu | %14.46 | %10.27 | %16.89 | %0 | %58.38 | 3766 decare |
| Çağlayancerit | %20.68 | %2.8 | %0 | %0 | %76.52 | 20345 decare |

**Table 10.** Average percentage size of total cultivated area for vegetables in districts according to determined years (determined vegetable area in the year / total vegetable area in the year)

| Districts | Average percentage size of sown areas | | | | | Average size of sown areas |
|---|---|---|---|---|---|---|
| | Pepper | Cucumber | Acrid | Tomato | Garlic | |
| Afşin | %7.77 | %5.23 | %0.75 | %51.39 | %34.86 | 14220 decare |
| Andırın | %20.11 | %35.89 | %0 | %44 | %0 | 980 decare |
| Dulkadiroğlu | %20.07 | %24.07 | %9.05 | %35.17 | %11.64 | 8454 decare |
| Ekinözü | %13.88 | %12.06 | %0 | %74.06 | %0 | 345 decare |
| Elbistan | %38.40 | %23.90 | %0 | %26.34 | % 11.36 | 9200 decare |
| Göksun | %9.01 | %7.65 | %0 | % 72.05 | %11.29 | 3882 decare |
| Nurhak | %30.07 | %12.34 | %3.18 | %34.01 | %20.40 | 314 decare |
| Onikişubat | %17.26 | %20.37 | %2.85 | %49.05 | %10.47 | 10404 decare |
| Pazarcık | %32.06 | %1.68 | %1.45 | % 30.71 | %34.10 | 10810 decare |
| Türkoğlu | %6.09 | %43.94 | %18.03 | %28.56 | %3.38 | 5890 decare |
| Çağlayancerit | %22.08 | %0 | %0 | %69.05 | %8.87 | 282 decare |

Various studies have been conducted on the size, yield, and average yield per 1 hectare area, and in these studies, it has been determined that there is 43% effective work and efficiency in the study on plant production enterprises and productivity in Aydın district of İzmir (Özden et al., 2005). As a result of a study conducted in Isparta province, it was determined that while grain cultivation areas decreased between 1991 and 2003, productivity increased, vegetable and fruit areas and production increased (Yılmaz et al., 2006). As a result of a study conducted in Çumra district of Konya province, the average farm size is 105.33 decares and grain production is 50.21%. It has been determined that the first rank in production is wheat with 34.46%, the second rank is corn with 23.05% and the third rank is barley with 15.75% (Keleş, 2015). As a result of a study conducted in Isparta province, it was determined that the total area allocated for field agriculture in Türkiye is 15.8 million hectares and it is used as 70% in cereals, 14% in industrial plants, 11% in forage plants and 5% in pulses. In addition, it has been determined that the most cereal production is wheat, barley and corn, chickpeas and lentils in legumes, sunflower and olive in oil plant, sugar beet in sugar plant (Baydar H, 2017). As a result of a study conducted in Çarşamba district of Samsun province, the total land of the plain is 777,560 decares and 76% of these lands are used for agriculture, and Çarşamba district covers 15.67% of this area. In addition, it has been determined that 50.4% of it is used as orchard area, 21.4% is used as vegetable area and 22.2% is used as field crops in Çarşamba district (Samsun Investment Support Office, 2018). As a result of a study conducted in the province of Ankara, it was observed that the producers' plant production activities included fruit growing, field crops and vegetable growing, respectively, and they acted carefully and meticulously in the relevant field (Vijdan, 2020).

## 4. Conclusion

In this study, in order to determine the relationship between the size of agricultural lands planted between 2016 and 2020 in all districts of Kahramanmaraş province and the average yield, with the data obtained from TUIK, 5 selected products in cereals, which are thought to be more widely produced in the region, respectively; wheat, corn, barley, chickpea and sugar beet, respectively, 5 selected fruit products; apple, cherry, strawberry, mulberry and walnut and 5 selected vegetables respectively; pepper, cucumber, acrid, tomato and garlic, and firstly, the stationarity test of the series was performed in order to apply the vector autoregressive model (VAR) method. The stationarity result is given after taking the first differences of the series.

**Author Contributions**

The percentage of the author(s) contributions is present below. All authors reviewed and approved final version of the manuscript.

| | İ.G. | M.Ş |
|---|---|---|
| C | 50 | 50 |
| D | 50 | 50 |
| S | 50 | 50 |
| DCP | 50 | 50 |
| DAI | 50 | 50 |
| L | 50 | 50 |
| W | 50 | 50 |
| CR | 50 | 50 |
| SR | 50 | 50 |
| PM | 50 | 50 |
| FA | 50 | 50 |

C=Concept, D= design, S= supervision, DCP= data collection and/or processing, DAI= data analysis and/or interpretation, L= literature search, W= writing, CR= critical review, SR= submission and revision, PM= project management, FA= funding acquisition.

**Conflict of Interest**

The authors declared that there is no conflict of interest.

**Ethical Consideration**

Ethics committee approval was not required for this study because of there was no study on animals or humans.

## References

Akıncı İ, Topakcı M, Çanakçı, M. 1997. Agricultural structure and mechanization characteristics of Antalya region agricultural enterprises. Agricultural Mechanization 17th National Congress, 17-19 September 1997, Tokat, Türkiye, pp: 45-57.

Awasthi MK. 2014. Socioeconomic determinants of farmland value in India. Land Use Pol, 39: 78-83.

Baydar H. 2017. Field crops. Isparta University of Applied Sciences, Faculty of Agricultural Sciences and Technologies, Department of Field Crops, Isparta, Türkiye.

Bayramoğlu Z. 2014. The effects of risk behaviors of cherry growers on business income, the case of Akşehir district. Ministry of Food, Agriculture and Livestock, Agricultural Economy Research Institute, Ankara, Türkiye, pp: 57.

Fuller WA. 1996. Introduction to Statistical Time Series, 2nd edition, John Wiley and Sons, New York, US, pp: 728.

Gacener A. 2005. Analysis of the validity of Wagner's law for Turkey. Dokuz Eylul Univ J Fac Econ Admin Sci, 20(1): 103-122.

Johansen S. 1995. Likelihood based inference in cointegrated vector autoregressive models. Oxford University Press, Oxford, UK.

Karakayacı Z. 2005. Investigation of the difference between income method and market value method applied in value appraisal of agricultural lands in Konya province Ereğli district. MSc Thesis, Selcuk University, Institute of Science and Technology, Department of Agricultural Economics, Konya, Türkiye, pp: 121.

Keles I. 2015. Determination of agricultural structure and mechanization characteristics of Çumra district agricultural

enterprises. MSc Thesis, Selcuk University, Institute of Science and Technology, Konya, Türkiye, pp: 68.

Özden A, Armağan G. 2005. Determination of the efficiency of crop production activities in Aydın province agricultural enterprises. J Agri Econ, 11(2): 111-121.

Özkan G, Kadağan Ö. 2019. An Evaluation for the development of Bursa province agricultural potential. Turkish Stud, 14(2): 503-522.

Samsun Investment Support Office. 2018. Wednesday County Agricultural Sector Report. URL: https://oka.ka.gov.tr/assets/upload/dosyalar/151carsamba-ilcesi-tarim-sektoru-raporu-52_v2.pdf (December 10, 2018).

Tanrivermis H. 2016. Real estate valuation principles licensing exams workbooks. Anakara, Türkiye.

Tarı R. 2012. Econometrics. Umut Tepe Bookstore, 8th Edition, Kocaeli, Türkiye.

Topçu P. 2012. Policies for the protection and effective use of agricultural lands, planning specialization thesis, general directorate of economic sectors and coordination. TR Ministry of Development, Publication No: 2836, Ankara, Türkiye.

Vijdan K. 2020. Factors Effective in organic crop production preference: Ankara province research. MSc Thesis, Ankara University, Institute of Science and Technology, Ankara, Türkiye, pp: 75.

Yılmaz H, Demircan V, Association Z. 2006. Agricultural structure, production and development potential of Isparta province. J Süleyman Demirel Univ Fac Agri, 1(2): 1-16.

Yomralıoğlu T, Çete M. 2005. The Need for a sustainable land policy for Turkey. TMMOB Chamber of Surveying and Cadastre Engineers, 10. Turkey Scientific and Technical Mapping Congress, 28 March-1 April 2005, Ankara, Türkiye, pp: 75.

Zeren Y, Tezer E, Tuncer HR, Evcim Ü, Güzel E, Sındır KO. 1995. Agricultural tools-machinery and equipment usage and production problems. Agricultural Engineering Technical Congress, Agricultural Week 95 Congress, 9-13 January 1995, Ankara, Türkiye, pp: 167.