DETERMINATION OF DAMAGE AMOUNT AND AGRICULTURAL INSURANCE SUPPORT STATUS OF GREENHOUSES DAMAGED BY NATURAL DISASTERS IN ANTALYA

ANTALYA'DA DOĞAL AFETLERDEN ZARAR GÖREN SERALARDA HASAR DURUMUNUN VE TARIM SİGORTALARI DESTEK DURUMUNUN BELİRLENMESİ

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ABSTRACT

Although Antalya has the largest share in greenhouse production in-country, due to reasons the fact that most of the existing greenhouses structures are structurally unstable or inadequate and its to be open to natural disasters due to their geographical location and climate structure, it suffers great losses in agricultural production from natural disasters in every year. So, the necessity of making agricultural insurance throughout the province is of great importance. In this study; how the plant production structures in Antalya province were affected by the natural disasters such as hail, torrential rain, storm or hurricane, tornedo and fire; what extent they were able to withstand these climatic disasters or how they were harmed by these events was determined. The number of damaged plant production structures, their structural features, how they are damaged, whether these structures are covered by agriculture and / or private insurance, and how much they benefit from this insurance were determined, also. In addition, it was determined the relationship between the type or violence of disaster which was occurred in that region with the dimensions of the bearing elements of the plant production structures, the type of greenhouse structure and the occurred disaster degree. Thus, it was determined which disasters are effective in which region of Antalya and how it affects the cover structures in that area. As a result of these data, appropriate greenhouse structure type (dimensions, roof type, cover type etc.) and construction element sections were suggested. 99% of greenhouse enterprises were made from blacksmith and 1% by private companies. In addition,% 77 of the enterprise owners were made their greenhouses with own money, 21% of them used loan from the bank and 2% of them benefited from the grant. 72% of the greenhouses damaged by the disasters were damaged from the hail, 1% from rain and hail, 19% from hurricanes, 1% from heavy rain and hail, 7% from hail and hurricane. 93% of greenhouses have been damaged by disasters occurred in the last 8 years. It was determined that 55% of greenhouses were not insured, 44% were agricultural insured and 1% were private insured, also.

Keywords: Agricultural insurance, greenhouse construction, hurricanes, natural disaster.

ÖZET

Antalya'nın örtüaltı üretiminde ülkedeki en büyük paya sahip olması, buna karşın mevcut örtüaltı yapıların büyük bir bölümünün yapısal yönden dayanıksız / yetersiz olması, coğrafi konumu ve iklim yapısı gereği doğal afetlere açık olması gibi nedenlerden dolayı Tarım Sigortasının il genelinde yapılma gerekliliği büyük önem arz etmektedir. Bu çalışmada; Antalya ilindeki bitkisel üretim yapılarının ilde oluşan dolu, sağanak yağış, fırtına, kasırga, hortum ve yangın gibi doğal afetlerden nasıl etkilendikleri, oluşan bu iklimsel afetlere karşı hangi oranda dayanabildikleri ya da bu olaylardan nasıl zarar gördükleri belirlenmiştir. Zarar gören bitkisel üretim yapılarının sayıları, yapısal özellikleri, nasıl zarar gördükleri, bu yapıların tarım ve/veya özel sigorta kapsamında olup olmadıkları, eğer sigortalıysa bu sigortadan ne kadar yararlandıkları belirlenmiştir. Ayrıca bitkisel

üretim yapılarının taşıyıcı elemanlarının boyutlarının, sera yapı tipinin ve meydana gelen zararın o bölgede oluşan afetin/afetlerin tipi veya şiddeti ile ilişkisi ortaya konulmuştur. Böylece oluşan afetlerin Antalya'nın hangi bölgesinde hangi oranda etkili olduğu, o bölgedeki örtüaltı yapılarını nasıl etkilediği belirlenerek o bölgeler için uygun sera yapı tipi (boyutları, çatı tipi, örtü tipi vs.) ve konstrüksiyon kesitleri önerilmiştir. Sera işletmelerinin %99'u demirci ustası, %1'i özel bir şirket tarafından yapılmıştır. Ayrıca işletme sahiplerinin %77'si kendi parasıyla, %21'i bankadan kredi alarak ve %2'si hibeden faydalanarak serasını yaptırmıştır. Afetlerden zarar gören seraların %72'si doludan, %1'i yağmur ve doludan, %19'u kasırgadan, %1'i şiddetli yağmur ve doludan, %7'si dolu ve kasırgadan zarar görmüştür. Seraların %93'ü son 8 yılda meydana gelen afetlerden zarar görmüştür. Seraların %55'inin sigortalı olmadığı, %44'ünün tarım sigortalı olduğu, %1'inin ise özel sigortalı olduğu belirlenmiştir.

Anahtar Kelimeler: Tarım sigortası, sera, yapı, fırtına, doğal afet

1. INTRODUCTION

As in the world, the importance of the agricultural sector in our country is great. In our country, a significant part of the population lives in rural areas and provides livelihood with agricultural production. For this reason, agricultural insurance is a very important need in order to reduce the effects of all kinds of risk factors affecting agricultural production in our country, to ensure a regular agricultural production and to prevent fluctuations in the income of the people living in rural areas.

The agricultural sector is one of the sectors most affected by natural and economic risks. Besides, the agricultural sector is a sector needs to be supported both economically and strategically throughout the world. Therefore, this sector should be protected against all risks to occur. Minimizing the effects of natural risks such as heavy rainfall, hail, hurricane, tornedo, frost, drought in the agricultural sector can only be achieved by applying effective risk management in the agricultural sector. Today, the most important and effective risk management tool used for the agricultural sector in the world is "Agricultural Insurance". Agricultural Insurance is a security system that compensates the losses occurred due to risks and uncertainties in agriculture (Kırkbeşoğlu, 2015).

In Turkey, In order to be guaranteed the risks threatening the agricultural sector in 2005 within the scope of Law No. 5363 dated 14.06.2005 "Agricultural Insurance Act" has been enacted. Within the scope of this law, an insurance pool was established for the purpose of compensating damages in agricultural production from a single center and developing and extending agricultural insurances. In order to carry out all the works and transactions related to this pool by a company in which the insurance companies participating in this pool have equal shares, the Agricultural Insurance Pool Management Inc. (TARSİM) was created (Çipil 2008; Sümer ve Polat 2016).

In our country, greenhouses are often built without taking into account local conditions and without static and strength calculations. Therefore either more or fewer construction materials than necessary are used. When more material is used than necessary the shading rate in the greenhouse increases, if less material is used the collapse occurs in bad weather conditions (Üstün ve Baytorun 2003).

Antalya is a vulnerable region to serious damage because of the surrounded by the Mediterranean Sea in the south and the Taurus Mountains extending parallel in the north. At the same time, it is a place where greenhouse cultivation is made as intense due to the favorable climatic conditions. In this study, the numbers of plant production structures damaged by natural disasters in Antalya in recent years, how they are damaged, whether these structures are covered by agriculture or private insurance and if they are insured, how much they benefit from this insurances were determined. In addition, the technical and structural features of the plant production structures damaged due to natural disasters and the causes of damage were determined.

2. MATERIAL AND METHOD

In the study, greenhouses damaged by natural disasters in central Antalya and other districts were used as material. For this purpose, the enterprises which were damaged in line with the data obtained from Antalya Provincial Directorate of Agriculture and Forestry and District Directorate of Agriculture and Forestry in districts were identified. The climatic events that caused the damage were taken from Antalya Meteorology Regional Directorate.

In the first stage, in order to determine the damages of disasters caused by climatic events, one-to-one surveys were conducted with the damaged greenhouse enterprises and measurements and observations regarding structural features of greenhouses were made. In the selection of the surveyed enterprises, Stratified Sampling (Neyman) Method" was used in order to increase the accuracy of the findings to be obtained with the information collected from the enterprises. Stratified sampling is a classical survey sampling technique, which is used to estimate population parameters efficiently when there is substantial variability between subpopulations (Cochran 1977; Neyman 1934). The number of sample enterprises to be surveyed with Stratified Sampling Method was calculated with the help of Equation 1 and Equation 2 (Çiçek ve Erkan 1996; Karagölge ve Peker 2002).

$$n = \frac{N.\Sigma(Nh\,.\,Sh^2)}{N^2.D^2 + \Sigma(Nh\,.\,Sh^2)} \qquad \text{Equation 1}$$

$$D^2 = \frac{d^2}{z^2} \qquad \text{Equation 2}$$

where the n is sample volume/size, N is number of units in the population, Nh is number of units in h layer, Sh is standart deviation in h layer, Sh^2 is variance in h layer, d is the allowed error amount in the population mean or difference between the sample mean and the population mean, which is taken as 5%, z is the z value in the standard normal distribution table (95% distribution table) according to this margin of error.

In the second stage, the results of the survey were statistically analyzed in SPSS package program according to Pearson Chi-Square test method. Descriptive statistics were presented with frequency, percentage, average and standard deviation values and $p < 0.05$ was considered statistically significant.

At the last stage, according to the survey, observation and measurement results obtained, the numbers of plant production structures damaged by natural disasters, how and how much they were damaged by which disasters, whether these structures were covered by agriculture or private insurance and if they were insured, how much they benefit from these insurances were determined. Furthermore, the technical and structural features of greenhouses damaged due to natural disasters and the causes of damage were determined and disaster maps of Antalya province were created on the basis of districts.

3. RESULTS AND DISCUSSION

The results obtained in this study were given as graphs. According to the obtained results, 76% of the business owners were primary school graduates, just 19% were high school and undergraduate graduates (Fig. 1). In addition, 95% of greenhouse owners were farmers, 2% were tradesmen and only 3% were agricultural engineers (Fig. 2).

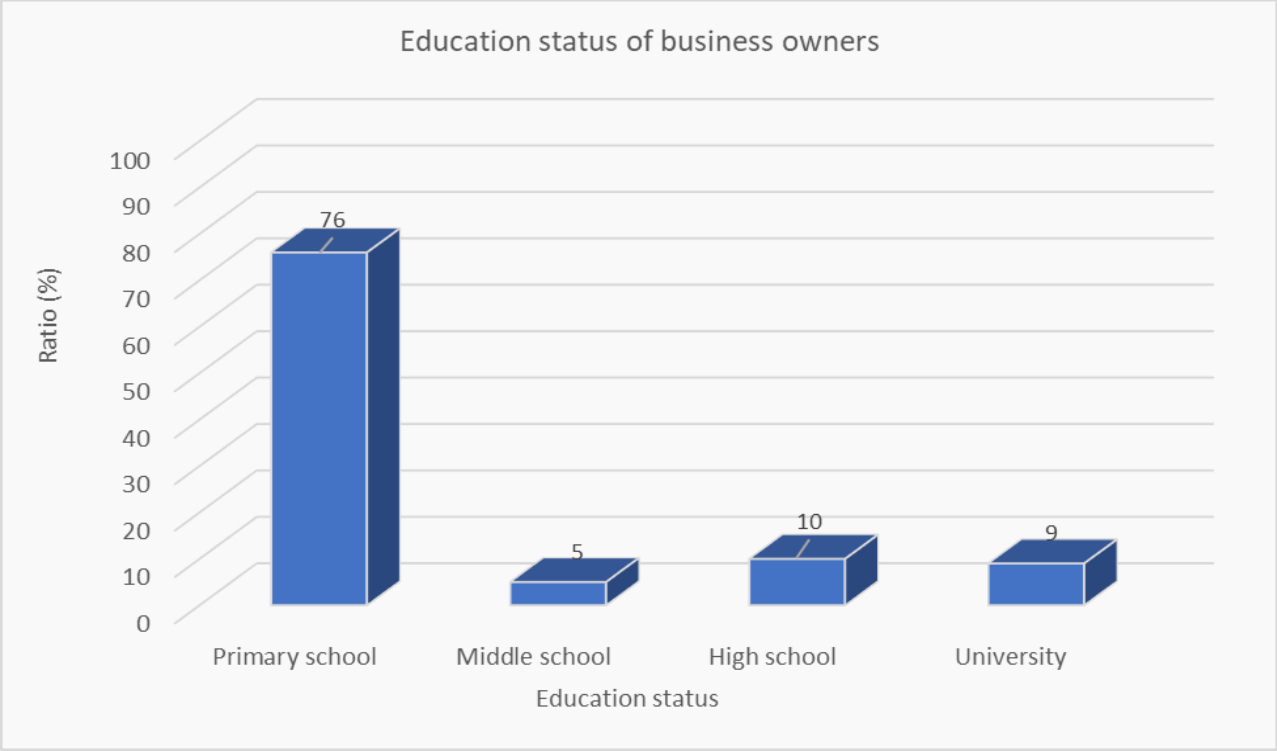


Figure 1. Education status of business owners

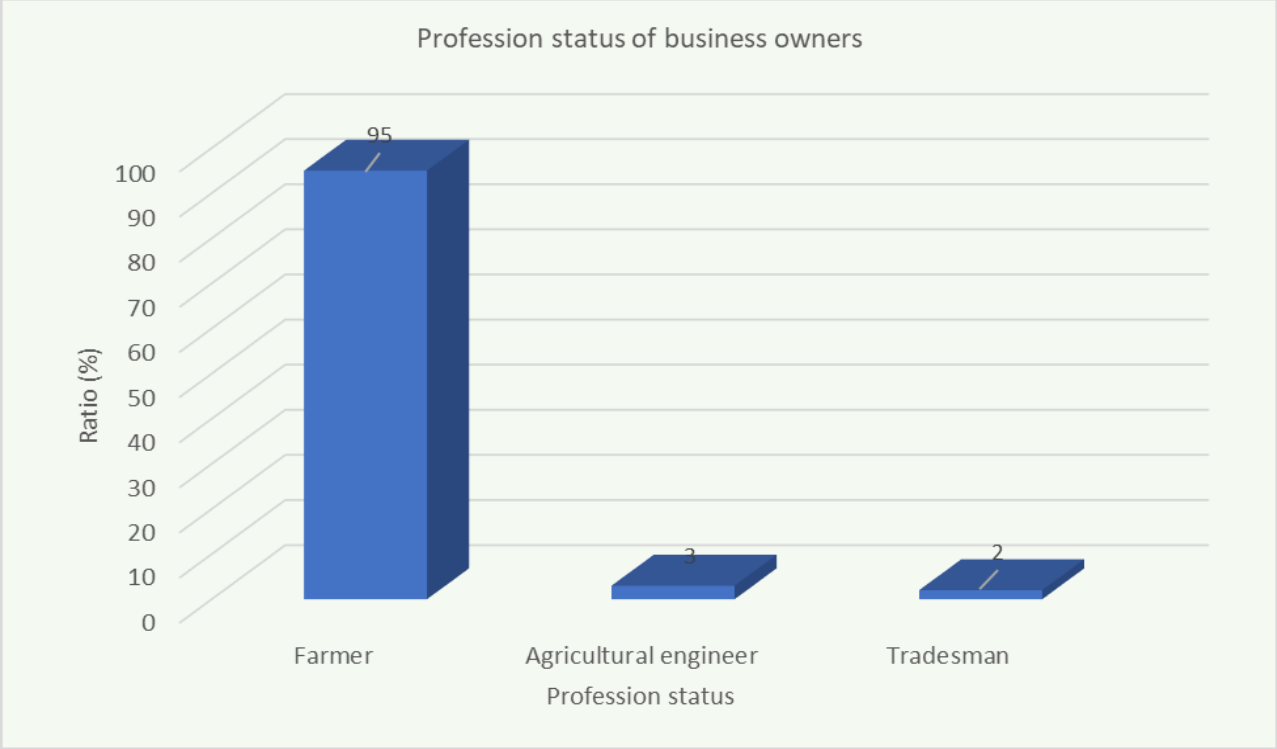


Figure 2. Profession status of business owners

8% of the greenhouses damaged by disasters had no foundation, 31% had no basement and 99% had no projects were determined (Fig.3). This situation might have been caused greenhouses to be damaged more easily than natural disasters. Because of heavy rainfall and storm or hurricane were common in the research area and there was no basement one of every three greenhouses examined, greenhouses might have been damaged more easily than natural disasters. In addition, it was determined that 99% of the greenhouses damaged by disasters were built by blacksmiths but only 1% of them were made by the greenhouse building company. According to Üstün and Baytorun

(2003), the greenhouses wich built without taking into account the climatic conditions of the place where are made and without making static and strength calculations are destroyed in the bad weather conditions.

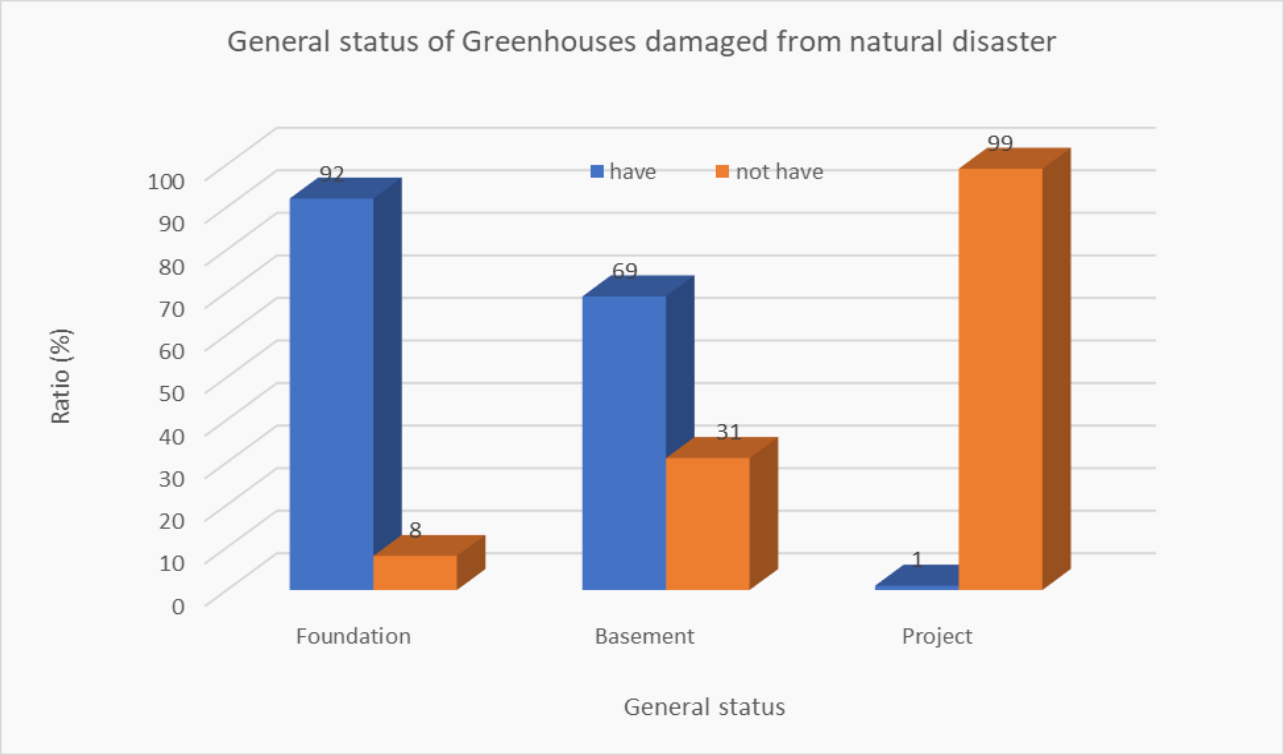


Figure 3. General status of greenhouses damaged from natural disaster

Disaster types that damage businesses were shown in Figure 4. As can be seen from the figure, 72% of the enterprises damaged by hail, 1% by rain and hail, 19% by the hurricane, 1% by heavy rain and hail, 7% by hail and hurricane. As many as 91% of the greenhouses damaged hail and from storms or hurricanes. It was determined that 100% of the greenhouses damaged by the disasters were built by blacksmiths. Those greenhouses have no static plan and project and build with insufficient thickness profiles. For this reason, more likely to be damaged in natural disasters. Greenhouse construction profiles should be selected by calculating the fixed and moving loads affecting the greenhouse building elements and performing static analyzes in terms of bending, vertical displacement and flambage. Standard galvanized steel profiles or aluminum box profiles should be used in the selection of the elements forming the column and roof truss as the skeleton material in the greenhouse construction (von Elsner vd. 2000; Critten ve Bailey 2002; Yüksel 2004; Hakgören ve Kürklü 2007; Baytorun 2016; Büyüktaş vd. 2016).

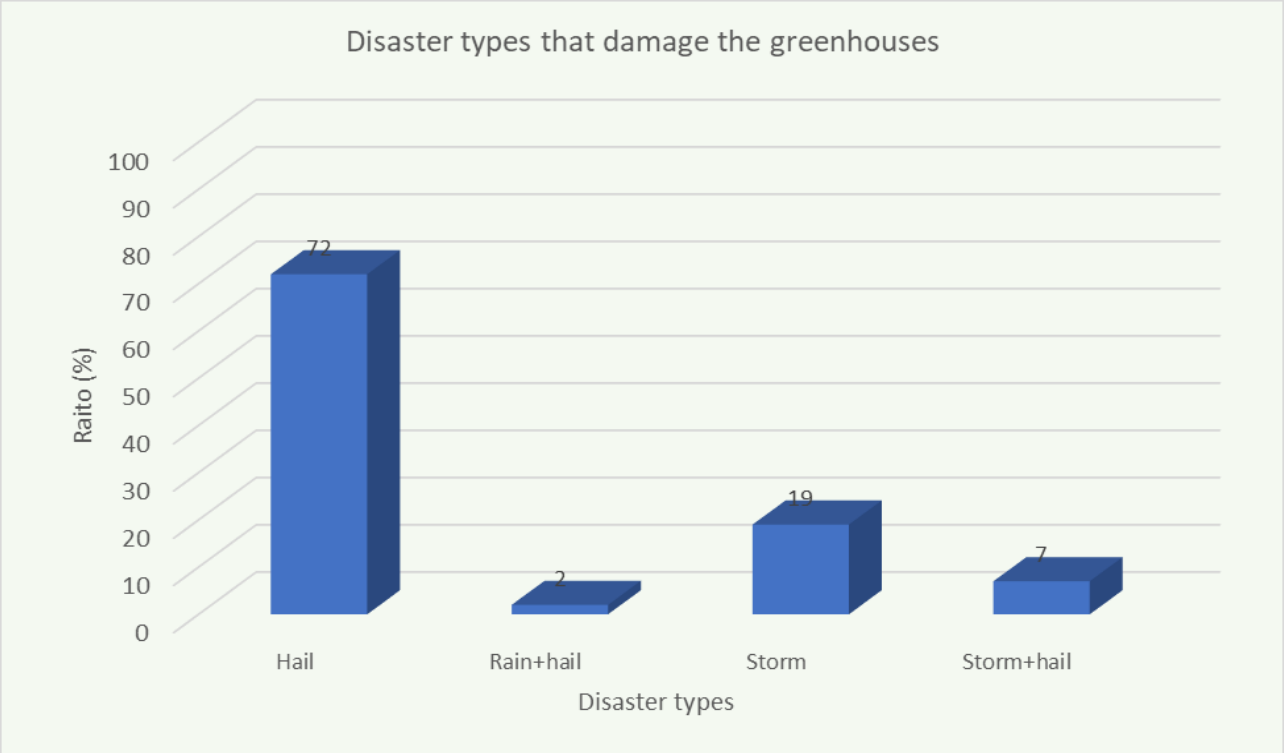


Figure 4. Disaster types that damage the greenhouses

The benefitting status of enterprises from loans, support or grants was shown in Figure 5. As can be seen in Figure 5, 77% of business owners have built their greenhouses with their own money, 21% by taking loans from the bank and 2% by benefiting from the grant. It was observed that the majority of greenhouses damaged by disasters were greenhouses built by the owners facilities, in other words, the greenhouses receiving grants and support from the state were less damaged.

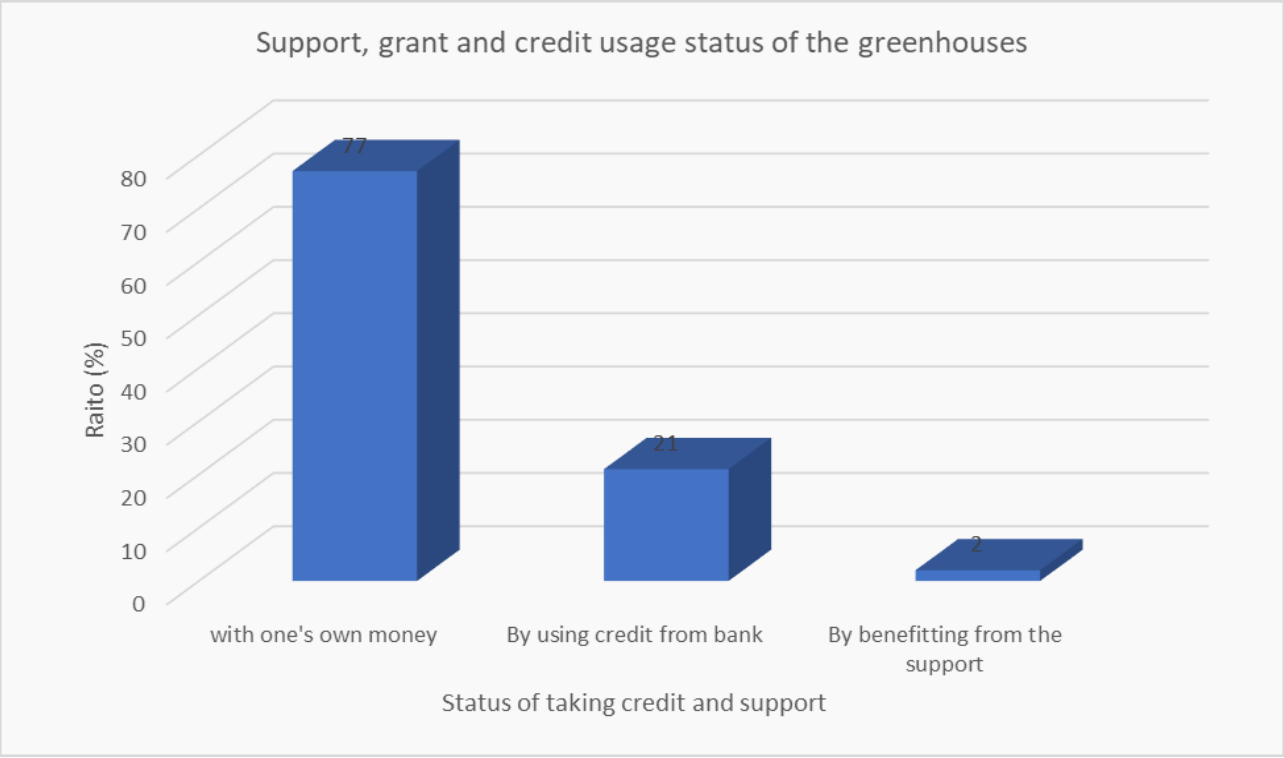


Figure 5. Support, grant and credit usage status of the greenhouses

The status of whether insured or not the greenhouses damaged by disasters was given in Figure 6. According to the results, it was determined that 55% of the greenhouses were not insured, 44% were agricultural insured and 1% were private insured.

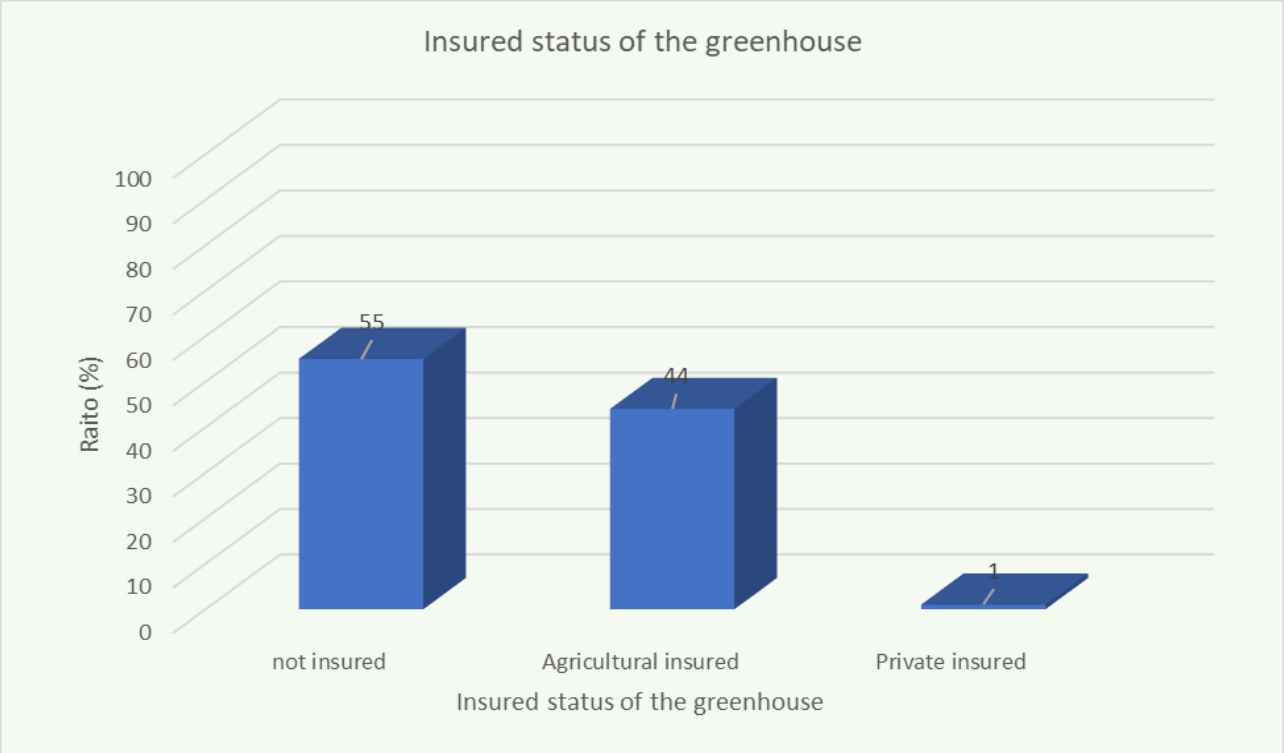


Figure 6. Insured status of the greenhouse.

Besides, 55% of the losses of the greenhouses damaged in disasters were not compensated, 44% were compensated by the insurance company and 1% were compensated by the state (Fig. 7).

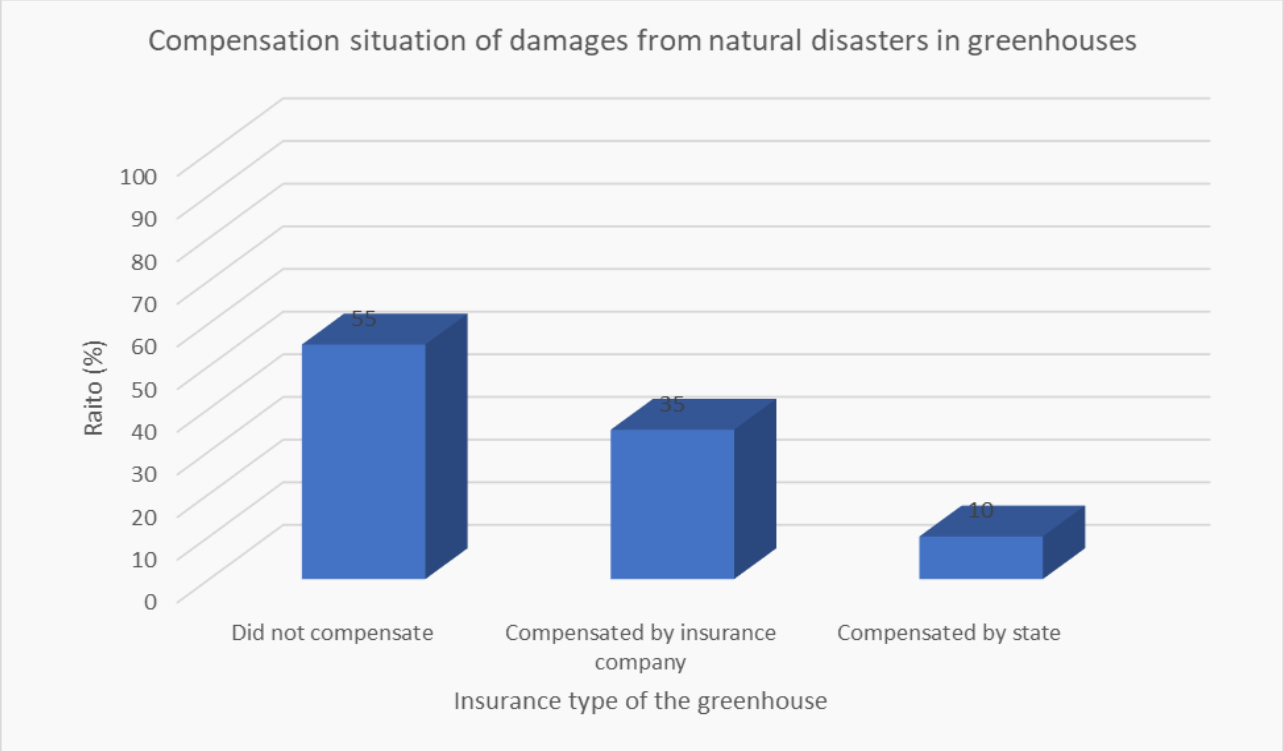
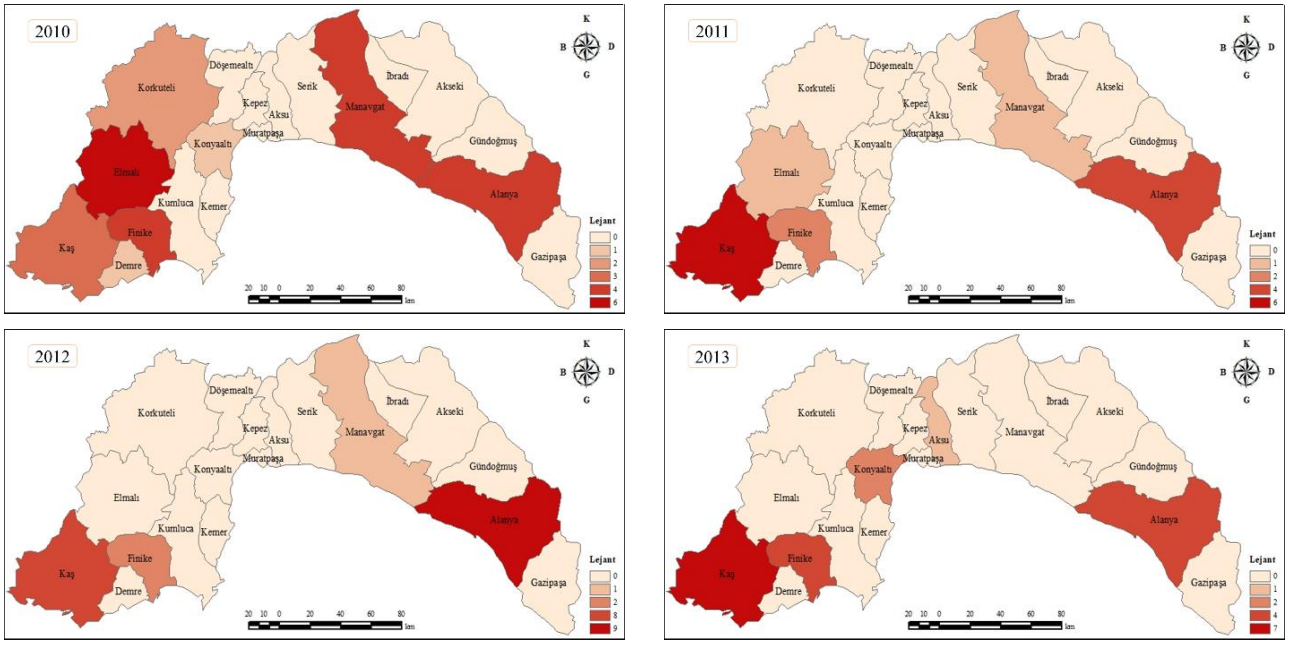


Figure 7. Compensation situation of damages from natural disasters in greenhouses.

In Antalya, where greenhouse cultivation is carried out intensely, hail and storm disasters which are of natural disasters damaging greenhouses, were mapped on the basis of districts and were given in Figure 8 and Figure 9. As seen in Figure 8, in 2010, the highest hail precipitation occurred in Elmalı (6 days) and the least hail precipitation in Konyaaltı and Demre (1 day). In 2011, the highest hail precipitation occurred in Kaş (6 days) and the least hail precipitation in Elmalı and Manavgat (1 day). In 2012, the highest hail precipitation occurred in Alanya (9 days) and the least hail precipitation in Manavgat (1 day). In 2013, the highest hail precipitation occurred in Kaş (7 days) and the least hail precipitation in Aksu (1 day). In 2014, the highest hail precipitation occurred in Alanya and Finike (7 days) and the least hail precipitation in Konyaaltı (2 days). In 2015, the highest hail precipitation occurred in Kaş and Finike (4 days) and the least hail precipitation in Gazipaşa and Konyaaltı (1 day). In 2016, the highest hail precipitation occurred in Alanya (8 days) and the least hail precipitation in Finike (1 day). In 2017, the highest hail precipitation occurred in Alanya (12 days) and the least hail precipitation in Kaş (3 days). In 2018, the highest hail precipitation occurred in Alanya (5 days) and the least hail precipitation in Finike (2 days). In the first half of 2019, the highest hail precipitation occurred in Alanya (6 days) and the least hail precipitation in Aksu and Kaş (1 day). In 2009, 226 storms, 128 heavy rainfalls, and floods, 75 hail, 10 lightning incidents, 6 days frost and 3 days strong snowfalls occurred in Antalya

in 2009 (Anonim 2010). In the flood, hail and storm that occurred on January 18, 2013, a total area of 1869 decares were damaged in the districts of Serik, Manavgat and Aksu. In addition, hail precipitation occurred on 15.06.2018 were caused great damage in greenhouses and olive gardens in the districts of Demre, Kumluca and Finike where greenhouse cultivation was carried out intensely, and 80% of greenhouses were damaged in Demre. Due to the downpour and hail, which was effective in Gazipaşa district on 24.10.2018, in glass and plastic greenhouses, orchards and agricultural areas damage occurred and 260 producers were damaged from the downpour and hail (Anonim 2019f). (Anonim 2019a).Heavy rain, hail and storm, which were effective in the district of Serik on 26.01.2019, damaged the agricultural areas and nearly 1000 decares of glass and plastic greenhouses were damaged (Anonim 2019e). (Anonim 2019b).



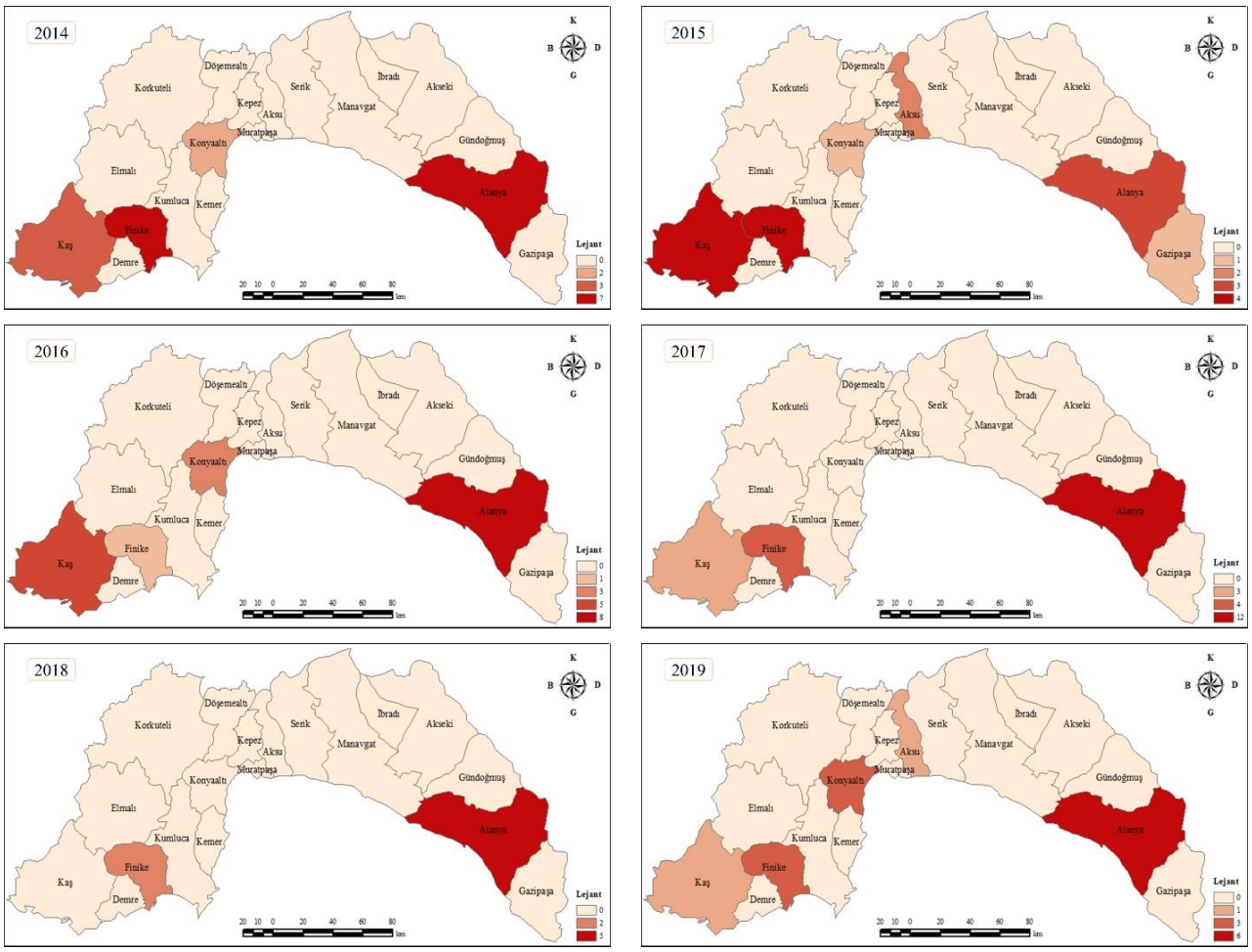


Figure 8. The 10-year hail map of Antalya province.

When looked the stormy days in 2010, the highest storm or hurricane occurred in Kepez (17 days) and the least storm or hurricane in Finike and Korkuteli (1 day). In 2011, the highest storm or hurricane occurred in Kepez (12 days) and the least storm or hurricane in Elmalı and Gazipaşa (1 day). In 2012, the highest storm or hurricane occurred in Kepez (20 days) and the least storm or hurricane in Elmalı and Aksu (2 days). In 2013, the highest storm or hurricane occurred in Kemer (62 days) and the least storm or hurricane in Elmalı (1 day). In 2014, the highest storm or hurricane occurred in Serik (42 days) and the least storm or hurricane in Demre and Kemer (1 day). In 2015, the highest storm or hurricane occurred in Serik (25 days) and the least storm or hurricane in Alanya and Finike (1 day). In 2016, the highest storm or hurricane occurred in Kepez (21 days) and the least storm or hurricane in Akseki, Aksu, Döşemealtı, Gazipaşa and İbradı (1 day). In 2017, the highest storm or hurricane occurred in Kepez (15 days) and the least storm or hurricane in Aksu, Konyaaltı and Döşemealtı (1 day). In 2018, the highest storm or hurricane occurred in Serik and Kepez (15 days) and the least storm or hurricane in Elmalı and Kumluca (1 day). In the first half of 2019, the highest storm or hurricane occurred in Kepez (15 days) and the least storm or hurricane in Finike, Gazipaşa and Demre (1 day). (Fig. 9).

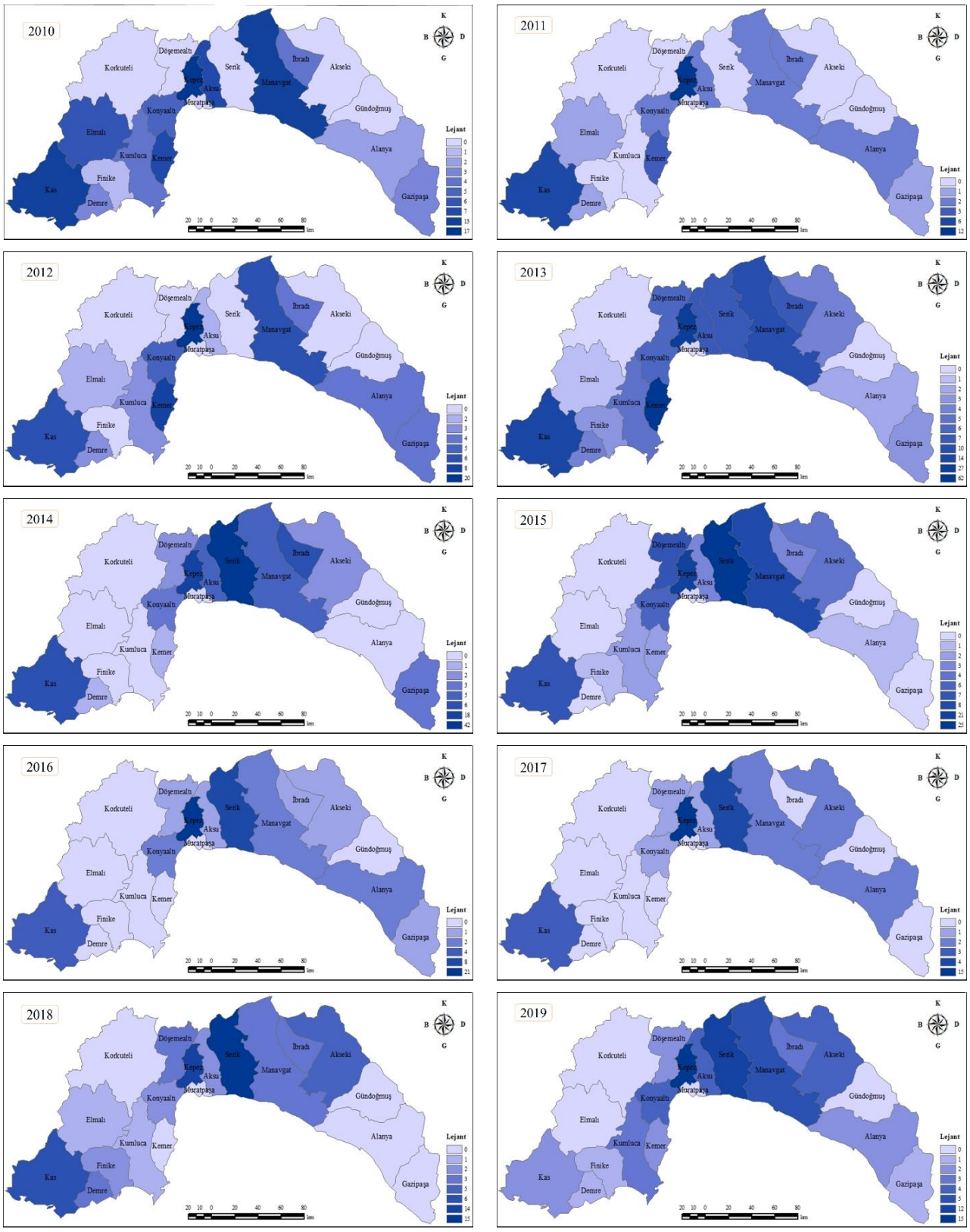


Figure 9. The 10-year storm/hurricane map of Antalya province.

The storm and hurricane that occurred many times throughout the province in 2014 and 2015 caused great damage in greenhouses in many districts, and the hurricane in Finike district damaged the covers of 7 plastic greenhouses and the product inside (Ersoy 2016). The storm and hurricane occurred throughout the province in 2016 caused great damage to the production of greenhouse and citrus fruits in the centers and districts (Anonim 2019g). (Anonim 2019c). In 2017, storms and hurricanes occurred throughout the city caused great damage to greenhouses in the center and

districts. The storm and hurricanes in Kumluca district between 10.01.2017 and 18.02.2017 caused great damage in 32 decares of greenhouses. In addition, about 750 producers and 2600 decares of land were damaged due to the hurricane, hail, heavy rain and storm occurred in Antalya on 13.11.2017. The greenhouse area damaged in the disaster is 520 decares in Kumluca, 200 decares in Finike, 267 decares in Demre and 840 decares in Kaş. In addition, 800 decares in Finike and 13 decares orchard in Demre were damaged (Anonim 2019h; Sarı ve Günay 2018). (Anonim 2019d; Sarı ve Günay 2018). Besides, the hurricane that occurred on November 15, 2017, damaged to greenhouses in the important agricultural regions of Antalya such as Finike, Demre, and Kumluca districts and that financial loss is more than 100 million Turkish Liras were It is stated (Anonim 2019i). (Anonim 2019e). The storms and hurricanes experienced in the year 2019 caused great damage to greenhouses in the city. The lands of approximately 5500 farmers in Antalya damaged. While making payments to 130 greenhouse producers registered in TARSİM, more than 4 thousand uninsured farmers could not be paid.

4. CONCLUSION

According to the results of the survey and measurement, it was found that the situation of greenhouses damaged, from natural disasters depends on the criteria such as the education level of enterprise owners, foundation and basement status and profile type used in the greenhouse. The statistical analyzes made, showed that there was a significant relationship between the construction materials type and the disaster types ($p < 0.05$). Also a significant relationship was found between the compensation of damages in greenhouses and the status of benefiting from any support of government ($p < 0.05$). In addition, it was found that there was a significant relationship between the disaster types damaging the greenhouses and the type of covering material used ($p < 0.05$).

Because of having no static plan and project of greenhouses built by blacksmiths who were not experts in their work, they were more likely damaged in natural disasters. In addition, the severity and types of natural disaster had been significantly effective in damaging to greenhouses. It was understood that as the education level increased, the insured status of the greenhouses increased. Therefore, insurance the greenhouses in the regions where natural disasters occur frequently minimizes the damage to the farmer families. This situation is an obligation that will not be put at risk for the farmers whose only source of income is agriculture.

Although Antalya province has approximately 82% of glass greenhouses and 53% of plastic greenhouse in Turkey, due to its geographical location and being surrounded by sea on one side, it is a province that is vulnerable to serious damage. As can be seen from the results obtained, plant production structures throughout the province were severely damaged due to severe disasters such as rainfall, hail, storm or hurricane. The necessary suggestions to prevent these damages or to meet the product and material losses are listed below.

Greenhouse construction profiles should be selected in suitable cross-section to carry static and moving loads affecting the greenhouse building elements. Galvanized standard steel profiles and aluminum box profiles should be used in the selected of elements such as columns and roof trusses as the carrier construction material in greenhouse construction (Critten ve Bailey 2002; Hakgören ve Kürklü 2007; Baytorun 2016;).

Especially, galvanized steel profiles with larger cross sections and thicknesses must use than those required should be used in the carrier systems of the greenhouses in Antalya center, Aksu, Serik, Kumluca, Finike, Kaş and Demre districts where plant production is intensive.

In greenhouses, at least with 300 dosages of 50x50x60 cm cross-section prismatic or 50x60 cm cross-section cylindrical concrete foundations should be made and the columns should be anchored to the anchoring elements placed within these foundations. In addition, in order to prevent heavy rainfall and surface flow water to entering into the greenhouse, it should be made concrete basement with 300 doses of the at 20-30 cm width and 20-30 cm height (Baytorun 2016; Büyüktaş vd. 2016).

In order to prevent damage from rainfall, flood, and floodwaters of greenhouses in the province, it should be considering morphological characteristics, climatic characteristics and topographic conditions of the river basins and the greenhouses should be established in places that will be least affected by natural disasters. The number of hydrological observation stations in stream and river basins in the province should be increased and early warning systems against floods and floods should be developed.

Besides, because of occurring continuous recurring meteorological disasters, insurance must be made compulsory in all greenhouse enterprises in Antalya and the state contribution in insurance should be increased to 70-75%.

Furthermore, in order to be hail and storm-resistant, full impact resistant glass or hard plastic (PC) material should be used, made widespread and encouraged instead of soft plastic (PE) and normal glass cover materials.

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REFERENCES

Anonymus, 2010. Devlet Meteoroloji İşleri Genel Müdürlüğü 2009 Yılı İklim Verilerinin Değerlendirmesi. Zirai Meteoroloji ve İklim Rasatları Dairesi Başkanlığı, Ankara. [Son erişim tarihi: 10.06.2019].

Anonymus, 2019a-f. Antalya'da Yaşanan ve Yaşanmakta Olan Sel Felaketlerine İlişkin Basın Açıklamalrı ve Haber Bültenleri.

Baytorun, N. 2016. Seralar, Sera Tipleri, Donanım ve İklimlendirmesi. Nobel Yayıncılık, Yayın no 1654, 417s, Ankara.

Büyüktaş K, Atilgan A & Tezcan A. 2016. Tarımsal Üretim Yapıları. Süleyman Demirel Üniversitesi Yayınları, Yayın no: 101, 253s, Isparta.

Critten, D.L, and Bailey, B.J. 2002. A Review of Greenhouse Engineering Developments During the 1990s. Agricultual and Forest Meteorology, vol. 112 (1), 1-22.

Çiçek A. & Erkan O. 1996. Tarım Ekonomisinde Araştırma ve Örnekleme Yöntemleri. T.C. Gaziosmanpaşa Üniversitesi Ziraat Fakültesi Yayınları, Yayın no: 12, 118s, Tokat.

Çipil M. 2008. Risk Yönetimi ve Sigorta. Nobel Akademik yayıncılık, 314s, Ankara.

Cochran WG. 1977. Sampling Techniques. John Wiley & Sons, Inc., New York, NY.

Ersoy, Ş. 2016. 2015 Yılının Doğa Kaynaklı Afetleri "Dünya ve Türkiye". TMMOB Jeoloji Mühendisleri Odası Yayınları, Yayınları no: 125, Ankara.

Hakgören, F. ve Kürklü, A. 2007. Sera Planlaması. Akdeniz Üniversitesi Ziraat Fakültesi Ders Kitabı, Yayın no 6, 184s, Antalya.

Karagölge C. & Peker K. 2002. Tarim Ekonomisi Araştırmalarında Tabakalı Örnekleme Yönteminin Kullanılması. Atatürk Üniversitesi Ziraat Fakültesi Dergisi, Sayı 33 (3): 313-316.

Kırkbeşoğlu E. 2015. Risk Yönetimi ve Sigortacılık. Gazi Kitapevi Yayınları, 650s, Ankara.

Neyman J. 1934. On two different aspects of the representative method: The method of stratified sampling and the method of purposive selection. J. Royal Stat. Soc. B. 97, 558–606.

Sarı, C. ve Günay, Ş. 2018. Kumluca'da Meydana Gelen Doğal Afetlerin Yerel Halk Üzerine Sosyoekonomik Etkileri. TÜCAUM 30. Yıl Uluslararası Coğrafya Sempozyumu /International Geography Symposium on the 30th Anniversary of TUCAUM, 3-6 Ekim 2018, Ankara

Sümer G. & Polat Y. 2016. Dünyada Tarım Sigortaları Uygulamaları ve TARSİM. Gazi Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi, Cilt 18(1): 236-263s.

Üstün S. & Baytorun N. 2003. Sera Projelerinin Hazırlanmasına Yönelik Bir Uzman Sistemin Oluşturulması. KSÜ Fen ve Mühendislik Dergisi, 6(1): 168-176.

von Elsner, B., D.Briassoulis, D.Waaijenberg, A.Mistriotis, von Chr.Zabeltitz, J.Gratraud, G.Russo and R.Suay-Cortes 2000. Review of Structural and Functional Characteristics in European Union Countries, Part I: Design Requirements. Journal of Agriculture Engineering Research, vol. 75(1):1-16s.

Yüksel, A.N. 2004. Sera Yapım Tekniği. Hasad Yayıncılık, ISBN 975-8377-09-4, 287s, İstanbul.