# Perceptions and Adaptation Strategies to Climate Change among Apple Producers in the West Mediterranean Region of Türkiye

***Bektaş Kadakoğlu [1], Fatma Handan Giray [2]***

*Department of Agricultural Economics of Faculty of Agriculture, Isparta University of Applied Sciences (ISUBÜ), Isparta, Türkiye [1]*

*Department of Agricultural Economics of Faculty of Agriculture, Eskişehir Osmangazi University (ESOGU), Eskişehir, Türkiye [2]*

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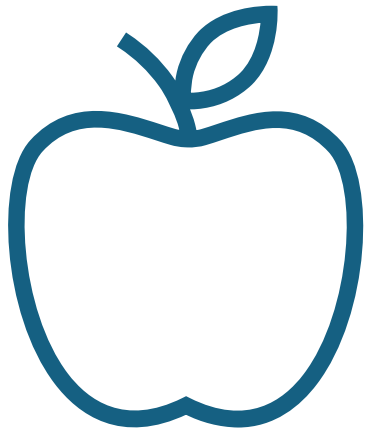
# Research Motivation

- Climate change is one of the most critical challenges affecting agricultural productivity and quality. Apple production, being highly sensitive to climatic conditions, is particularly vulnerable to these changes.
- Türkiye holds a significant share in global apple production, and the Western Mediterranean Region of Türkiye constitutes an important place of the country production.
- Therefore, determining the adaptation levels of producers in this region is of vital importance for both regional and national agricultural policies.

# Aim

- The main objective of the study is to analyze the adaptation behaviors of apple producers in Türkiye's Western Mediterranean Region to climate change and to identify the factors influencing these behaviors.
- In this context, various factors were examined using binary logistic regression analysis to determine their effects on producers' adaptation decisions to climate change.



# Introduction

- Türkiye is one of the world's top apple producers, where domestic consumption dominates but export potential is increasing. The Western Mediterranean Region stands out as a major hub for apple cultivation due to its favorable ecological conditions and production potential.
- However, in recent years, the region has experienced increasing challenges such as higher temperatures, spring frosts, irregular rainfall, and drought, which undermine the sustainability of production when relying solely on conventional farming practices.
- Under these conditions, the development of adaptation strategies by producers has become indispensable. Adaptation behaviors are shaped by producers' individual and socio-economic characteristics.
- Hence, micro-level research aimed at understanding producers' adaptation behaviors is essential for strengthening their resilience and for guiding agricultural policy interventions toward climate-resilient farming systems.

# Introduction

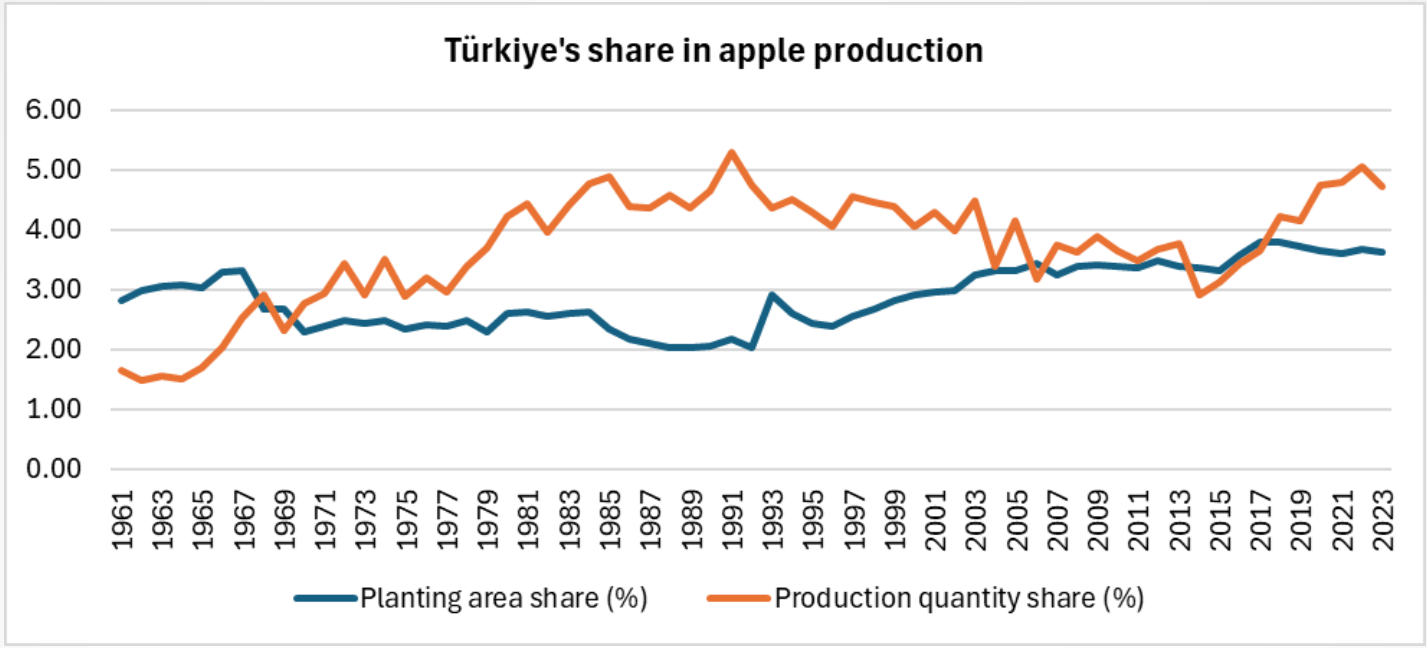



**Fig 1.** Türkiye's share in the world in terms of apple production (FAO, 2025)

- Türkiye ranks fourth in the world in terms of apple growing area and third in terms of production volume.
- Türkiye's share in world apple production increased from approximately 1.5% to 5% between 1961-2023.
- Although the share of Türkiye's apple growing area in the world declined to approximately 2% at certain times, it has risen again in recent years, approaching 4%. (FAO, 2025)

# Material

The study has conducted in Eğirdir, a district of Isparta province located in the Western Mediterranean Region because Isparta ranks first in apple production in the country, accounting for approximately 25% and Eğirdir is one of the key apple-producing districts within the province.

In the study area, apple production constitutes a major source of income not only for farmers but also for seasonal workers employed during the harvest period.

The data for this research collected through face-to-face surveys conducted with 57 farmers, selected using the Neyman sampling method (Yamane, 2001) in June-July 2025.

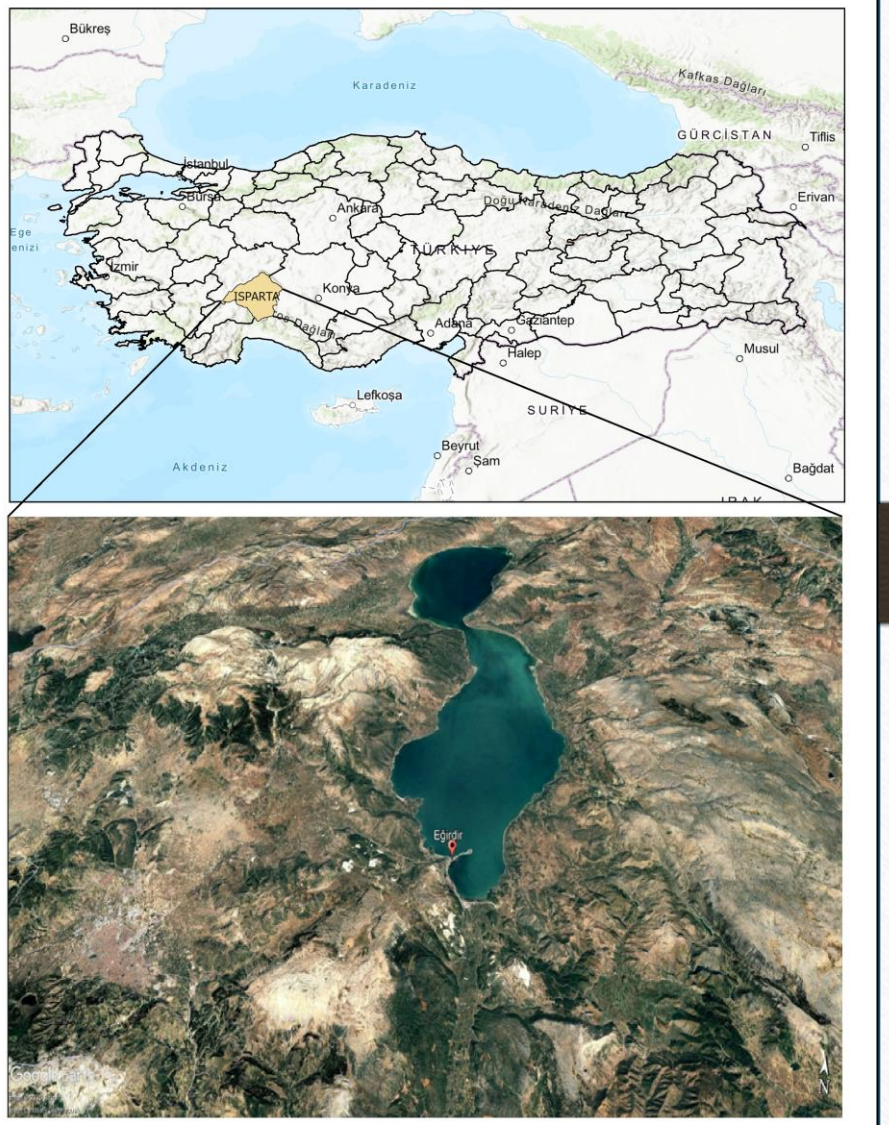



**Fig 2.** Map of the study area

# Methodology

## Analysis of Factors Affecting Apple Producers' Adaptation Strategies to Climate Change

- A binary logistic regression model was used to determine the factors affecting farmers' adaptation to climate change.

- A 5-point Likert-type scale was used as the adaptation index, and farms were categorized as compatible or incompatible with climate change based on their implementation of 13 practices (such as good agricultural practices, organic farming, soil analysis, leaf analysis, biotechnical control, etc.).

# Research findings

**Table 1. Apple producers' perception of the future regarding climate change**

| Statements | Average | Standard deviation |
|---|---|---|
| Product prices will increase | 4.42 | 0.94 |
| Plant and animal diseases will increase | 4.30 | 0.65 |
| Producer income will decrease | 4.28 | 0.62 |
| Production costs will increase | 4.26 | 0.72 |
| Product yields will decrease | 4.25 | 0.66 |
| Water resources will decrease | 4.18 | 0.80 |
| Natural disasters will increase | 4.02 | 0.79 |
| Living standards will decrease | 3.88 | 0.78 |

1: Strongly disagree, 2: Disagree, 3: Moderately agree, 4: Very much agree, 5: Strongly agree

Producers think that following changes will occur because of the effects of climate change:

- product prices will increase in the future (4.42), plant and animal diseases will increase (4.30),
- their income will decrease (4.28),
- production costs will increase (4.26), and
- product productivity will decrease (4.25)

**Table 2. Descriptive statistics of the variables in the model**

| Variables | Definition | Average |
|---|---|---|
| Adaptability to climate change (Dependent variable) | 0: Incompatible<br>1: Compatible | 0.42 |
| **Independent variables** | | |
| Farmer age | 1: 30 years and under<br>2: 31-50 years<br>3: 51 years and over | 46.00 |
| Farmer education duration | 0: Literate<br>1: Elementary education<br>2: High school<br>3: Associate degree<br>4: Bachelor's degree | 10.30 |
| Membership status in agricultural organizations | 0: No 1: Yes | 45.6% |
| Agricultural income other than apples | 0: No 1: Yes | 24.6% |
| Experience duration in apple production | 1: 10 years and under<br>2: 11-20 years<br>3: 21 years and over | 19.20 |
| All household members work in apple production | 0: No 1: Yes | 49.1% |

# Research findings

**According to the determined adaptation index, 42.11% of farmers were found to be adaptable to climate change, and 57.89% were found to be incompatible with climate change.**

Descriptive statistics for six independent variables thought to affect producers' adaptation to climate change are: age, education level, cooperative/union membership, experience in apple production, existence of non-apple agricultural income, and whether the entire household is involved in apple production.

## Table 3. Binary logistic regression analysis results

| Independent variables (IVs) | β | S.E. | Wald | P (Sig) | Exp. (β) |
|---|---|---|---|---|---|
| Farmer age | 0.458 | 0.692 | 0.438 | 0.508 | 1.581 |
| Farmer education duration* | 1.517 | 0.622 | 5.942 | **0.015** | 4.558 |
| Membership status in agricultural organizations** | 1.573 | 0.930 | 2.862 | **0.091** | 4.821 |
| Possession of agricultural income other than apples | 0.687 | 0.997 | 0.474 | 0.491 | 1.987 |
| Experience duration in apple production** | -1.088 | 0.632 | 2.966 | **0.085** | 0.337 |
| All household members work in apple production** | 1.527 | 0.825 | 3.424 | **0.064** | 4.603 |
| Overall Percentage = 78.95<br>-2 log likelihood = 42.012<br>Cox&Snell $R^2$ = 0.464<br>Negalkerke $R^2$ = 0.624<br>P = 0.001 | | | | | |

*0.05 and **0.10 significance level

# Research findings

**Note:**

β: The coefficient for the IVs, (This coefficient expresses the effect of the independent variable on the dependent variable),

S.E.: The standard errors of the IVs,

Wald: $X^2$ statistic testing the significance of the presence of the IVs in the model,

P (Sig): The P-value indicating the significance levels of the Wald statistics,

Exp. : The odds ratio.

# Research findings

**Binary logistic regression analysis results**

- The explanatory power of the binary logistic regression model is determined by the Cox & Snell or Nagelkerke $R^2$ values. The closer these values are to 1, the higher the explanatory power of the established model (Sinthupundaja et al., 2017).
- The Nagelkerke $R^2$ value was found to be 0.624. This value indicates that the established logistics model explains 62.4% of the variation in the variables used.
- Four of the six independent variables in the model were found to be statistically significant.

# Research findings

**Binary logistic regression analysis results**

- **According to the model results,** the factors affecting apple farmers' adaptation to climate change were **determined level of education, membership in an agricultural organization, length of experience in apple production, and all family members working in apple production.**

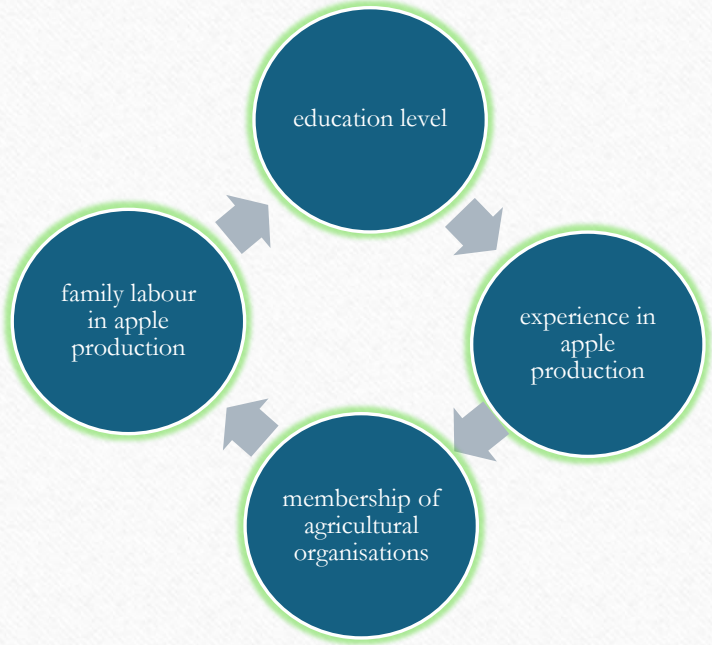



**Fig 3.** Main actors influencing farmers' decisions regarding climate change adaptation

# Research findings

**Binary logistic regression analysis results**

- The analysis findings reveal that education level is the strongest and most significant determinant of adaptation. Each increase in education level increases producers' likelihood of adapting to climate change by approximately 4.6 times. Studies reaching similar conclusions regarding educational level are available in the literature (Maddison, 2007; Deressa et al., 2009; Saguye, 2016; Çankaya, 2023).

- Membership in agricultural organizations and all family members working in apple production were also found to have a positive and significant effect. Each increase in these variables, respectively, increases producers' likelihood of adapting to climate change by approximately 4.8 times and 4.6 times.

- The variable of experience in apple production was found to have a negative and significant effect. This suggests that farmers who have maintained the same production system for many years may be inclined to stick to conventional methods and be more cautious about new practices.

- The variables of farmer age and having non-apple agricultural income were not found to be statistically significant; therefore, it was understood that they did not have a decisive effect on adaptation behavior.

# Conclusion

- The findings suggest that in order to enhance resilience against climate change in agricultural production, policymakers should particularly focus on supporting farmer education programs, encouraging agricultural organization membership, and promoting measures that sustain family labor contributions.
- Farmer education programs should aim to provide continuous and timely information to producers, as climate change generates new challenges and necessitates the adoption of appropriate measures and practices.
- Moreover, strategies to attract younger generations into agriculture and awareness-raising programs that facilitate the participation of experienced farmers in adaptation practices will be equally important.
- By implementing such measures, apple producers can strengthen their resilience and develop a more sustainable production system against the adverse impacts of climate change.

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# Thank You!

Bektaş KADAKOĞLU

Fatma Handan GİRAY

bektaskadakoglu@isparta.edu.tr

fatmahandan.giray@ogu.edu.tr