

Bibliometric Analysis of Durum Wheat Studies Addressed in Türkiye

Yeşim Sıla Tekin¹, Taner Akar^{*2}

Abstract: Bibliometric analysis is a common and rigorous method for examining and analyzing large volumes of scientific data which can reveal the evolving nuances of a particular field while highlighting new areas within that field. There have been many bibliometric studies focusing on durum wheat; however, to our knowledge, there has been no study on the bibliometric analysis of durum wheat studies in Türkiye. Therefore, we performed a comprehensive bibliometric analysis on durum wheat articles addressed in Türkiye. A literature search on durum wheat studies in Türkiye was conducted using only the Web of Science (WOS) database. Publication date interval was limited between 01/01/2000 and 31/12/2023. Web of Science Index, document type and language were limited as Science Citation Index Expanded (SCI-Expanded), Article, and English, respectively. The data shows that there are a total of 486 articles related to durum wheat addressed in Türkiye from 01/01/2000 to 31/12/2023, in 186 different sources. Totally 1354 authors contributed the number of publications and the number of single-authored articles was 65. On the other hand, the number of co-authors per article was 4.31 and international co-authorships was 24.69%. The most productive years were 2019, 2018, and 2017 with 41, 33, and 30 articles, respectively. The poorest years for article production were 2001, 2002, 2005, 2013, 2014, and 2000 with <10 articles. The top 10 keywords have been durum-wheat (86 times used), quality (51), cultivars (47), yield (47), winter-wheat (42), growth (41), grain-yield (39), plants (39), wheat (35) and genotypes (31), respectively. Collaboration network analysis illustrates that there are eight different strong author groups and especially Çukurova University, Sabancı University and Hacettepe University have collaborated many times with other organizations in Türkiye to conduct studies on durum wheat. Although there has been a slight fluctuation in recent years, it is understood that durum wheat research has increased from the past to the present in Türkiye; however, studies strengthened with statistical models are needed to provide more concrete data.

Keywords: Bibliometrics, durum wheat, *Triticum durum* L., research, Türkiye

¹**Address:** Akdeniz University, Faculty of Agriculture, Department of Field Crops, Antalya/Türkiye

²**Address:** Muğla Sıtkı Koçman University, Faculty of Agriculture, Department of Field Crops, Muğla/Türkiye

***Corresponding author:** tanerakar@mu.edu.tr

Citation: Tekin, Y.S., Akar, T. (2024). Bibliometric Analysis of Durum Wheat Studies Addressed in Türkiye. Bilge International Journal of Science and Technology Research, 8(2): 90-97.

1. INTRODUCTION

Wheat (*Triticum* L.) is the most widely grown crop globally, and is produced on more than 210 million hectares annually across over 90 countries, each with an annual production of at least 10,000 tons. While the three major cereals, maize, rice, and wheat, account for 90% of the cereals produced

worldwide, wheat alone represents 26% of this production (FAOSTAT, 2023).

Wheat is also an important staple crop for Türkiye, and is one of the largest producers and consumers of wheat worldwide. Wheat consumption in Türkiye is about 170 kg per capita/year, which is one of the highest in the world (FAOSTAT, 2023). At the same time, Turkey is the world's

largest flour exporter and the second largest macaroni exporter (FAOSTAT, 2023). Wheat (*Triticum* spp.) is grown on more than 6.8 million hectares annually in Turkey, and wheat production is approximately 21 million metric tons (TUIK, 2023). 4.3 million tons of this production belongs to durum wheat (*Triticum durum* L.) and Central Anatolia and Southeastern are the regions with the highest durum wheat production.

Türkiye is known as one of the gene centers for wheat and its wild relatives; therefore, there is also a wide genetic variation for durum wheat varieties, landraces and their wild relatives. Many research studies have been conducted on durum wheat in Türkiye; however, there has been no detailed information for quantifying the published documents addressed in Türkiye.

In the literature, there have been publications with use of classical bibliometric methods to reveal the annual production globally for durum wheat research. The recent literature related to durum wheat and its end-use products includes many reports concentrating on agronomic practices, production systems, effects of stress factors on yield and quality, and genetic diversity etc. (Li et al., 2018; Arriagada et al., 2020; Beres et al., 2020; Santis et al., 2021; Taranto et al., 2023).

Bibliometric analysis is a common and rigorous method for examining and analyzing large volumes of scientific data which can reveal the evolving nuances of a particular field while highlighting new areas within that field. Currently, various bibliometric approaches combining statistics and visualization have been developing. One such approach is bibliometric mapping which provides information about knowledge fields that contain large and complex amounts of information in bibliographic databases. Using this approach, many studies have been conducted in different fields in Türkiye (Korkmaz et al., 2019; Ercan, 2020; Altay and Kaplan, 2023; Ergin et al., 2023; Beram, 2024), but there are no studies on durum wheat research in the literature. The aim of this study is to provide historical overview (from 2000 to 2023) of the structure and evolution of durum wheat research in Türkiye.

2. MATERIAL AND METHOD

2.1. Data collection

In the current study, the literature search on durum wheat studies in Türkiye was conducted using Web of Science (WOS) database. Bibliographic data were retrieved on July 10, 2024, by using the query (TS=(durum wheat) OR TS=(*Triticum durum*) OR TS=(*Triticum turgidum* var. *durum*) OR TS=(*Triticum turgidum* subsp. *durum*) OR TS=(*Triticum turgidum* ssp. *durum*)) AND (AD=(Turkey) OR AD=(Türkiye)), i.e., by using the searching parameters “durum wheat” or different scientific names of this species. The publication date interval was limited between 01/01/2000 and 31/12/2023. Web of Science Index, document type and language were limited as Science Citation Index Expanded (SCI-Expanded), Article, and English, respectively.

2.2. Bibliometric analysis and clustering

A package “bibliometrix” (Aria and Cuccurullo, 2017) in the RStudio software v.4.2. was used to perform all analyses. In this package, firstly, raw data were retrieved by the query explained in data collection section, and then were filtered for removing duplicated data by using the function “convert2df”. Afterwards, the processed data were used to generate and visualize the bibliometric maps by using the function “biblioshiny”.

3. RESULTS

The data shows that there are totally 486 articles related to durum wheat addressed in Türkiye from 01/01/2000 to 31/12/2023 in 186 sources. The line graph showing the annual article production about durum wheat in Türkiye is given in Figure 1. Annual growth rate (%), average citations per article, and average citations per year per article are 0%, 19.8 and 1.982, respectively. Totally 1354 authors contributed this number of publications and number of single-authored articles was 65. On the other hand, number of co-authors per article was 4.31 and international co-authorships was 24.69%.

Annual Article Production

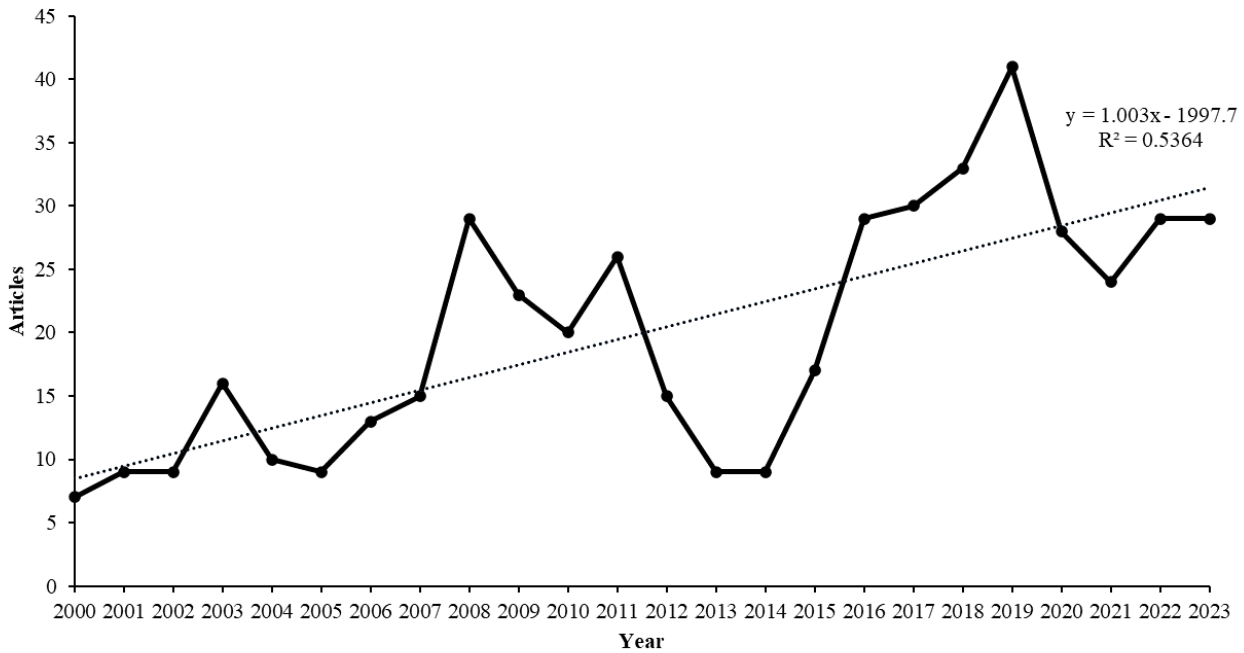


Figure 1. Trends in publications on durum wheat in Türkiye

The most productive years were 2019, 2018, and 2017 with 41, 33, and 30 articles, respectively. The poorest years for article production were 2001, 2002, 2005, 2013, 2014, and 2000 with <10 articles.

The most relevant sources are shown in Figure 2. This graph shows that Fresenius Environmental Bulletin (FEB), Turkish Journal of Agriculture and Forestry (TJOAF), Turkish Journal of Field Crops (TJOFC), Journal of Cereal Science (JOCS), Plant and Soil (PAS), Applied Ecology and Environmental Research (AEAER), Cereal Research Communications (CRC), Journal of the Science of Food and

Agriculture (JSFA), Cereal Chemistry (CC), Genetic Resources and Crop Evolution (GRCE), Journal of Plant Nutrition (JOPN), and Notulae Botanicae Horti Agrobotanici Cluj – Napoca (NBHA) have been the top journals over 9 articles during the last 23 years. In particular, FEB and TJOAF are the most published journals with 32 and 20 articles, respectively. WOS categories of these journals are generally Agronomy, Plant Sciences, Environmental Sciences, Food Science & Technology, and Agriculture Multidisciplinary.

Most relevant sources

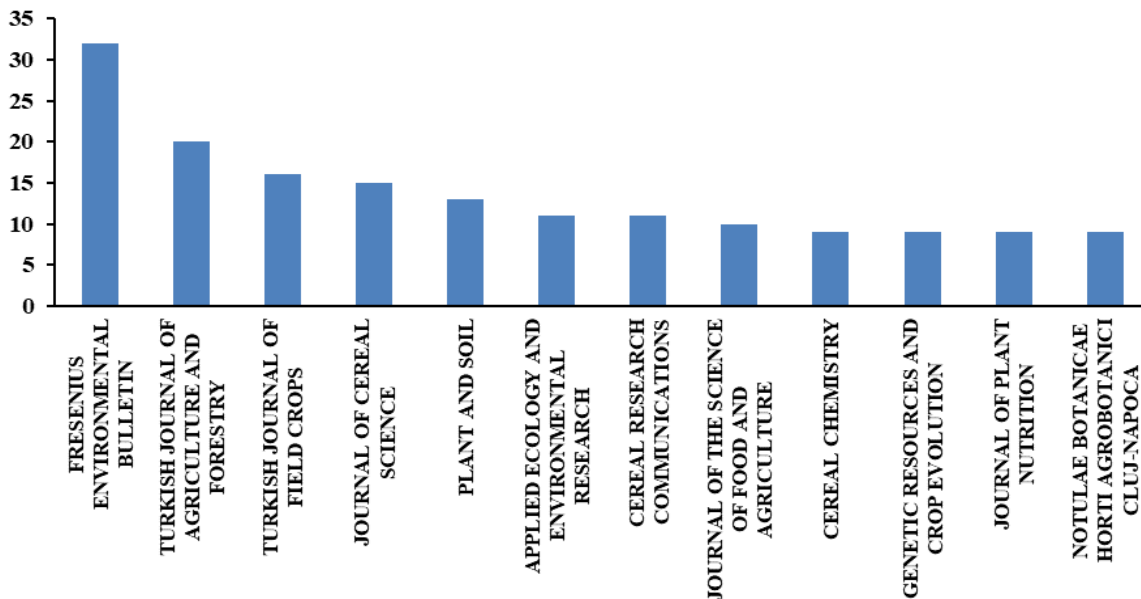


Figure 2. Top 12 journals with the most articles published

The most cited sources of published articles related to durum wheat in Türkiye are given in Figure 3. Top 10 cited sources over 200 citations were Crop Sciences (469 citations, 14%), Theoretical and Applied Genetics (459, 13%), Plant and Soil (422, 12%), Euphytica (407, 12%), Journal of Cereal Science

(392, 11%), Cereal Chemistry (354, 10%), Field Crops Research (271, 8%), Plant Physiology (246, 7%), Journal of Experimental Botany (230, 7%), and Journal of Agricultural and Food Chemistry (218, 6%), respectively.

Most Cited Sources

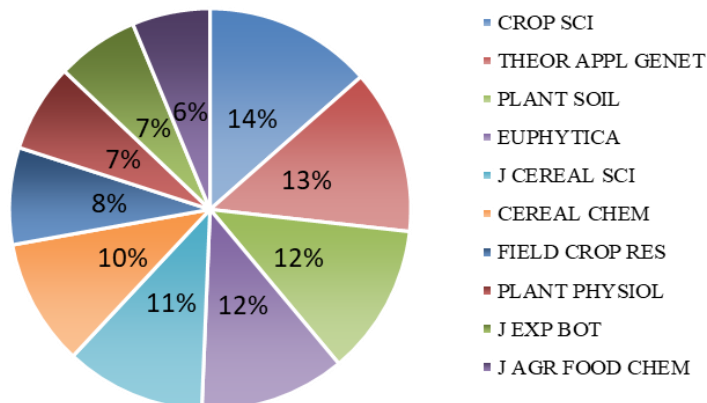


Figure 3. Top 10 most cited journals

The most productive authors for durum wheat studies in Türkiye during last 23 years are given in Figure 4. Top 10 authors are Cakmak I, Ozkan H, Ozturk L, Koksels H, Zencirci N, Budak H, Baloch FS, Morgounov A, Yildirim M, and Alsaleh A, respectively. Although the rankings have

changed, many of the most cited authors have also been among the most prolific. The most cited authors over 20 citations have been Cakmak I (54 citations), Alsaleh A (28), Baloch FS (28), Ozkan H (25), and Ozturk L (20), respectively.

Most relevant authors

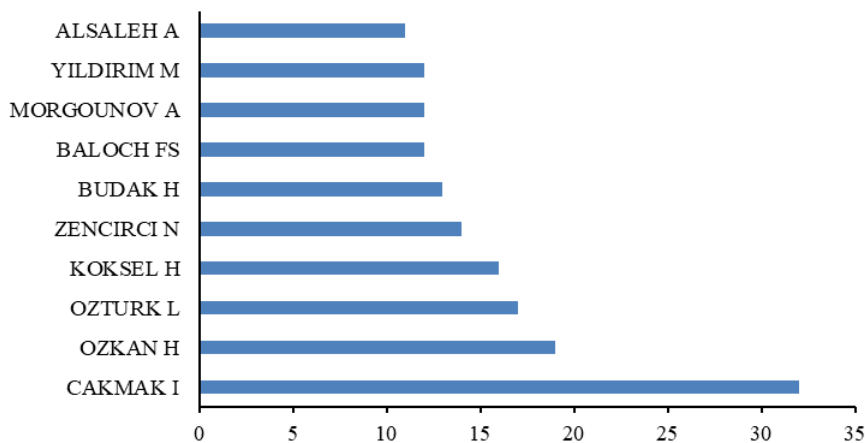


Figure 4. Top 10 prolific authors producing articles with durum wheat in Türkiye

Additionally, the parameters showing production efficiency, such as number of articles per year and total citations (TC)

per year, of these prolific authors were visualized and are given in Figure 5.

Authors' Production over Time

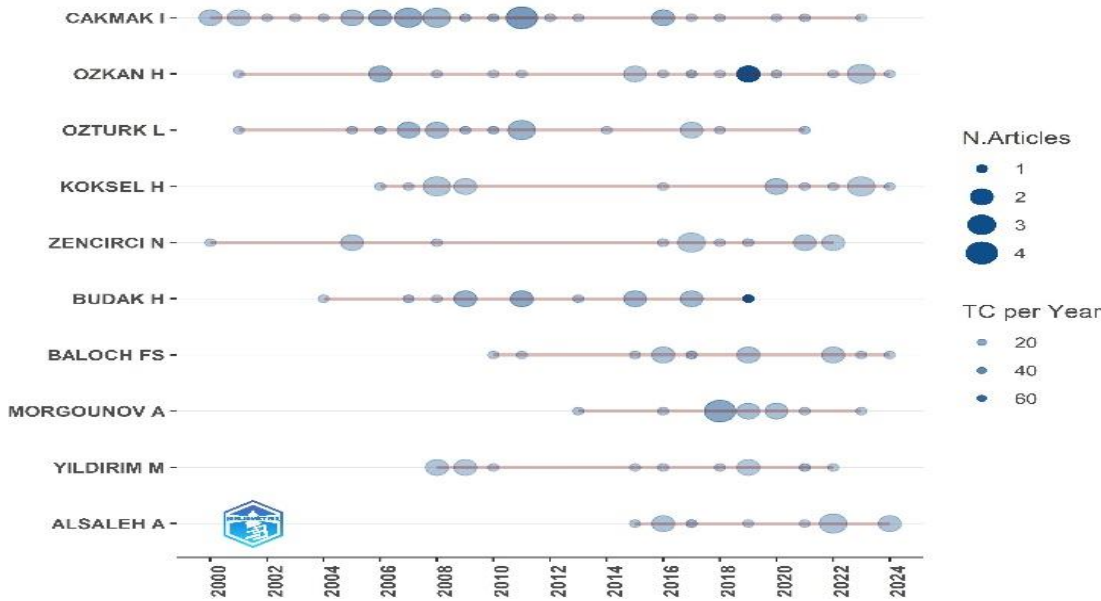


Figure 5. Number of articles and number of total citations per year of the most prolific authors

The top 10 organizations producing articles about durum wheat in Türkiye are illustrated in Figure 6. The most productive organizations are listed as Cukurova University, Sabancı University, Hacettepe University, Ankara University, Karamanoğlu Mehmetbey University, Dicle

University, Abant İzzet Baysal University, Harran University, Ege University and Selcuk University, respectively. In particular, Cukurova and Sabancı Universities have been prominent with 94 and 83 articles.

Articles

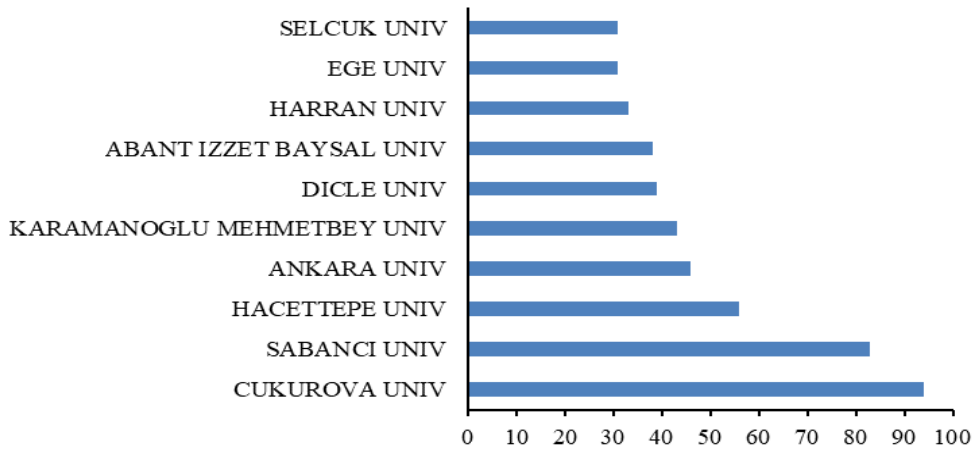


Figure 6. Most relevant organizations producing articles of durum wheat in Türkiye

The most frequent keywords were visualized as a WordCloud and this is given in Figure 7. The top 10 keywords have been durum-wheat (86 times used), quality

(51), cultivars (47), yield (47), winter-wheat (42), growth (41), grain-yield (39), plants (39), wheat (35) and genotypes (31), respectively.

4. DISCUSSION AND CONCLUSIONS

A bibliometric analysis about durum wheat studies was carried out with the objectives of quantifying the articles published by scientific journals indexed in Science Citation Index-Expanded in WOS and trends and their interactions from 2000 to 2023 in Türkiye. A total of 486 articles from the WOS database were analyzed by a package “bibliometrix” in R environment, and bibliometric maps were visualized.

This study has found that annual article production has fluctuated and the article production especially between 2016 and 2019 was higher than other years. Blanco (2024) generated a bibliometric map showing the global durum wheat research trend from 1961 to 2022 and determined that there has been an increased interest in worldwide durum wheat research during the last two years. He also reported that *Journal of Cereal Science*, *Euphytica*, *Theoretical and Applied Genetics*, *Cereal Research Communications*, and *Cereal Chemistry* are the top 5 journals for durum wheat research in the world. The present study shows that three of them are also among the most popular journals for durum wheat research in Türkiye (Fig. 2). Cecchini et al. (2020) analyzed the trend in research on durum wheat and pasta with a bibliometric approach and claimed that the general view of studies and their evolution during the years highlight a lower interest in genetic aspects in favor of topics related to health and nutritional quality.

Chandra et al. (2024) also reported a bibliometric analysis showing general wheat research trend in the world and determined that keywords such as “stress”, “GWAS”, and “gene” have been the most prominent words. The present study reports that the most prominent keywords are durum wheat, quality, cultivars, yield, winter wheat, growth, and grain yield in the durum wheat research in Türkiye (Fig. 7) and this shows that durum wheat studies in Türkiye are generally related to agronomy and quality. However, the research groups, especially in the developed countries, have concentrated on studies that correlate the data obtained as a result of molecular and agronomic studies rather than only agronomy and especially on solutions to the negative consequences of climate change. In this respect, in order to catch up with the trends in durum wheat research in the world, the studies carried out in our country should be directed in more detail and focused on today's solutions.

Overall, it is understood that durum wheat research has increased from the past to the present in Türkiye, however, studies strengthened with statistical models are needed to provide a more concrete data.

Acknowledgements

We thank to Dr. Mehmet TEKİN for his contribution to bibliometric analysis in R environment.

Ethics Committee Approval

N/A

Peer-review

Externally peer-reviewed.

Author Contributions

Conceptualization: Y.S.T.; Investigation: Y.S.T.; Material and Methodology: Y.S.T., T.A.; Supervision: T.A.; Visualization: Y.S.T.; Writing-Original Draft: Y.S.T.; Writing-review & Editing: Y.S.T., T.A. Both authors have read and agreed to the published version of manuscript.

Conflict of Interest

The authors have no conflicts of interest to declare.

Funding

The authors declared that this study has received no financial support.

REFERENCES

- Altay, Y., Kaplan, S. (2023). Bibliometric analyzes of some major effect genes associated with meat yield traits in livestock. *Selcuk Journal of Agriculture and Food Sciences*. 37(3), 608-617.
- Aria, M., Cuccurullo, C. (2017). bibliometrix: An R-tool for comprehensive science mapping analysis. *Journal of Informetrics*. 11(4), 959-975.
- Arriagada, O., Marcotuli, I., Gadaleta, A., Schwember, A.R. (2020). Molecular mapping and genomics of grain yield in durum wheat: A review. *Int. J. Mol. Sci*. 21, 7021.
- Beram, A. (2024). Bibliometric Analysis of Academic Studies on Particleboard. *Düzce Üniversitesi Orman Fakültesi Ormancılık Dergisi*, 20(1), 395-412.
- Beres, B.L., Rahmani, E., Clarke, J.M., Grassini, P., Pozniak, C.J., Geddes, C.M., Ransom, J.K. (2020). A systematic review of durum wheat: Enhancing production systems by exploring genotype, environment, and management (G × E × M) synergies. *Frontiers in Plant Science*. 11, 568657.
- Blanco, A. (2024). Structure and trends of worldwide research on durum wheat by bibliographic mapping. *International Journal of Plant Biology*. 15, 132-160.
- Cecchini, C., Menesatti, P., Antonucci, F., Costa, C. (2020). Trends in research on durum wheat and pasta, a bibliometric mapping approach. *Cereal Chemistry*. 97(3), 581-588.
- Chandra, T., Sahu, J., Jaiswal, S., Iquebal, M.A., Kumar, D. (2024). Current research status and emerging trends in wheat: An integrated scientometric analysis based on ploidy uncovers hidden footprints in the scientific landscape. *Heliyon*. 10, e36375.
- Ercan, F. (2020). Türkiye'deki gastronomi turizmi konulu makalelerin bibliyometrik analizi. *Journal of Tourism & Gastronomy Studies*. 8(2), 1058-1075.
- Ergin, M., Albayrak Delialioğlu, R., Altay, Y., Koşkan, Ö. (2023). Bibliometric analysis of lactation curves in

livestock. *Türk Tarım ve Doğa Bilimleri Dergisi*. 10(4), 1009-1016.

FAOSTAT, (2023). Crops and livestock products. <https://www.fao.org/faostat/en/#data/QCL> (accessed 6 August 2024).

Korkmaz, İ.H., Çetinkaya, C. (2019). Post-graduate thesis on logistics and supply chain in Turkey: A bibliometric analysis. *Gaziantep University Journal of Social Sciences*. 18(1), 479-493.

Li, L., Niu, Y., Ruan, Y., DePauw, R.M., Singh, A.K., Gan, Y. (2018). Agronomic advancement in tillage, crop rotation, soil health, and genetic gain in durum wheat cultivation: A 17-year Canadian story. *Agronomy*. 8, 193.

Santis, M.A., Soccio, M., Laus, M.N., Flagella, Z. (2021). Influence of drought and salt stress on durum wheat grain quality and composition: A review. *Plants*. 10, 2599.

Taranto, F., Esposito, S., De Vita, P. (2023). Genomics for yield and yield components in durum wheat. *Plants*. 12, 2571.