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SCIENTOMETRIC ANALYSIS ON THE USE OF PASTURE IRRIGATION IN THE YEARS 2013 TO 2023

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ABSTRACT

The objective of this work was to analyze the development of scientific publications on pasture irrigation in the years 2013 to 2023 through scientometrics. Pair searches were carried out in the databases: Web of Science of the Institute for Scientific Training (ISI), Scielo, Science Direct, Springer, PubMed and Scopus to download the data collected from each search platform. To guide the research, the following questions were used: What is the number of publications on pasture irrigation in the last 10 years in the world? The following keywords were used for the research: irrigated grasses and tropical grasses and pasture irrigation, both were searched in Portuguese, English and Spanish. After screening according to the chosen criteria, a total of 296 studies were obtained. The country with the highest number of publications was Brazil and the platform with the highest number of articles was Science Direct. It was observed that there was an increase in the production of

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works on irrigation, with the most used being sprinkler and center pivot irrigation, showing an increase in forage production.

Keywords: Pasture. Fodder. Start.

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INTRODUCTION

According to Mapbiomas (2022), 151,142,588 ha, which corresponds to 17.77% of the entire Brazilian national territory, is destined for pastures, being the main source of food for cattle. Data presented by the Brazilian Institute of Geography and Statistics (IBGE) pointed out that in 2022 Brazil had 234,352,649 cattle. Araújo *et al.,* (2017) cite that 95% of the animal protein produced in the country comes from the raising of ruminants on pastures, as it is an economical and efficient form of production.

With the increase in livestock activity in recent years, there has also been the expansion of pastoral areas, transforming several natural ecosystems into cultivated pasture areas. Pastures and deforestation are strongly interconnected, since for changes in native vegetation to occur, introduced or exotic forages are implanted (Parente, 2019; Stabile, 2020; Santos, 2022).

It is estimated that between 70-80% of pasture is in some stage of degradation, some factors such as overstocking, overgrazing, poor soil preparation, use of poor quality seeds, pests and diseases, water availability, are associated with this, which can act together or in isolation, which influences food production (Borghi *et al.*, 2018).

Among the criteria for the implementation of irrigation systems, we can mention the increase in productivity between 2.27 and 123%, greater profitability for the producer, availability of water where the resource is in a state of scarcity or long periods of drought and increase in the quality of forage (Reis, 2017).

It is important to emphasize that before installing any technology, factors such as cost, terrain, morphology, climatology and physiology of the plants must be analyzed (Reis *et al*., 2017), in addition to the environmental impact on the Cerrado biome.

According to Paraquett (2006), the countries: Brazil, Argentina, Chile, Uruguay, Peru, Colombia, Ecuador, Venezuela and Bolivia, have invested in agricultural technologies and practices to improve the productivity and sustainability of pastures, in addition to seeking international markets for the export of livestock products, such as meat and dairy products, and pasture agriculture plays a fundamental role in the economy and food security of these countries.

Thus, the present work aimed to carry out a quantitative technical analysis through scientometrics as a form of literature review on the focus of propagation and development of scientific knowledge through a sequence of information from discussions on pasture irrigation in the last 10 years of Portuguese-speaking countries, English and Spanish.

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MATERIALS AND METHODS

A scientometric survey was carried out in pairs, using the Web of Science databases of the Institute for Scientific Training (ISI), Scielo, Science Direct, Springer, PubMed, and Scopus between the years 2013 and 2023. Subsequently, the data were entered into the data organization platform Start (*State of the Art through Systematic Review*). In it, it was possible to analyze repeated publications, the countries with the highest number of publications, which keywords were most used, and the number of works published by search platform per year.

The Start software was developed by the software engineering research laboratory of the Federal University of São Carlos (UFSCAR) to assist researchers in systematized revisions through the use of protocols (HERNANDES *et al.,* 2010).

To carry out this work, a guiding question was asked: What is the number of publications on pasture irrigation in the last 10 years with Portuguese, English and Spanish? In order to collect quantitative information through the review of literary works.

Next, the criteria for selecting sources were created, which were classified into P1, P2 and P3, as follows:

- P1-Evaluate the growth of publications in the last 10 years on pasture irrigation.
- Q2-What are the most used irrigation methods in pasture irrigation?
- Q3-Which grasses are irrigated?

Subsequently, the following criteria were analyzed for the search:

1. To evaluate the growth of publications in the last 10 years on pasture irrigation;
2. What are the most used methods in pasture irrigation;
3. Which grasses are most irrigated;
4. Which countries in the English, Portuguese and Spanish-speaking world have the highest number of publications;
5. Which search sites have the highest number of publications;
6. In which years there was the highest number of publications.

The following keywords were used for the research: Irrigated grasses, tropical grasses and pasture irrigation, both were searched in Portuguese, English and Spanish.

As inclusion criteria: Articles, theses and dissertations written in Portuguese, Spanish and English, works that use irrigation methods in pastures, published and fully

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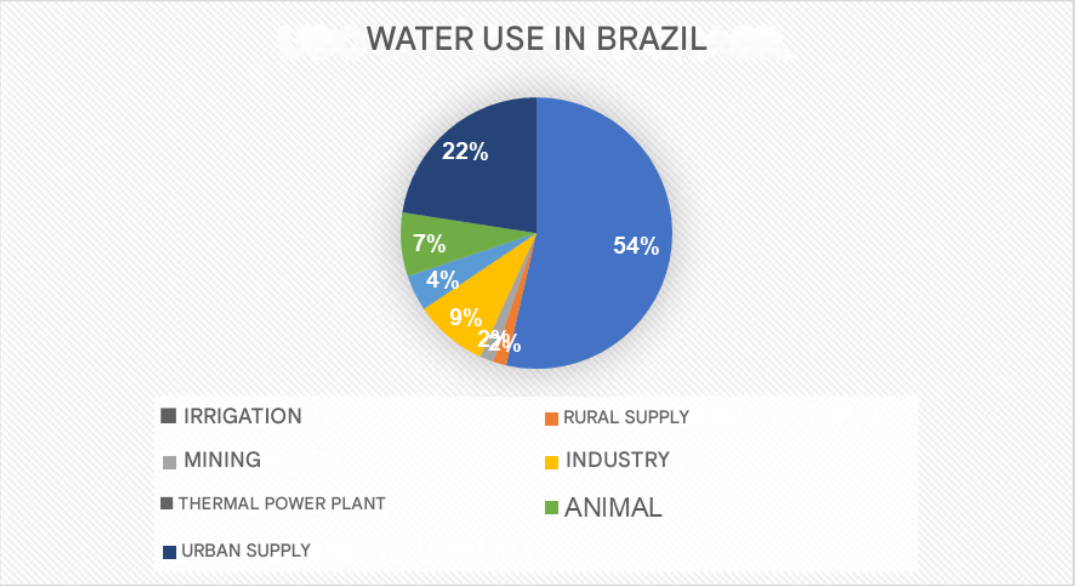
available in the scientific databases sought, use or reference the use of irrigation in pastures.

The exclusion criteria were: Articles, theses and dissertations written in languages other than Portuguese, Spanish and English; that do not present abstracts and works that did not use grasses.

RESULTS AND DISCUSSION

The conjuncture report of the National Water Agency reports that in Brazil in 2022 the use of water occurs mainly for irrigation areas, a demand that has been increasing over the years. This technology is responsible for most of the water use in the country and in the world, followed by urban and industrial supply (Figure 4).

Figure 4. Image representing the percentage of water use in Brazil



According to the research carried out, 296 works were found between the years 2013 and 2023, in articles published in journals. At first, the data were placed in the Start program, for which the following criteria were analyzed: year of publication, search platforms, how many works were published per year (Figure 5) and how many works were published per year according to each platform (Figure 6). The search platform with the highest number of publications was Science Direct, with 251 papers, the remaining 45 were distributed among the other search platforms.

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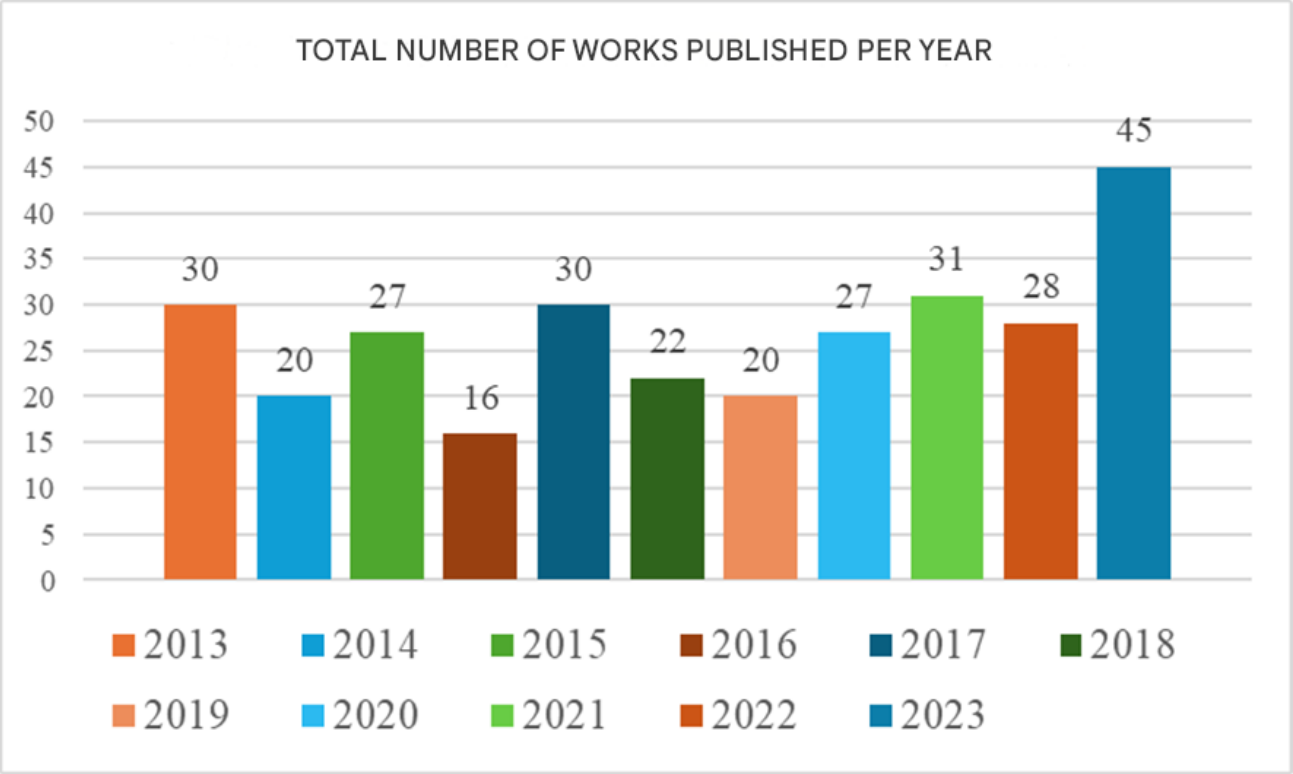
Figure 5 - Number of publications on pasture irrigation during the years 2013 to 2023 according to the following criteria: year of publication and search platforms on pasture irrigation.



It can be observed that the years 2016(16), 2014(20), 2019(20) and 2015(22) were the times when the least articles on the subject were published. According to graph 01, it is possible to analyze that the year 2023 was the year with the most published works, which shows that interest in the use of irrigation has been increasing over the years, since production with the use of this technology is 2.7 times greater than traditional cultivation, improving productivity (Guimarães and Landau, 2020).

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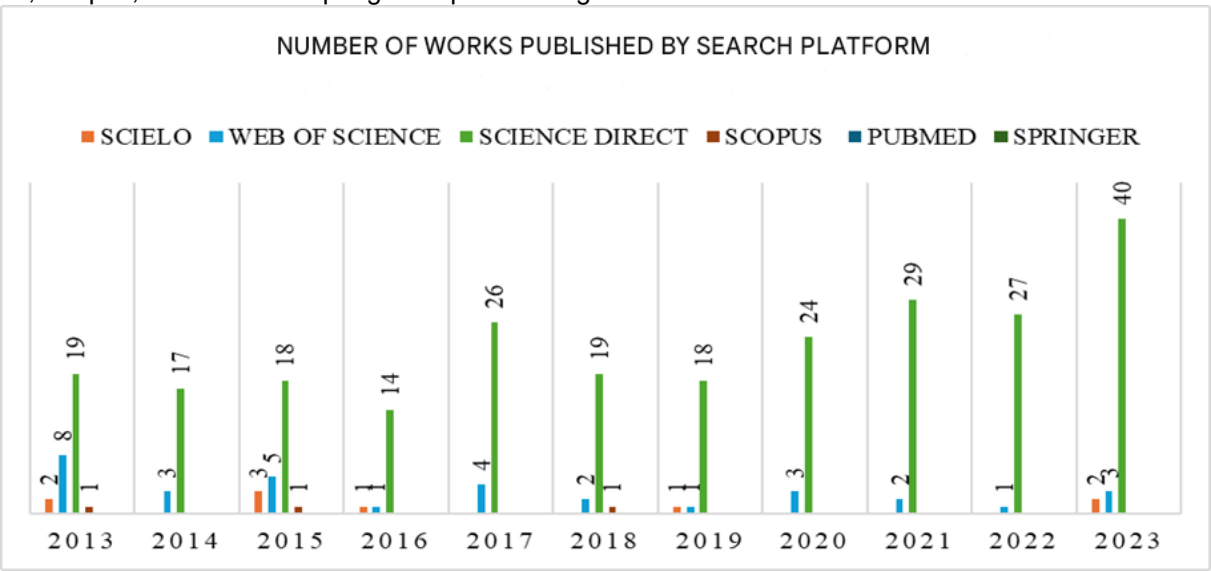
Figure 6. Number of publications from 2013 to 2023 by search platform Scielo, Web Of Science, Science Direct, Scopus, Pubmed and Springer on pasture irrigation.



Of the studies found after analysis of the exclusion and inclusion criteria, 63 studies were accepted and 223 were excluded.

Of the 63 studies accepted by the inclusion criteria, there were publications in 14 countries (Figure 7), with Brazil having the highest number of publications (36), followed by Australia (6) and the United States (5).

Australia is a country that has from severe droughts to rains with floods, with most of its agriculture on average 28% cultivated in its interior, its irrigated area corresponds to 2,500,000 ha. Irrigation provided the development of communities. The main type of irrigation is the superficial type, which occurs due to low energy needs (Rodrigues and Domingues, 2017).

The United States is one of the countries with the largest irrigated agricultural area with about 27,000,000 hectares. The use of much of the irrigation depends on groundwater. The country does not have sufficient water resources to implement irrigation, and must adapt to the available resources efficiently in order to develop the economy in addition to being concerned with the environment (Rodrigues and Domingues 2017).

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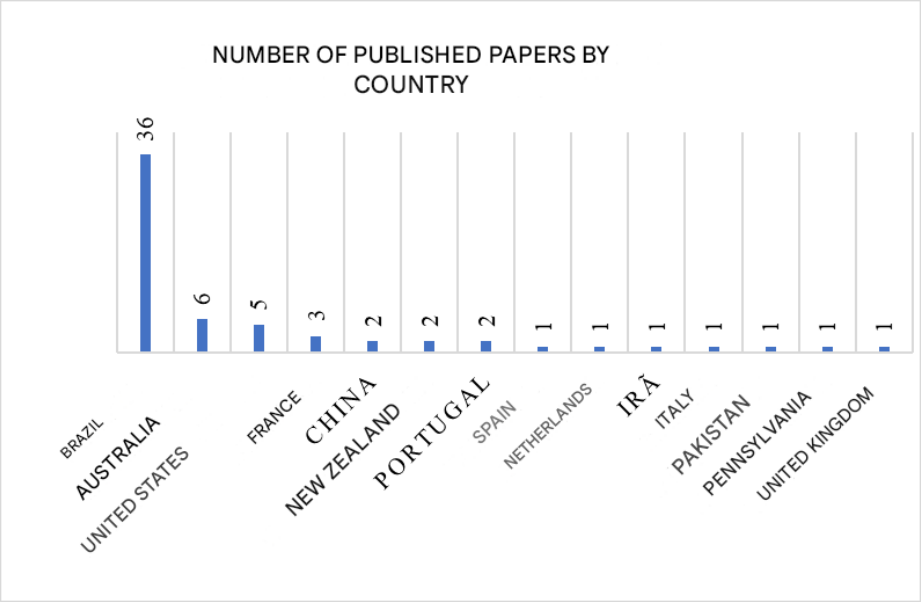
Figure 7- Number of publications by countries during the years 2013 to 2023 on pasture irrigation.



Data from the Confederation of Agriculture (CNA) state that in 2022 Brazil had 8.2 million irrigated areas, with a potential for 55 million, in addition to the country having the largest hydrological reserve in the world, which facilitates the implementation of irrigation methods.

Of the 63 works accepted according to the selection criteria, the most irrigated grasses are of the species, popularly known as mombasa grass. This species is originally from Africa, being marketed in Brazil since 1993 by EMBRAPA. It has long leaves, short and hard hairs that can reach up to 1.65 m in height, being a great alternative for soils with high fertility and with intense animal production systems (Factori *et al.,* 2017).

On the Springer search platform, it was not possible to download and analyze the data, since it has free publications and others not. No studies were found on the PubMed platform, and it was observed that this search platform is more suitable for searches in the health area.

The most frequent keywords found in the studies were: irrigation, evapotranspiration and climate change, as can be seen in the word cloud generated by the START program (Figure 8).

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Figure 8. Word clouds, demonstrating the most frequent words in order of size of published works on pasture irrigation.

Source: Start, 2024.

Regarding the most used type of irrigation, the central pivot and mesh sprinkler stand out. According to Silva, Vasconcelos, and Peres (2023), the first system adapts very well to different types of soils, topography, and climatic conditions, used mainly in large areas. It features a lateral line, equipped with sprinklers, which is suspended by towers mounted on wheels that rotate around a central fixed point.

In the second system, the lateral lines are interconnected in a mesh and buried in the ground and its sprinkler is exposed (EMBRAPA, 2005). It has a higher cost-benefit ratio and reduced labor costs, has low energy consumption, durability and adaptability to any type of terrain, which facilitates its implementation.

CONCLUSION

Over ten years, it was possible to observe the growth of work in the area of pasture irrigation, with Brazil being the country with the highest number of publications, followed by Australia and the United States.

In Brazil, the predominance of soil is due to pastures, which predominate the genus *Megathyrsus* and *Urocloa*, which are the main form of food for cattle, since the country is the second largest producer in the world.

Irrigation proves to be efficient where the lack of water resources is present, being a way to increase forage production, with the most irrigated species being *Megathyrsus maximum*, which is easy to adapt and has high productivity.

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