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Water Use in Australian Irrigated Agriculture—Sentiments of Twitter Users

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Abstract: The objective of this research was to examine consumer perceptions of water use in key Australian irrigated agriculture industries. Twitter data ('Tweets') from 2018 to 2022 related to water use/water footprints by/of the cotton, rice, and dairy industries were analyzed. The results revealed a higher prevalence of negative sentiments towards water use in Australian irrigated dairy, cotton, and rice industries compared to positive sentiments. The cotton industry received the most criticism. Our analysis showed that although the term "water footprint" was not widely used, the volume of water required for the production of irrigated cotton, dairy, and rice, or products derived from these commodities, is being circulated in tweets. However, the study also highlighted the presence of highly variable, incorrect, or outdated water footprint data in these tweets, indicating the unreliability of Twitter as an information source for consumers seeking to make sustainable consumption choices. This research offers valuable insights into consumer sentiments, benefiting stakeholders and policymakers in addressing public concerns and misinformation in the Australian irrigated agriculture sector.

Keywords: consumer; cotton; dairy; rice; water footprint

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1. Introduction

Water for irrigation is a critical input to maximize food, pasture, and fiber production in arid or semi-arid countries such as Australia, and irrigated agriculture is essential in maintaining the global supply of food [1]. Australian irrigated agriculture makes a significant contribution to the Australian economy (GVIAP $18.9 billion in 2020–2021, [2]), or nearly a third of the Australian agricultural sector's economic value. It manages to achieve this while utilizing less than 1% of the area of agricultural land available in Australia [2]. There have been significant improvements in water use efficiency and irrigation efficiency in Australia through innovations and improvements in irrigation infrastructure and technology, crop management, and genetics [3–6], meaning that Australian irrigated cotton and rice are among the most water-efficient in the world [7,8]. Further, many recent government- and industry-funded agricultural research and extension initiatives have been aimed at further improving agricultural water productivity [9–12]. Despite the relatively efficient use of water in Australian agricultural industries, water extractions for irrigation in Australia have been associated with negative environmental impacts such as loss of habitat for native flora and fauna [13–18], and calls have been made by politicians and in the media to change crops to those that are less water intensive or to cease water extractions completely to improve the ecological condition of rivers [19,20]. However, reducing the volume of water that is extracted for agriculture to reduce environmental impacts will be associated with trade-offs such as a decline in the productivity of existing cropping land (i.e., yields will decline). The supply of cropping land is constrained at a global scale and meeting the food, fiber, and biofuel needs of a growing population will increase the demand for additional cropping land, the creation of which is associated with a loss of biodiversity and the release of greenhouse gases to the atmosphere [21]. A decline in the productivity of existing cropping land by reducing the area irrigated would exacerbate this projected increase in demand for cropping land. Acknowledging trade-offs that occur with irrigated agriculture and also that no agricultural system will possess all attributes of sustainability, the increase in crop yields and more efficient use of existing agricultural land align with two key attributes of sustainable agricultural production as outlined by Hochman, Carberry [22]. Modelling the changes in Australian cotton production, Nguyen et al. [23] highlighted that the water impacts of Australian cotton lint production are influenced by indirect factors including changes to related crops at regional scales. Additionally, Xu et al. [24] emphasized the need to manage irrigation agriculture in a balanced way, considering the potential rebound effect where the expected water savings from improved efficiency may be offset by increased water use in other areas.

In Australia, over two-thirds of irrigated agriculture is located in the Murray–Darling Basin (MDB), which is a large area of interconnected rivers and lakes and is over 1,000,000 km^2 [25,26]. Access to water is regulated in the MDB with water allocated to each entitlement (i.e., a volume of water available to each user that possesses a right to access water for irrigation) on an annual basis determined by the water availability [27]. Increasing public scrutiny of the impacts of water extractions on the environment led to the development of the MDB plan to address the perceived imbalance in current water sharing arrangements between the environment and irrigation in Australia [27] by returning 2750 gigalitres (GL) of water to the environment [28]. The success of the plan in addressing the perceived imbalance is uncertain as the efficacy of the plan has been highly debated through several scientific papers since its inception [29–36].

Consumer awareness of the environmental impacts of their consumption has increased in recent years [37], and the perceived imbalance in water sharing arrangements and media attention on the irrigation sector, such as reports of water theft by some cotton growers in the MDB [38,39], may have contributed to this increase. The water footprint (WF), a method for quantifying water use embedded directly and indirectly in products/services, was developed to provide information that individuals, businesses, and governments can use to reduce their environmental impacts [40,41]. The WF of many agricultural commodities has been published in scientific journals [42–45] and has also been circulated in more publicly accessible media [46–49], highlighting the availability of water footprint data to consumers. However, there was a lack of research specifically examining consumer perception of water use in Australian irrigated agriculture industries, despite their crucial role in food, pasture, and fiber production. Prior research on consumer awareness of water footprints has primarily focused on traditional survey methods [50–53].

The use of social media has become one of the most popular digital activities worldwide and has increased in Australia and globally [54]. Further, social media has been successfully used to run campaigns to influence public opinion [55] and is utilized by environmental non-government organizations, government departments, and agricultural industries to advocate their respective agendas. Social media has provided a new source of data for researchers of various fields for understanding public perceptions about topics such as climate change and public health events [56–64]. More specifically, the microblogging service Twitter, which has 330 million monthly active users globally with 5.8 million from Australia [65], has attracted the attention of researchers because of the accessibility of the real-time, large-scale public data. Twitter users from diverse backgrounds communicate with each other and freely express their views and emotions using short text with other content (e.g., images, URL). This study aimed to address a significant literature gap in the field of consumer sentiments regarding water use in key Australian irrigated agriculture industries by utilizing Twitter data. This approach offered a novel perspective on how information about water footprints was disseminated and received by consumers in real-time, contributing to a more comprehensive understanding of the public perception surrounding sustainable water use. The study focused on the cotton, rice, and dairy industries because they are considered to be among the largest water consumers within irrigated agriculture in Australia and worldwide [26,66–70]. We seek to understand whether there are differences in the sentiments expressed on Twitter towards water use between the cotton, rice, and dairy industries in Australian irrigated agriculture.

2. Methodology

In this study, data were extracted from Twitter about the water footprints of cotton, dairy, and rice using a Twitter full-archive search of the application programming interface (API) with the Academic Research product track. Approval from Twitter was gained for Academic Research access that gives a complete history of public Twitter data at no cost for qualifying researchers. Consumer keys and authentication tokens were generated and used to connect to the full-archive search. The R package (R Version 4.1.3, [71]) academictwitterR [72] was used to extract tweets that contained specific search terms (Supplementary Table S1). Only primary twitter data that the users created themselves (i.e., not replies and retweets to other users' content) were collected, and the search was constrained to tweets from January 2018 to April 2022. This period covered opposing conditions of the 2019 drought of east coast Australia and the subsequent 2020–2022 La Nina event that resulted in record-high rainfalls being achieved. Tweets were limited to those written in English. The collected twitter data included the content and date of the tweet, the number of likes and retweets of the original post, and the number of followers of the tweet author. Liking and retweeting (sharing content without adding any text) a tweet by other users often show that they agree with the sentiment of the tweet author, and retweeting further disseminates the information in that tweet to new audiences.

An initial search was conducted, and irrelevant tweets that were not in line with our research questions or that were not about the irrigation of the crops/dairy (e.g., tweets mentioning cotton and rice water for makeup purposes, dairy/milk allergies, advertisements, webinar announcements) were removed from the dataset. Further, neutral tweets (i.e., those that did not express a positive or negative sentiment) and ambiguous tweets the expressed more than one sentiment were excluded. It was not possible to narrow the search to Australia since Twitter users are not required to geotag their posts or accounts. Among the posts which contained geographic information, we excluded the tweets written explicitly about water footprints of dairy, cotton, or rice in countries other than Australia. However, we included tweets that referred to technologies that improve the water footprint of production or tweets about the impacts of using water in other regions.

Thematic analysis was used to organize tweets into key themes on the production of each irrigated commodity. Thematic analysis was performed on the tweet text, and any hashtags, URL links, and/or images/videos shared with the texts were not considered in the thematic analysis. Tweets were categorized based on their primary message and classified as having a positive, neutral, or negative sentiment. Further, institutional users (i.e., twitter accounts that did not belong to an individual) were divided into different groups according to the user's brief description provided on their twitter account.

Data were not normally distributed, so a non-parametric test was used for further analysis. Significant differences between the independent variables (number of likes and retweets for negative and positive tweets) were assessed using the Mann–Whitney U test, while the correlation between two variables (between count of followers and count of likes and retweets for each tweet) was assessed using Spearman's rank correlation, and the influence of the dependent variables (use of hashtags, URL/visual content) on the independent variables (count of likes and retweets) was evaluated using the Kruskal–Wallis one-way ANOVA (GenStat 14th edition, VSN International Ltd., London, UK).

3. Results

3.1. Number of Tweets

The total number of tweets on cotton's water use was much larger compared to the total tweet count on water use of dairy and rice. The search terms and operators used for dairy, cotton, and rice generated 16,833, 61,472, and 14,095 tweets, respectively. The removal of irrelevant, duplicate, and neutral tweets left 697, 7857, and 452 tweets for dairy, cotton, and rice, respectively.

3.2. Tweet Sentiments

The number of tweets expressing a negative sentiment towards water use exceeded the number of positive tweets, with the most significant difference observed in the case of cotton, where there were eight times more negative tweets than positive ones (Figure 1). The primary topics of tweets with a negative attitude towards cotton water use were mainly related to the volume of water required to produce cotton, including comparisons with hemp, theft of water by irrigators, and maladministration of the MDB (Supplementary Table S2). For dairy, negative tweets were mainly related to high water use of daily milk compared to plant-based milk (Supplementary Table S3). Rice had the lowest number of total tweets (Figure 1), and the primary topic was that rice should not be grown in Australia due to it being water intensive.

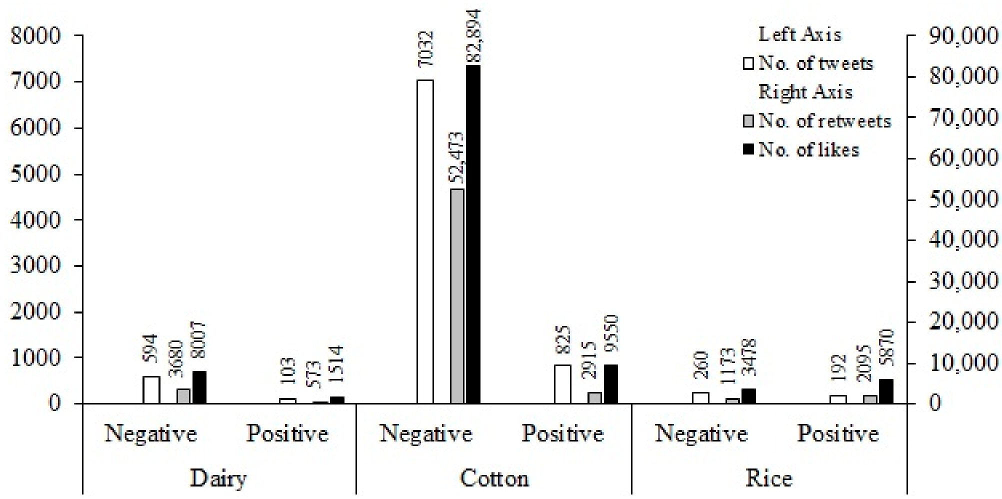

Figure 1. The number of tweets, the number of likes and retweets received for tweets with a negative or positive sentiment for dairy, cotton, and rice.

The primary topics of tweets that showed a positive attitude towards cotton were tweets where the cotton industry defended its water usage, tweets on the relative efficiency of Australian cotton, and tweets on water savings or projects that would result in water savings. For dairy, the primary topic for positive tweets was water sustainability efforts; and for rice, the primary topic was alternative irrigation practices to reduce water use in rice. (Supplementary Table S4).

3.3. Number of Likes and Retweets

The total number of likes and retweets for tweets with a negative sentiment were greater than the number of likes and retweets for tweets with a positive sentiment for dairy and cotton (Figure 1). Tweets on cotton water use had an average of 12 likes and 7 retweets per negative tweet and 6 likes and 3 retweets per positive tweet, respectively. Tweets on dairy had an average of 13 likes and 6 retweets per negative tweet and 15 likes and 5 retweets per positive tweet, respectively. Tweets on rice had an average of 13 likes and 4 retweets per negative tweet and 31 likes and 10 retweets per positive tweet, respectively.

For all three commodities, the distribution of number of retweets and likes was positively skewed for tweets with a positive or negative sentiment (Figure 2). The number of likes and retweets for tweets with a negative sentiment was significantly greater than the number of positive likes and retweets for cotton ($p < 0.001$, $p = 0.003$, respectively) and for rice ($p < 0.001$, $p = 0.001$, respectively). The number of retweets and likes between tweets with a negative and positive sentiment for dairy were not significantly different. Less than half of the total tweets included one or more hashtags (dairy—47%, cotton—36%, rice—36%). Most of the tweets shared URL links (dairy—69%, cotton—68% and rice—64%) or visual content, i.e., immediately viewable images or videos or YouTube links (dairy—15%, cotton—13% and rice—10%). We did not find any significant effect of the use of hashtags on the number of likes and retweets for dairy, cotton, or rice. When compared to the tweets with URL links or to the tweets with neither URL links nor visual content, the tweets with visual content received significantly more likes (dairy: $p = 0.006$, cotton: $p < 0.001$, rice: $p < 0.001$) and more retweets (cotton: $p < 0.001$, rice: $p = 0.004$). The number of followers of each tweet represents the reach of the tweet (access of the tweet to the followers). Rice-related tweets with a positive sentiment had a greater reach compared to dairy and cotton, where negative tweets had a greater reach.

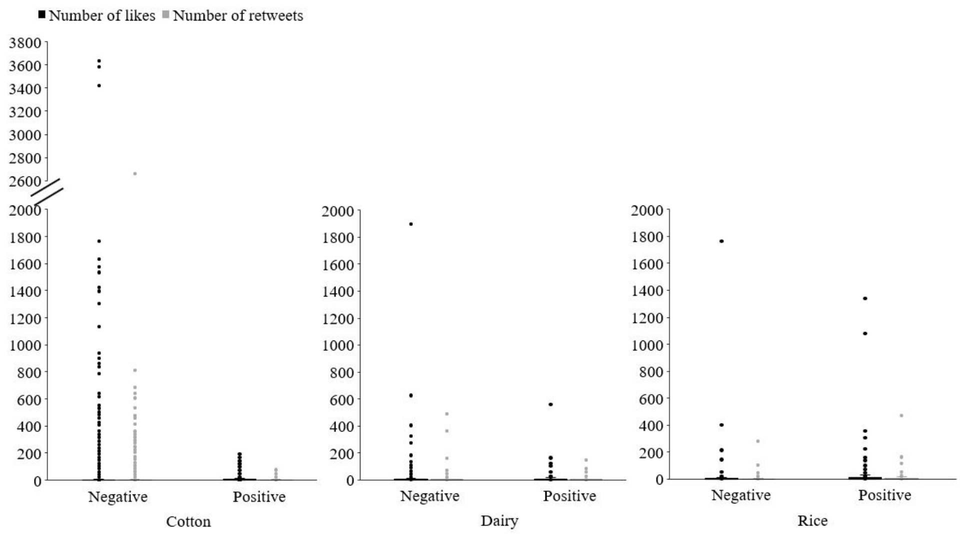

Figure 2. The distribution of the number of likes and retweets received for tweets with a negative or positive sentiment for dairy, cotton, and rice.

The number of followers were weakly correlated with the number of retweets and the number of likes for all tweets within each commodity (dairy: $r = 0.53$, $p < 0.001$; $r = 0.49$, $p < 0.001$, cotton: $r = 0.54$, $p < 0.001$; $r = 0.47$, $p < 0.001$, and rice: $r = 0.6$, $p < 0.001$; $r = 0.58$, $p < 0.001$).

3.4. Users

The majority of the collected tweets in this study were made by individual users (76% of cotton tweets, 72% of rice tweets, and 60% of dairy tweets). The individual user group includes personal twitter accounts that have no mention of a company/organization/group as well as the users that indicate they are an employee of a company/organization (and may or may not have disclaimers that their tweets/opinions are their own), for example, journalists' or senators' or research scientists' personal twitter accounts. In this study, the institutional users refer to the twitter accounts of a company, an organization, or a community group. The institutional users were grouped into different categories according to the user's brief introduction on their twitter accounts (Supplementary Figures S1–S3). For example, twitter accounts for news or television channels, newspapers, or magazines such as ABC News, Guardian Australia, The Conversation, and Ethical Consumer are grouped into the media unit. Twitter accounts related to fashion brands, clothing businesses, or home textiles are grouped into the clothing/textile group. Twitter accounts for non-government or non-profit organizations or community campaigns related to environment were grouped into the environmental group. Twitter accounts of research centers or research institutes including universities and government or non-government organizations such as Deakin Research, AgriFutures Australia, CIMMYT, CGIAR | Climate-smart agriculture, etc. were categorized as the research group. The commercial company group includes twitter accounts for manufacturing companies, suppliers, or retailers of products such as farm equipment, water storage, or water control products, wastewater treatment applications, for example, Cistermiser Ltd., MICROrganic Technologies, Woolworths SA, etc. The agriculture group includes twitter accounts related to agriculture, including AgTech companies, agriculture recruitment, farmers' communities or agriculture platforms such as Goanna Ag, Agricen Australia, National Farmers' Federation, Agri-Innovation, etc.

The top three user groups with a negative sentiment towards cotton water use were the media unit, environmental group, and clothing/textile/linen group, while the top three user groups with a positive sentiment were the cotton group (including Cotton Australia), media unit, and agriculture group (Supplementary Figure S1). The top three user groups with negative sentiment towards dairy water use were the vegan/pro-animal group, environmental group, and media unit, while the top three user groups with positive sentiment were dairy group (including Dairy Australia), irrigation group, and media unit (Supplementary Figure S2). Tweets made by the vegan/pro-animal group and media unit with negative sentiment received the highest number of likes and retweets. The top three user groups with negative sentiment towards rice water use were the media unit, environmental group, and agricultural group, while the top three user groups with positive sentiment were the media unit, rice group, and research group (Supplementary Figure S3). Tweets made by the media unit with positive sentiment received the highest number of likes and retweets.

3.5. Use of Water Footprints

There were a total of 1375 tweets that provided information on the water footprint of cotton production, expressed in different units. For example, some tweets expressed a water footprint for a given mass of cotton while others presented a water footprint for the cotton required to produce a specific garment (Supplementary Table S5). The commonly used figures included 2700 L for manufacturing a cotton t-shirt (n = 519), 20,000 L for producing a kilogram of cotton fiber (n = 137), and 6814 L for growing the cotton needed for a pair of jeans (n = 70). However, there was significant variation in the water footprint of cotton production or a cotton garment, with figures ranging from 1100 to 27,000 L for a cotton t-shirt, 1893 to 30,283 L for a pair of jeans, and 1214 to 29,000 L for a kilogram of cotton (Supplementary Table S5). Water used in the production of raw cotton was also expressed using alternative units such as the number of bathtubs or the number of years of drinking water, and these figures varied significantly among the tweets (Supplementary Table S6). The majority of tweets discussing the water footprint of dairy (n = 55) used a value of 628 L of water per liter of dairy milk (equivalent to 120 L of water for a 200 mL glass of dairy milk), while others used 1000, 1020, or 1050 L of water per liter of dairy milk (Supplementary Table S7). There were fewer tweets that provided numerical data on water usage for rice (Supplementary Table S8).

3.6. Inconsistent Boundaries

The boundary of the water footprint was also inconsistent between tweets, with the water footprint data for rice production referring to rice at the farm, milled rice, or cooked rice, and only six of the tweets actually referenced the type of rice the water footprint represented.

3.7. Tweet Numbers Were Dependent on External Events

Spikes in the number of tweets on cotton, dairy, and rice water use typically corresponded to external events that increased public attention on the topic. Figure 3 shows the number of positive and negative sentiment tweets for cotton, dairy, and rice from January 2018 to May 2022. For cotton, the percentage of negative sentiment was the largest in early 2019 (1187, 750, and 580 tweets in Jan, Feb, and Mar 2019 respectively). A large number of tweets posted in a month could be attributed to news events. For example, an article published in January 2019 "Photos reveal Queensland cotton farms full of water while Darling River runs dry" [73], the most shared news article throughout the year 2019, a push to ban cotton export [19,74,75], media release of Levi's new line of clothing made with hemp [76], mass fish deaths, and water theft accusations/charges. Cotton Australia and other users took to Twitter to share the cotton industry's response to allegations regarding the reduced flow in the lower Darling River caused by the drought in January 2019. The peaks in the negative sentiment in March and August 2018 were in line with the water buyback scandal in March 2018 and media release of Murray–Darling water funding fraud in August 2018.

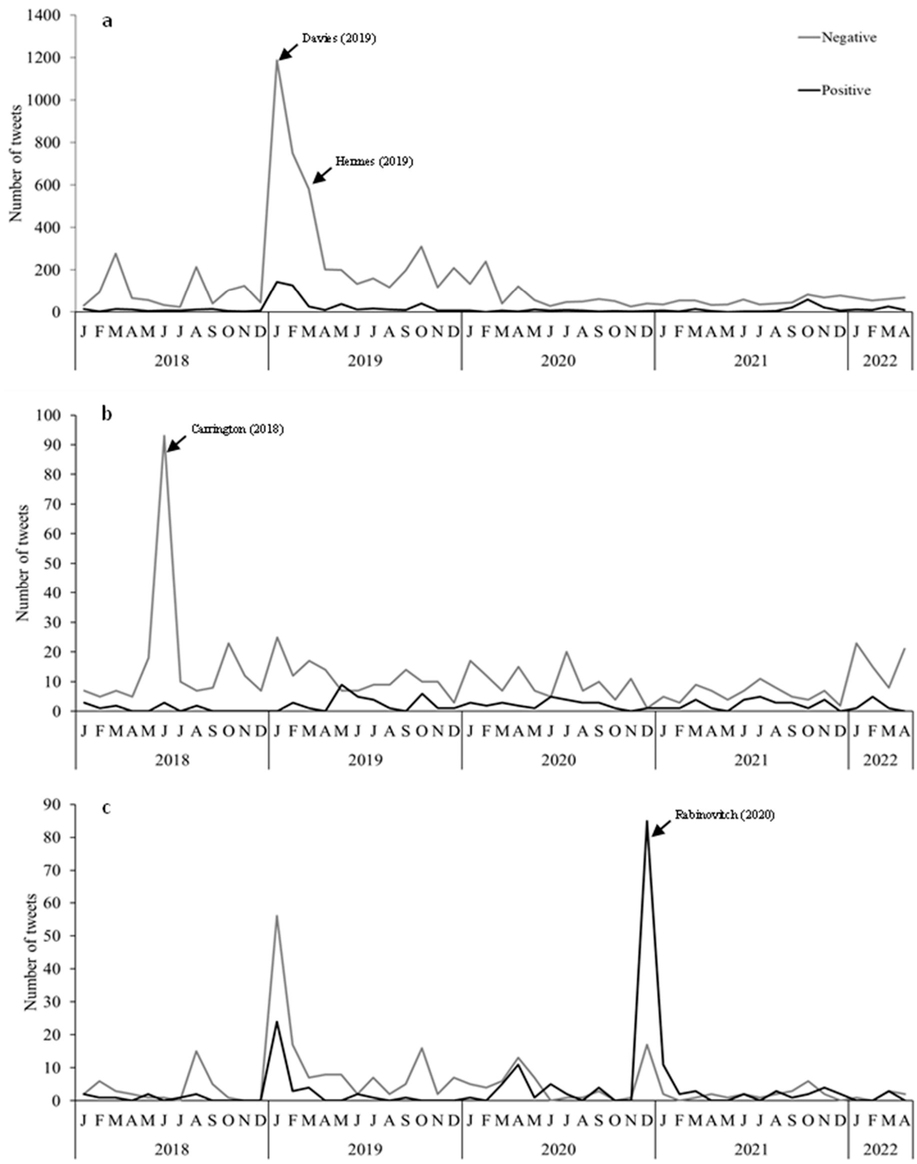

Figure 3. Temporal trends in the number of tweets with a negative or positive sentiment from Jan 2018 to May 2022 for (**a**) cotton, (**b**) dairy, and (**c**) rice. Arrows indicate the publication of key articles that related to the search topics.

The largest peak in the negative sentiment on dairy water use was found in June 2018, which was consistent with the media release on 31 May 2018, titled "Avoiding meat and dairy is 'single biggest way' to reduce your impact on Earth" [77]. Regarding tweets on rice water use, the percentage of positive tweets increased sharply in December 2020, consistent with the news event of drip irrigation developed by an Israeli company which was published in Reuters [78] and other news media during that period. The peak in the percentage of negative tweets on rice water use in January 2019 is consistent with the news events of mass fish death in Murray–Darling. The positive peak on rice water use in January 2019 (though smaller than the negative peak) coincides with an article published in January 2019 with positive views on cotton and rice in Australia: "Cotton and rice have an important place in the Murray Darling Basin" [79].

3.8. Citations in Tweets

Where a tweet cited an article, the most frequently cited source of information for all three industries was news media (Supplementary Figure S4).

4. Discussion

The water footprint concept has been gaining increased attention among businesses, researchers, and policy makers [80–83] at a time when the environmental impacts of choices is impacting consumer decisions [37] and the use of social media is increasing [54]. This analysis found that the term "water footprint" was rarely used to describe water consumption for the production of cotton, dairy, and rice in tweets. However, quoting a volume of water required to produce a particular product fulfills the criteria of a water footprint [41]. Hence, despite not using the term "water footprint", our research has identified that Twitter is used to communicate the water footprint of irrigated cotton, dairy, and rice, or products derived from these commodities, to consumers. The research has also demonstrated that more negative sentiments are expressed towards water use in the Australian irrigated dairy, cotton, and rice industries on Twitter than positive sentiments and that the cotton industry has received the most criticism. There have been reports of Australian consumers' growing consciousness regarding the negative social and environmental impacts of specific industries such as fast fashion and food, as well as the increasing popularity of eco-friendly clothing alternatives and the plant-based food market in Australia [84]. Nevertheless, Cooper et al. [85] found a limited number of environmental or sustainability-focused tweets compared to ethical and personal health considerations in their analysis of drivers for vegan food choice. The scope of this study did not include an exploration of the underlying factors or reasons contributing to the sentiments expressed in the tweets. Conducting follow-up surveys, interviews, or focus groups with consumers could help uncover the motivations, concerns, or experiences that drive their positive or negative attitudes towards water use in specific agricultural industries.

The Australian dairy, cotton, and rice industries all recognize the need to enhance the social license of their respective industries [86–88], and all three peak industry bodies have a Twitter presence. The relatively high proportion of tweets with a negative sentiment suggests that previous and existing Twitter strategies that aim to maintain or increase social license may not have been effective, especially for the dairy and cotton industries. Further, our analysis showed that news media was the most frequently cited source of information in tweets regarding all three industries. In 2022, the majority of Twitter users (59%) utilized the platform for accessing news content, and 51% of Twitter users stated that over half of their feed consists of news content [89]. The prominence of news media as a source of information in tweets has implications for policymakers and stakeholders, emphasizing the media's influential role in shaping public opinion and discourse. Policymakers can collaborate with news outlets to ensure accurate and balanced coverage, while stakeholders can engage with the media to communicate their perspectives effectively and recognize its impact on public perception and decision-making.

Wunderlich, Gatto [37] suggested that educating consumers to eliminate uncertainty in their understanding of the impacts of their choices would allow for better decisions to be made. Concerns have been raised about the water footprint concept and its usefulness in providing consumers with sufficient information on the sustainability of water use [90–96]. Our research showed that a total of 1480 tweets presented data on water requirements to consumers; however, we propose that the data presented to Twitter users is unlikely to eliminate uncertainty and lead to better decisions, and they could actually create confusion. For example, the products (e.g., raw cotton v a cotton t-shirt) for which data on water consumption were presented were not consistent for cotton, dairy, and rice (Supplementary Tables S5–S8), with cotton having a total of five products against which water use was reported. Further, in many instances, a qualitative unit (e.g., bathtubs, years of drinking water) of water was used to describe water consumption, and it could be argued that the purpose of tweets that use qualitative units is focused more on garnering an emotional response as opposed to providing robust figures to inform consumers.

A water footprint involves quantifying the consumption of three types of water: blue (surface water and groundwater used for irrigation), green (rain water captured by a crop), and grey water (water that is a byproduct of another process) [41]; however, the type of water included in a water footprint was not referred to by any tweet, positive or negative. This is important because not including all types of water in a calculation may be the reason for the large variation in results presented in the tweets. Social media is a mix of genuine and fabricated content posted by related individuals, groups, or organizations [97], and incorrect information can be presented by reputable organizations. For example, one tweet on water use in cotton from the official account of Greenpeace stated that it requires 27,000 L of water to produce a cotton t-shirt. This tweet received 173 likes and 224 retweets. This was despite a report by the Transformers Foundation and the International Cotton Advisory Committee (ICAC) demonstrating that widely-circulated figures of cotton's water footprint in popular media and websites were inaccurate and outdated [98,99]. An indication of difference in reach of accurate v inaccurate data is demonstrated by fewer tweets referencing these reports than those tweets referencing inaccurate figures for a cotton water footprint. In addition, the Transformers Foundation [99] also debunked the claim that organic cotton used less water than conventional cotton, yet there were only five tweets that reported this finding compared to the 275 tweets that presented a favorable view of organic cotton and water use.

These issues strongly suggest that Twitter is an unreliable source of information for consumers who aim to improve the sustainability of their choices. Although we were not able to discern their presence in the present study, the unreliability of Twitter as a source of information for consumers was also highlighted by research that has shown that Twitter is prone to echo chambers (i.e., tendency to discuss issues only with other like-minded people) and confirmation bias (e.g., reinforcing one's attitudes and beliefs) [100–105]. Future work should identify the role of these important concepts in determining consumer attitudes to sustainability of water used in Australian irrigated agriculture.

It is important to note that this research focused specifically on the cotton, rice, and dairy industries in Australian irrigated agriculture. Future research can consider including other sectors and industries relevant to water usage in agriculture, such as fruit and vegetable production or livestock farming. By broadening the analysis, a more comprehensive understanding of sentiments related to water use in the agricultural sector can be achieved. In addition, future research could expand the analysis to include data from other social media platforms, such as Facebook or Instagram, enabling a more comprehensive understanding of the range of sentiments related to water usage in Australian irrigated agriculture. Lastly, our research analysis was restricted to English-language tweets, which may introduce language bias. Future studies can explore multilingual analysis by incorporating tweets in languages other than English to provide a more inclusive representation of consumer sentiments regarding water use in irrigated agriculture.

5. Conclusions

By analyzing Twitter data, we gained insights into the prevalent negative sentiments expressed towards water use in key Australian irrigated agriculture industries, namely cotton, rice, and dairy. This finding provides empirical evidence to support existing knowledge on the environmental concerns associated with irrigation practices. Our research has demonstrated that Twitter is used to inform consumers of the water footprint of Australian irrigated cotton, dairy, and rice production, even though the phrase "water footprint" itself is not widely used. This indicates that consumers are aware of the water-intensive nature of these industries and are circulating information related to water use through Twitter. This understanding is crucial for stakeholders and policymakers seeking to enhance public knowledge and engagement in sustainable water use practices. However, our research has also demonstrated that Twitter is an unreliable source of information for consumers who aim to improve the sustainability of their choices. This is due to incorrect values for water footprints being used in tweets and the unit used for a water footprint being inconsistent within a single commodity. This critical assessment addresses a gap in the literature by providing insights into the potential pitfalls and inaccuracies that can arise from social media platforms such as Twitter, emphasizing the need for careful consideration and validation of information when it comes to sustainable consumption choices.

In conclusion, this study provides valuable insights into consumer sentiments towards water use in Australian irrigated agriculture industries. This knowledge can assist policymakers, researchers, and industry professionals in understanding public concerns and assist the Australian irrigated agriculture sector in developing strategies to address misinformation on social media.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/w15152713/s1. Supplementary Table S1: Search terms used in study; Supplementary Table S2: The number of tweets, likes and retweets for each category of negative or positive tweets for cotton; Supplementary Table S3: The number of tweets, likes and retweets for each category of negative or positive tweets for dairy; Supplementary Table S4: The number of tweets, likes and retweets for each category of negative or positive tweets for rice; Supplementary Figure S1: Number of twitter accounts (not the individual users) grouped in different categories and the number of likes and retweets received by their tweets on cotton water use; Supplementary Figure S2: Number of twitter accounts (not the individual users) grouped in different categories and the number of likes and retweets received by their tweets on dairy water use; Supplementary Figure S3: Number of twitter accounts (not the individual users) grouped in different categories and the number of likes and retweets received by their tweets on rice water use; Supplementary Table S5: Liters (or gallons where specified) of water required to produce various cotton products, including raw cotton, presented in tweets; Supplementary Table S6: Cotton water usage data presented as the number of bathtubs or the number of years of drinking water; Supplementary Table S7: Reported data on dairy water use; Supplementary Table S8: Reported data on rice water use; Supplementary Figure S4: The most frequently referenced domains (>1%) in tweets on (a) cotton water use, (b) dairy water use, and (c) rice water use.

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