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# Agriculture and the Consumption of Water

Dienifer Calegari Leopoldino Guimarães[1], and Selma Clara de Lima[2]

*1. Universidade Federal do Espírito Santo, Brazil*

*2. FAESA and Civil Engineer, MULTIVIX, Brazil*

**Abstract:** This study has the purpose to present the impact of agriculture on the consumption of water as an essential source to the productivity of agrobusiness. The research was made of a bibliographic research, using as reference relevant sources as scientific magazines and digital reports of global organizations that support researches and diagnostics about the themes of agriculture and water. The results show that agriculture is dependent on the availability of water, in which irrigation is the main factor of high consumption and productivity. However, in conclusion, this economic activity still lacks advances in technology, legislation and environmental awareness.

**Key words:** hydric resources, water, agrobusiness, consumption

## 1. Introduction

The consumption of fresh water has increased since the last century and continues to grow at an 1% rate per year due to population growth, economic development and changes in consumption patterns. Many regions face the economic scarcity of water: it is physically available, however there isn't the necessary infrastructure for access. This in a future in which the prevision is that the consumption of water will increase in 25% until 2030.

The data presented on the Hydric Resources Development Report show that the world might face a hydric deficit of 40% by 2030 also that concrete measures and solutions should be guided by integrated actions between governments, the private sector, the community and NGOs, especially through preventive and corrective actions and that would ensure the exchange of knowledge and expertise in the Management field with the purpose of assuring and preserving the hydric resources and decreasing waste regarding the utilization of water [8].

**Corresponding author:** Diênifer Calegari Leopoldino Guimarães, Master; research areas: sanitation and civil engineering. E-mail: dicalegari@gmail.com.

The supply chains in agriculture and agroindustries have a growing impact on the natural resources in Brazil. Agricultural production demands a great quantity of water and the efficiency of this use is relevant to the productivity. Technology and management of hydric resources can contribute avoiding waste and the inadequate utilization of this fundamental asset because water has become an object of attention given the different impacts and disputes (most of the times non-explicit) related to the mercantilization of fresh waters, that involve the maintenance of ecosystems, food agriculture and exportation agriculture, the urban sector and the industrial sector and the need to guarantee the water security of the population [9].

According to the National Counsel of Food and Nutrition Security [5], when the increase on the volume of Brazilian exportations is analyzed, regarding rice, soy, meat and sugar and consequently, it is found out that there is an increase of the volume of water intrinsic to this production. In conclusion, it is necessary to think about the possible environmental impacts that the exportation of primary products and semi-manufactured could have been having on the hydric resources. Considering water as a commodity

(since 1992), that is, a merchandise, it started to appear alerts to the possible valuation of this renewable natural resource. Moreover, the concept of embedded water was created, referring to the quantity of water necessary to the production of a commodity, and it was replaced by the term virtual water, immediately accepted and used by specialists.

The world virtual water flow divides the globe in exporter and importer countries. Some countries and regions assume a central role in this balance and stand out for their position as exporters. Those are: Brazil, North America, Central America and Southeast Asia. India is considered the fifth biggest virtual water exporter in the world, this in part because of its expressive vegetable products exportation.

The necessity of a change in behavior regarding the use of hydric resources is urgent. Moraes and Jordão [10] affirmed that as the population and economic activities increase, the water demand also increases.

## 2. Materials and Methods

A bibliographic research was made about the theme on scientific magazines available online, digital books and online reports of known world organizations, gathering and comparing different data found on the sources and listing the main factors in where agriculture has an impact in the consumption of water, also how its relation with economy and proposing sustainable solutions on the conservation of water through an environmentally conscious agriculture.

## 3. Results and Discussion

According to CONSEA [5], the agricultural sector, including irrigation and cattle raising is the main consumer of water. It makes up 69% of the yearly water use in the world. On the other hand, the industry, including energy generation makes up 19% of the water use, and the domestic use 12% (Fig. 1). The rapid urbanization and the expansion of the cities' water systems and water supply and sanitation also contribute to the growing demand.

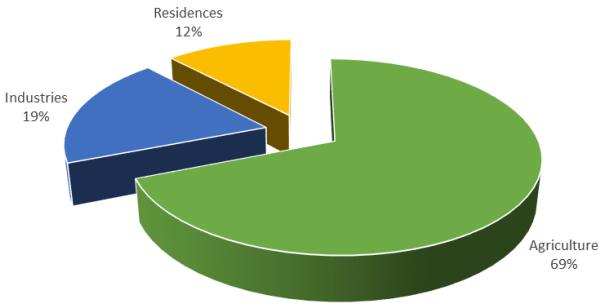


**Fig. 1 Industries, residences, agriculture.**

According to the United Nations Educational, Scientific and Cultural Organization (UNESCO) if the degradation of the natural environment and the unsustainable pressure on the hydric sources in the world continue in the current rate, 45% of the Gross Domestic Product (GDP) in the world and 40% of the production of grains will be at risk by 2050 [4].

The modernization in agriculture uses core elements for the sustainable expansion of the tillage process in the hydric resources capitation and that generates an increase in productivity. Even so, a large amount of the water used for agriculture is lost during transport or the outflow that returns to the environment through the leakage on the Fields and this can also affect the fertility of the soil. Nevertheless, these are opportunities that should be explored and solved by applying new Technologies and adequate irrigation strategies.

In Brazil, irrigation started in the beginning of the twentieth century for the rice production in Rio Grande do Sul. The intensification of the activity in other regions of the country occurred during the 1970s and 1980s. The expansion of agriculture in the country was only possible due to the employment of irrigation, especially in the regions that are affected by continuous scarcity of the hydric resources, as in the Brazilian semiarid, that needs constant irrigation. However, in regions affected by the lack of water in specific periods of the year, as in the central region of the country, additional irrigation practices were necessary during the drought months [6].

Modern irrigation systems are present in about 20% of all cultivated area in the world. This is a reflex of the little access to technological innovations in underdeveloped countries. In contrast, even in low quantity, the agricultural production using an irrigated system makes up 40% of the total of foods produced in the world. This because the productivity in an irrigated system is at least 2.3 times bigger than in a non-irrigated system. If there wasn't the irrigated system, it would be necessary to increase the planted area in at least 20% to produce the same number of foods that are produced nowadays. After that, the environmental importance of this production system is evident.

The Food and Agriculture Organization (FAO) estimates that irrigated land in developing countries will increase in 34% by 2030. Even with the implementation of this technology and the betterment of practices and management of irrigation, the consumption of water will have an increase of 14% [9].

According to the National Agency of Waters [1], in Brazil irrigation is responsible for the biggest consumption of water, where approximately 29.6 million hectares of land are irrigated. Estimates show that approximately 1000 to 3000 $m^3$ of water to each ton of harvested grains are necessary, or yet, 1.285 liters of water are necessary to produce a kilo of soy. Of equal importance, the plantations that most use irrigation are sugarcane, soy, rice, corn, beans, oranges, coffee, onions, watermelon, cotton and wheat. Not to mention the exorbitant amount of water used in the production of meat.

Still in accordance to ANA [1], Brazil exports about 112 trillion liters of potable water per year through beef, soy, sugar, coffee and other agricultural products that have developed countries as the main destination. The water that is exported intrinsically with the products is called "virtual water". Virtual water is the amount of water employed in the production of a product in a certain place, destined to another place, in which a virtual flux between the countries is created.

In the report of the Agriculture and Livestock Confederation of Brazil [3], it informs that agrobusiness has gained recognition for the contribution on economic growth in Brazil. In 2019, the sum of goods and services generated in agrobusiness makes up R$ 1.55 trillion or 21.4% of the Brazilian GDP and internationally represents 43% of exportation. This resulted in the record expansion of 24.31% in the Gross Domestic Product (GDP) of agrobusiness.

An alternative to reduce water consumption and waste in agriculture would be using drip irrigation. This method utilizes a minimum quantity of water that is poured over the soil in the form of drops in a more regulated and economic manner. By using this form of irrigation, it would be possible to save up to 50% of the water currently used. Another economic method is the micro water sprinkler, in which small water sprinklers are used and are responsible for the distribution of water, however, this method is less efficient in water economy than the drip irrigation method. Furthermore, both methods are unfeasible in large extensions of land, that could save water choosing the acquisition of equipments to control the level of irrigation according to the necessity of the soil and of the plantations, according to the weather conditions, geotechnology could also be used, for example a drone to read the plantation conditions [3].

A lower consumption of water could also be obtained by gene improvement. Even though the drought tolerance mechanisms in plants are difficult to manipulate and are part of complex physiological processes, researchers from the Federal University of Alagoas (UFAL) developed a new kind of sugarcane that is drought tolerant and is recommended to seeding in extensive lands in the Brazilian northeast [11]. Besides that, the identification of genes that could be used to the betterment of the efficiency in photosynthesis is also an interesting strategy to the development of drought tolerant plants. High

photosynthetic efficiency plants produce more without the necessity of increasing the planted area [6].

With the purpose of recommending actions and solutions to reduce the water waste on agriculture and promote economic growth, studies and researches propose:

- Knowing correct practices to the reduction of the use of water in agriculture in order to establish new strategies foreseeing sustainable actions.
- Technical and financial incentives from the government or from the private sector for the conservation of strategical areas and the environment. For example, ANA's Water Production Program.
- Financial aid to small farmers during drought or water crisis times that generate water scarcity when the irrigation is suspended, similar to the Fishing Fund.
- Investments in technology and internet of things (IoT) to manage water use.
- Environmental education, raising awareness to the environmental issue embodying the social, political, economic, cultural, ecological and ethical dimensions to small and big farmers, as to build social values, knowledge, abilities, attitudes and competencies set towards the conservation of the environment, a common use good for the people, essential to a healthy life quality and its sustainability, as establishes the Law 9.795/99 about the National Policy of Environmental Education.

Irrigation systems when adequately employed produce benefits to the environment, to farmers and consumers because this technology increases productivity, reduces unit costs and improves the use of supplies and equipments.

In addition to the employment of new technologies it is important to raise awareness to the correct tillage process, in which the crops should be adequate to the location and capable to obtain the maximum advantage from the water available in the region.

Next, to know and understand the environmental legislations that have guidelines for protection, improvement and recuperation of environmental quality in Brazil. For example, the Law 9.433/97 [2] that established the National Policy of Hydric Resources and the creation of the National System of Hydric Resources Management elaborated the National Plan of Hydric Resources.

Nevertheless, these proposals show benefits in producing more foods with bigger quality, regarding the costs. It is relevant and auspicious to approach these important themes, as the discussion for the construction and the approval of water dams, in which it is difficult to have a consensus between agrobusiness and environmentalists.

The awareness in the use of water and its relation to agrobusiness should be seen by companies as something fundamental to the survival of business, as well as a differential that could guarantee competitivity and visibility to the companies. The solution for the problematic of water isn't necessarily and exclusively in the public campaigns made by the government nor in the creation of a rigid legislation or punitive oversight. The path to the promotion of economy and management of hydric resources could be in the binomial science and education [7].

## 4. Conclusions

Regarding agricultural production, the use of water has always been a matter of great importance in the cultivation of any plants. Therefore, there is the necessity of increasing the investments in technologies, geotechnologies, biotechnologies and hydric infrastructures that would be capable of meeting the demands of the plantation without wasting this resource, added to other efforts, could collaborate in a significant way to the economy of water in agriculture and also to face the challenges that scarcity and waste can cause in the agrobusiness.

It is important to remember that all irrigation systems must be authorized by the government and must be aligned with the rational use of water, the legal demands and the management instruments. It should prioritize the sustainability of the activity, the increase on the efficiency and consequently the reduction of waste.

The discussion about how to manage the role of a resource that is indispensable to production (water) with the issues of scarcity and preservation for the continuity of said production, which is threatened by the excessive use and lack of maintenance of the hydric resources.

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