

## Technology and Agribusiness – The Ethical Search for Increase Food Production

Lúcio Cândido de Oliveira Júnior<sup>1</sup>, June Faria Scherrer Menezes<sup>2</sup>, Rildo Mourão Ferreira<sup>3</sup>

<sup>1</sup>Mestrando em Direito do Agronegócio e Desenvolvimento pela Universidade de Rio Verde-GO. Especialista em Direito Público pela Pontifícia Universidade Católica de Goiás - PUC-GO. Graduado pela Faculdade de Direito de Franca-SP. Promotor de Justiça do Ministério Público do Estado de Goiás.

Email: luciomestrado@hotmail.com

<sup>2</sup>Doutora em Fitotecnia (Produção Vegetal) pela Universidade Federal de Viçosa. Mestra em Fitotecnia (Produção Vegetal) pela Universidade Federal de Viçosa. Professora titular da Faculdade de Agronomia na área de Nutrição de Plantas da Universidade de Rio Verde - UniRV. Docente permanente dos programas de Pós-Graduação Stricto Sensu em Produção Vegetal e Direito do Agronegócio e Desenvolvimento da Universidade de Rio Verde – UniRV.

Email: june@unirv.edu.br

<sup>3</sup>Pós-Doutor em Desenvolvimento Sustentável pela UnB. Doutor em Ciências Sociais pela PUC/SP. Mestre em Direito Empresarial pela Universidade de Franca. Pós-Graduado em Direito das Relações do Trabalho pela Universidade Mogi das Cruzes. Professor Titular da Faculdade de Direito da UniRV. Professor Titular do Mestrado em Direito do Agronegócio e Desenvolvimento da UniRV. Membro do Grupo de Pesquisa – Direito, Agronegócio e Sustentabilidade – UniRV, certificado pelo CNPq.

E-mail: rildo.mourao@unirv.edu.br.

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**Keywords—** Agribusiness, Brazil,  
Technology, Sustainability.

**Abstract—** Man found in agriculture an effective way to satisfy hunger and produce wealth, however, such implementation came at the expense of the health of the natural environment, directly impacting the natural cycle of seasons and climates and thus adversely affecting the entire planet earth. The problem of the present research lies in presenting techniques that may represent a common denominator between producing more and with quality, using less soil, concomitantly meeting the needs indicated in the 2030 agenda of the United Nations Organizations. With the advancement of research in the agribusiness sector, as well as the introduction of technology in agriculture, there is a potential means to find a balance between producing and protecting the natural environment. In this way, the present study is justified because the balance between producing and repairing the environment is the key to maintaining the planet for the next generations, in this sense, academic production is necessary to discuss techniques that bring producers, researcher and society in general. To this end, the methodology used was qualitative bibliographic research, in which books, scientific articles, as well as content available on virtual channels of various bodies that deal with the theme were used. In the end, it was possible to verify that the indiscriminate use of soil and agricultural inputs imply the depletion of natural resources, however, the implementation of technology in food production represents the way to sustainable production, preserving and repairing the environment.

## I. INTRODUCTION

Man and the environment have always maintained the relationship of interdependence and coexistence. For the primitive human being, nature was the provider of food and from where they manifested divinities, through natural phenomena.

With the discovery of soil preparation tools, man was no longer dependent on hunting, finding another way of subsistence in the natural environment. What was dependence on nature becomes domination of the former in relation to nature.

And, as suggested by Suzana Albornoz<sup>1</sup>, a cycle of consumption and environmental degradation begins, as “By developing agriculture, human ingenuity already disturbs the balance of nature. Discovering in planting a new source of food for themselves and their children, men multiply.” In this sense, it appears that the availability of food directly impacts the multiplication of the human race, and the former impacts it.

In this cycle suggested by the illustrious author, the calculations that involve food production and restoration of the environment are not always mathematical, because in practice what is seen is that “Numerical expansion leads to conquering new areas of forest for cultivation. As it takes a long time to restore a strip of forest to full cultivation capacity, the jungle is being destroyed and transformed into undergrowth or pasture land.”<sup>1</sup>

With the advent of the Industrial Revolution, man, delighted and concerned with the need to increase the mechanical production of goods, relegated the environment to the second plan of priorities. In this same understanding, Franco, Druck and Seligman-Silva<sup>2</sup> mention that, in addition to environmental degradation, human health was seriously affected in this period.

The increase in the world population requires public policies to be implemented in order to prepare environments for the impacts that will arise. According to the Department of Economic and Social Affairs of the United Nations, the population projection for the year 2025 is 8,184,437 billion people, and for 2050, 9,735,034 billion people<sup>3</sup>.

Such population demand will generate a need to increase production systems, especially in the food sector (raw material and final product), which, in turn, will impact the use of natural resources, with significant impacts on the environment.

In this area, agribusiness presents itself as the main protagonist, having to reconcile the increase in production with respect for the environment, conforming, therefore, to the concept of sustainability. The challenge, and this is the

objective of the present work, is to draw attention to the struggle of agribusiness to develop an increase in sustainable production, in accordance with the needs indicated in the 2030 agenda of the United Nations Organizations<sup>4</sup>.

The problem lies in verifying the balance between exploring, caring for and protecting the environment during the stages of food production, since agribusiness has to make use of resources, which can often affect the environment in some way. environment. So, the desired ethics will be on how to increase production so that the impacts generated by the activity are mitigated and/or repaired in a satisfactory way.

In the search for a solution to the problem, the work will be developed in 02 stages. In the first one, basic concepts about the presented theme will be discussed. Afterwards, technologies introduced in production will be indicated, which seek to mitigate environmental damage and reduce resource consumption and CO<sub>2</sub> emissions into the atmosphere.

At the end, the work presents the conclusions reached and their collaboration. It is noteworthy that the methodology used was qualitative bibliographic research, which used books, scientific articles, as well as content available on virtual channels of various bodies dealing with the theme.

## II. ENVIRONMENT, ECOLOGY, SUSTAINABILITY AND AGRIBUSINESS

### 2.1 Environment

The concept of the environment is not easily found in doctrine. Because it is constantly changing, the expression is “more easily intuited than definable, due to the richness and complexity it contains”<sup>5</sup>.

It is argued that the expression environment, used in Brazil, brings redundancy, since both terms, environment and environment, would be the same thing, in addition to clarifying the theme Edis Milaré<sup>5</sup> brings important notes, for the author:

Both the word milieu and the word environment have different connotations, whether in scientific or vulgar language. neither of these terms has a univocal meaning (having a unique meaning), but both are equivocal (same word with different meanings). Medium can mean? Arithmetically, half of an integer; a given physical or social context; a resource or input to achieve or produce something. Environment can represent a geographic or

social, physical or psychological, natural or artificial space<sup>5</sup>.

Despite the academic discussion about the expression, and considering that the Federal Constitution itself uses it, it is certain that the environment can be seen in several aspects: natural environment, work environment, artificial environment etc., and, for the purpose of the present study, only that first aspect will be considered.

Along with the clarification highlighted above, the environment is conceptualized as the “sum total of the surrounding external conditions within which an organism, a condition, a community or an object exists. The environment is not a unique term; organisms can be part of another organism's environment.”<sup>6</sup>.

Considering these aspects, it is worth highlighting the understanding brought by the legal text, such as by Law No. 6,938, of August 31, 1981, which provides for the National Environmental Policy, its purposes and mechanisms of formulation and application, whose article 3, item I, defines the environment as “the set of conditions, laws, influences and interactions of a physical, chemical and biological order, which allows, shelters and governs life in all its forms”<sup>7</sup>.

Also, in the same diploma, in article 2, item I, because it is for collective use, it raises the environment to the condition of Public patrimony.

## 2.2 Ecology

According to Gilge and Prestes<sup>8</sup>, the term “oecologie”, which was translated into Portuguese as “ecology”, was coined by Ernst Haeckel in 1866. The excerpt that presents the term is a footnote:

By expanding the concept of Biology in this broad and understandable scope, we close the narrow and limited sense in which Biology is often (especially in entomology) confused with Ecology, [...] with the way organisms relate to each other. and with the external environment etc.<sup>9</sup>.

Therefore, ecology (“oikos” and “logos” = house and study = study of the house of living beings), is understood as the science that studies the relationships of living beings with each other and with the environment.

More than a science, from the 1960s onwards, with the pacifist movements, ecology began to gain a political bias, with a concern, especially among young people, with the environmental quality that would be left for other generations.

Given the concern with the theme, in 1972 the Stockholm Conference was the starting point for the race

to preserve the environment, since it was the first worldwide mobilization for this purpose.

From there, global ecological thinking developed more vigorously, causing the United Nations to create the United Nations Environment Program.

Later, in 1992, the realization of ECO-92 in Rio de Janeiro culminated in the creation of Agenda 21, a document used as an instrument that guides strategies and planning for the development of sustainable societies regardless of their geographical bases, in this sense the merit of the document is in the concern to reconcile both environmental protection and economic efficiency, whose practices reach the whole of society as a form of social justice, through Agenda 21 s, the term “ecology” was consolidated at a global level.

## 2.3 Sustainability

Boff<sup>10</sup> teaches that, in 1560, in the German province of Saxony, the word *Nachhaltigkeit* appeared, which translated from German means sustainability. The term came about because of the residents' concern regarding the use of forests, so that, using them rationally, they would gain time for regeneration, and, in this way, there would always be wood.

If it is necessary to explore, this exploitation cannot go to the extreme of using resources until they are completely exhausted, so that future generations are deprived of the use, enjoyment and fruition of these same resources.

The vision on production and on the man who produces and for whom it is produced gains a new vision. It is not enough for the producer to simply produce at any cost. It is necessary that, in the face of this awareness of preservation, production uses natural resources in order to allow its renewal. What's more, this production guarantees the renewal of what was extracted from the environment. And more, that seeks to improve the quality of life and narrow the social distance between people.

The concept of sustainability, introduced by John Elkington, in the 1990s, in his book **Sustainability** – cannibals with a knife and fork, then, is based on three foundations, namely: environmental concern, financial concern and social concern<sup>11</sup>.

Sustainable development, which is understood by the United Nations as “development capable of meeting the needs of the present generation without compromising the ability to meet the needs of future generations.”<sup>12</sup>.

In 2015, representatives from 193 countries signed a document called - Agenda 2030, in which they agreed on measures to promote sustainable development until 2045. The plan has 17 objectives and 169 targets for eradicating

poverty and improving quality of life. to all people on the planet.

#### 2.4 Agribusiness

The term agribusiness was created by John Herbert Davis and Ray Allan Goldberg, and is found in the work “A concept os agribusiness”, which Caio Pompeia<sup>13</sup> translated as:

[...] The sum of all farm operations, plus the manufacture and distribution of all agricultural production inputs provided by the business, plus the total of operations performed in connection with the handling, storage, processing and distribution of commodities agricultural. In short, agribusiness refers to the sum total of all operations involved in the production and distribution of food and fiber<sup>13</sup>.

More than the simple activity carried out within the rural property, agribusiness encompasses all activity prior to agricultural production, involving the machinery and input industry. Also, after production, agro involves the storage, processing and exportation of the product.

According to a technical statement from the Confederation of Agriculture and Livestock of Brazil (CAGED), the agribusiness sector generated, in the first half of 2021, about 151,252, and, if considered “in the accumulated of the first half of 2020, only Agriculture recorded net creation number of jobs (62,419), all other sectors of the economy lost jobs in the period.”<sup>14</sup>. Thus, it is observed that the sector absorbs 1 in 3 Brazilian workers.

Compared to 2019, exports of Brazilian products in 2020 suffered a considerable drop. However, the agricultural sector, on the other hand, grew by 6.0%, with values totaling US\$ 45.27 billion, with special emphasis on soybeans (10.5%) and raw cotton (23.1%)<sup>15</sup>.

These data demonstrate the importance of the sector in the Brazilian economy and also the prominent role of agribusiness in food production worldwide. According to the Food and Agriculture Organization of the United Nations (FAO), about 690 million people worldwide are hungry, representing 8.9% of the world's population<sup>15</sup>.

Faced with this sad situation, the role of the Brazilian agricultural sector is of considerable importance, since, standing out as the largest producer of food on a global scale, it must be the protagonist of the attempt to reduce inequalities, reducing poverty, eradicating hunger, these goals delimited by the 2030 Agenda.

### III. AGRIBUSINESS SUSTAINABILITY TECHNOLOGIES

In the 1960s and 1970s, small farmers from southern Brazil migrated to the Brazilian Midwest in search of larger properties that could provide greater agricultural productivity, a fact that coincides with the growth of the biotechnology industry, and with genetic manipulation. of plants and living organisms<sup>16</sup>.

In the same period, as mentioned by Rodolfo F. Alves Pena, “the high mechanization and expansion of the agricultural frontier allowed the advancement of agriculture and livestock, which, on the one hand, increased the country's productivity in the countryside, but, on the other hand, contributed to the remarkable deforestation of the original vegetation”<sup>17</sup>. It was the so-called “green revolution”, which incorporated new technologies into production, from planting to harvesting<sup>18</sup>.

For Wandell Seixas<sup>19</sup>, the development of agribusiness in Goiás is mainly due to the soybean crop, which is the main commodity produced in the state which, in 2020, produced 13.7 million tons, making it the 4th largest Brazilian producer, responsible for 10.1% of all national production.

Considering that the soil of the cerrado region is oxisols, has high acidity, is poor in essential nutrients and has high aluminum toxicity, the development of soybean cultivation, in particular, was only possible due to the use of technologies made available. from the producer. The acidity, for example, was attenuated with the application of limestone (liming), and the lack of nutrients, with the use of targeted fertilization<sup>20</sup>.

Several technologies used enabled agricultural advancement in the cerrado. Some, which I refute to be the most important, will be dealt with separately below.

#### 3.1 No-Till

Of all the technologies used in Brazilian and global agribusiness, none was as impactful and as conservationist as the no-tillage system. Used in England and the United States since 1950, this technique arrived in Brazil only in 1970<sup>21</sup>.

The direct sowing system was introduced to Brazil by farmers from the north of Paraná, where it presented satisfactory results, so much so that, until the present day, it is used in about 80% (eighty) percent in the production of agricultural commodities in Brazil<sup>22</sup>.

The no-tillage technique basically consists of sowing under the straw left by the previous crop, without moving the soil through plowing, harrowing or scarification. In the same sense, Paulino Motter and Herlon Goelzer de



Almeida, explain that “the term “no till” originates from the concept of “no till”, which in English means precisely the practice of cultivation inserted directly into the land, without the need to turn the soil”<sup>21</sup>.

The no-tillage system, due to the dry cover on the soil, avoids the action of water, preventing the appearance of erosive systems; retains soil moisture for a longer time, bringing less suffering to crops in times of prolonged drought; improves soil quality compared to conventional planting<sup>21</sup>.

Still, and the most important of the benefits brought by the no-tillage system, is the control of CO<sub>2</sub> emission into the atmosphere, which directly contributes to the prevention of the increase in global temperature, one of the Brazilian commitments signed at COP15 – Copenhagen, Denmark .

Cordeiro et al demonstrate that:

The accumulation of SOM in the No-tillage System (SPD) and, consequently, its potential for CO<sub>2</sub> removal in Brazil, for example, has already been proven by several authors in the 35 Global Warming and Low Carbon Agriculture. different ecoregions. This process of fixing carbon in the soil in the form of humified (stable) organic matter over a long period of time is popularly known as carbon sequestration. Thus, soils managed under SPD without tillage and with the addition of straw pass from the condition of source of CO<sub>2</sub> towards the atmosphere to the condition of drain or assimilation of CO<sub>2</sub> to the soil<sup>23</sup>.

And keeps going:

Another effect of reducing GHG emissions in the SPD is related to the decrease in mechanized operations. Estimates indicate a reduction of 40 liters of diesel oil per hectare per year with the elimination of one plowing and two harrowing<sup>23</sup>.

It can be seen, therefore, that the benefits brought to the environment by the no-tillage system make food production more sustainable, protect the soil from the action of rainwater, preventing runoff and loss of the fertile soil layer. Also, due to the decrease in machine traffic, CO<sub>2</sub> emissions into the atmosphere and fuel consumption significantly decrease.

### 3.2 Biological Nitrogen Fixation In the Soil

Biological nitrogen fixation in the soil is an important technology for food production, considered clean, it

replaces commonly used fertilizers, which are harmful to human health and costly for the producer.

This technology allowed the extremely acidic cerrado soil to become fertile, due to the biological fixation of nitrogen in the soil. Research by agronomist Johanna Döbenreine indicates that the use of *Rhizobium bacteria*, in a natural process of plant-bacteria interaction, incorporates the nitrogen available in the air into the plant's nutrition mechanism<sup>24</sup>. With this, there is the replacement of nitrogen-based fertilizers, which have a high price and are highly polluting.

Also, according to Hungria et al.<sup>25</sup>, biological nitrogen fixation in the soil is a low-carbon technology, and credits can be commercialized in the international market, in addition to bringing the advantage of adopting clean technology, providing a positive perception. both nationally and internationally.

### 3.3 Other technological advances

Just to illustrate the progress that agribusiness has been achieving, in search of better sustainable development, only a few technologies will be addressed, since, to go deeper, other spaces will be needed, such the breadth of matter and speed of technological events.

#### 3.3.1. precision agriculture

Antuniasse<sup>26</sup> explains precision agriculture as the localized management of agricultural systems, using resources how mapping From factors in production, tools in Support The decision and application located in inputs.

In terms economic, The use of this technology makes it possible The prioritization of investments in areas where the production potential is more effective, ensuring greater economic returns.

From an environmental point of view, the rationalization and reduction of the use of inputs should be evaluated as one of the main benefits of precision agriculture<sup>26</sup>. With the use of the global satellite monitoring system, the rural producer can make a detailed management of his crop, from before planting to harvest, providing a better rationalization of the production stages, which, consequently, will bring fuel savings, reduction of manpower, better use of inputs and pesticides, and, in the end, the production of a sustainable product, with low impact on the environment.

Also, automation systems in irrigation devices, which allow a rational use of water; intelligent sprayers, which detect only the weed plant and allow less product to be thrown into the soil, preventing waste and preserving the environment; planters and harvesters coordinated by GPS, which avoid wastage of seeds, in the planting, and grains, in the harvest, etc.

### 3.3.2 Genetic improvement of seeds

Genetically modified organisms (GMO), or transgenics, are organisms that have received a gene from another donor organism, altering its DNA and allowing it to show a characteristic that it did not have before. The application options are endless and can cover the most diverse areas.

In sustainable agriculture, for example, Biotechnology makes it possible to produce more food, with quality, at a lower cost and without the need to increase the cultivation area<sup>27</sup>. In this way, there are germination resistant to pests, to prolonged drought, to the use of herbicides, causing the products to use less inputs, with greater production, without, however, expanding their planting area.

Law No. 11,105, of March 24, 2005<sup>28</sup>, establishes safety standards and inspection mechanisms for construction, cultivation, production, handling, transport, transfer, import, export, storage, research, commercialization, consumption, release into the environment and disposal of genetically modified organisms - GMOs and their derivatives, having as guidelines the stimulus to scientific progress in the area of biosafety and biotechnology, the protection of life and human, animal and plant health, and the observance of the precautionary principle for the protection of the environment.

The agribusiness entrepreneur has at his disposal an infinite range of technological products, aimed, in particular, for work inside the gate, which will lead to increased productivity, cost reduction, better management of property and resources, respect for the environment and sustainable development, a goal pursued by Brazil, within the 2030 Agenda.

## IV. FINAL CONSIDERATIONS

Through the study carried out, it became evident that the need to increase world food production is a worrying factor and a topic on the political agenda of all countries, since food security is a globalized collective problem.

Since the Industrial Revolution, the population has been experiencing a worrying growth, and by 2030 it may reach numbers close to 10 billion people, which represents, in just under nine years, an increase of one third in the global population. Given this situation, producing a greater amount of food is essential for human survival.

However, this need to increase food production comes up against the consumption of non-renewable resources and the indiscriminate use of soil and agricultural inputs, which can cause negative impacts on the environment. In view of this situation, the UN, with the endorsement of

193 countries, presented the 2030 Agenda to the world, containing sustainability objectives and goals, whose objective n° 02 is the end of hunger, with the achievement of food security and improvement of nutrition, as well as promoting sustainable agriculture.

To achieve this goal, the rural producer has been using new technological instruments, which seek to increase production without the need to increase the arable area.

Examples are the development of research in the area of biotechnology and genetic manipulation, the use of information technology in the management of property and products, artificial intelligence in the use of machines and implements.

All the efforts have been giving increasingly significant results in the Brazilian agricultural trade balance, making agribusiness a sustainable activity, both from an environmental, social and economic point of view. This generates income for the producer, food security for the population, preservation of the environment, with the search for the evident sustainable development desired by countries committed to the Global Agenda 2030.

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