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Precision Agriculture in the Promotion of Sustainable Development

Karla Emmanuelle da Silva[1*], Taciana Simas Carvalho Paes Barreto [2], Neide Kazue S. Shinohara[3], Júlio da S. C. O. Andrade[4] and José Machado[5]

ABSTRACT

With the constant population growth, the demand for foods to supply the society's necessity for food, follow this growth, but the areas intended for planting are being used in an exploratory way, without careful evaluation of the environmental impacts that this practice would cause to the ecosystem. The precision agriculture appears as a technologic tool that favors the optimization of agriculture inputs aiming to reduce harmful impacts on the environmental, ensuring the increase of the productivity and protection to the environmental. The purpose of this article is to relate the use of the precision agriculture and its scope combined with sustainable development in compliance whit natural resources. It was observed that with precision agriculture in the agricultural production it brought greater control to the cultivation promoting the increase of production and the reducing of environmental impacts.

Keywords: Farming Precision, Environmental Impacts, Cost Reduction

Agricultura de Precisão na Promoção do Desenvolvimento Sustentável

RESUMO

Com o constante aumento populacional, a demanda por alimentos para suprir a necessidade alimentar da sociedade, acompanhou esse crescimento, mas as áreas destinadas para o plantio estão sendo utilizadas de forma exploratória, sem criteriosa avaliação dos impactos ambientais que essas práticas possam vir a causar ao ecossistema. A agricultura de precisão surge como uma ferramenta tecnológica que favorece a otimização dos insumos agrícolas visando redução de impactos nocivos ao ambiente, garantindo aumento da produtividade e proteção ao meio ambiente. O objetivo deste trabalho é relacionar a utilização da agricultura de precisão e sua abrangência aliado ao desenvolvimento sustentável em observância aos recursos naturais. Observou-se que com a utilização da agricultura de precisão na produção agrícola trouxe um controle maior para o cultivo promovendo o aumento da produção e a redução de impactos ambientais.

Palavras-chave: Fazenda de Precisão, Impactos Ambientais, Redução de Custos

[1,2]Estudante de Engenharia Agrícola e Ambiental da Universidade Federal Rural de Pernambuco – Recife, Pernambuco, Brasil.
*k.emmanuellesilva@gmail.com
[3,4,5]Professor do Departamento de Tecnologia Rural da Universidade Federal Rural de Pernambuco – Recife, Pernambuco, Brasil.
   josemachado@ufrpe.br

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Introduction

The increase in food production to supply the of the population makes that some protection areas, as the Atlantic Forest, were devasted in a constant way, a fact that lasts unit today. Some unsuitable practices.

Some unsuitable practices have been used since the beginning of agriculture, such as Example, the burning of areas with the aim of increasing soil fertility, the indiscriminate use of chemicals and the uncontrolled use of resources (PÁDUA, 2012). With this, there is a need to increase production and productivity with a reduction in environmental impacts, bringing development in a sustainable way.

Precision Agriculture (AP) emerges as an important technological tool to increase productivity and reduce the environmental impacts caused by conventional agriculture. Precision farming is a technique that performs directed studies, not looking at the whole plantation, but at every fraction that composes it, with the objective of obtaining information aiming at a better utilization of the area, reducing the use of inputs and consequently reducing the Damage caused by nature.

Conventional agriculture generally promotes many environmental impacts, since it destroys the environment and biodiversity, wastes inputs and produces a very heterogeneous crop. Knowing the AP and its benefits for sustainable development is an important alternative for society since it broadens the knowledge of the rural producer, who, for the most part, is not convinced of the benefits of new technologies and bringing it to everyday life is still great.

The objective of this work is the use of precision agriculture as a tool that assists in reducing the environmental impacts caused by conventional farming practices.

Material and Methods

A scientific review was conducted based on descriptive expositions using as main source of research published articles, and books on conventional agriculture and precision agriculture.

The main problems generated by conventional agriculture for the environment were identified and new techniques used in precision agriculture were sought in order to reduce these impacts, but they did not affect the productivity and quality of the crop but contributed to a better Development.

Results and Discussion

Through precision agriculture, it is possible to identify heterogeneous zones allowing the management of soil, agricultural inputs and the best use of water. For this to happen, it is necessary to know the agronomic characteristics of the crops in order to assure producers of the choices that are technically and economically advantageous to them and to the environment.

New technological resources used in this field offer numerous possibilities to the farmer based on systems of georeferencing, use of sensors, mechanization, and software for data processing.

Agricutural inputs

In the absence of detailed information, and aiming at additional productivity increases, many producers still perform the soil correction and fertilization of their crops, without any major criteria in the definition of location, dosages and time of application of fertilizers. The great majority still uses formulations of nutrients and fixed amounts, a practice that can, over time, favor the unbalance in the supply of these nutrients, since these fertilizations can be carried out sub or oversized (MOLIN et al., 2015). Another limiting factor for productivity is the competition between weeds and the crop, and weeds need to be removed for a better development of the crop, and this removal is done with the application of herbicides that are extremely harmful to plants and the environment (RIZZARDI et al, 2001).

Most applications of these chemicals are carried out by spraying aircraft that pour pesticides throughout the plantation area. However, spraying should respect the differences in cultivation zones, because it is already known that weeds do not grow in a homogeneous way, thus promoting waste and irrational use of herbicides when applied in an empirical way.

Precision agriculture appears as an important mechanism for optimizing the inputs used in production and reducing the environmental impacts caused. Silva et al. (2009), In his work noticed a reduction of 24.11% in the use of agricultural inputs with precision farming. This is due to the fact that with precision agriculture the application of these inputs, such as fertilizer and limestone, are carried out in the places that are needed by reducing the quantity to be purchased and the accumulation of these products in the soil or in watercourses. SHIRATSUCHI et al., (2004), made the use of precision agriculture for weed mapping by generating thematic maps of treatment for the purpose of raising the exact locations for herbicide application.

In the research of Nunes and Souza (2016), it was based on the development of a methodology capable of assisting the farmer in locating the brown bug in the soybean crop. For the process of locating this pest, a computational resource was

used for manual evaluation of the delimited sites, through a technique called a rag. Based on this analysis and based on the manually performed samplings the rural producer will know which defensive one to use, the quantity and the location of the application, through estimates of isolated points of the property.

For the application of the amount of nitrogen, Coelho and Inamasu (2008) used optical sensors based on remote sensing to determine the nutritional status of maize. These sensors use the spectral characteristics of the leaves as indicators of the availability of nitrogen in the soil. Optical sensors, such as the ACS-210, help a lot in the cultivation since they can be coupled to the machinery, which simultaneously will realize the correction of the nutritional deficit in the place indicated by the readings. Ferraz et al. (2010), in a case study, performed a comparison between the application of phosphorus (P) and potassium (K) in a conventional way and using AP. Geo-referenced soil samples were collected and analyzed in the laboratory. The costs of conventional fertilization were obtained through simulation. As a result, a reduction of 53 kg/ha of potassium was achieved using the precision agriculture technological resources.

Based on this research it is noted that in all cases there was a considerable reduction in the use of inputs. This is very important for the development of sustainable agriculture since the reduction in the use of these inputs will reduce the contamination of environmental areas such as the accumulation of chemicals in the soil, which are often heavy metals, which were subject to leaching to the contaminated watercourse so other natural resources.

Soil management

The survey of the slope of the land through equipment such as GNSS can determine a way of planting that reduces erosion, as well as avoid the loss of nutrients by leaching and have the best use of the area of planting. Nogueira-Neto (2007) used commercial vehicles at a speed of 20 km / h and traveled through the Santa Cruz-PR area where altitudes were collected every 5 seconds through two Legacy Top Dual Frequency GPS. The data were collected and processed generating the map of the terrain slope. These types of maps help in the determination of the forms of planting, instead of the traditional rows, the planting is carried out following the length of the contour curves.

Another utility for the slope survey is the determination of the spacing between the planting. Spacing is important for the availability of water and nutrients for the crop. Automated tractors with georeferencing systems perform the

planting more precisely by reducing the waste space. These tractors also perform the correction of planting failures. Almeida-Junior et al. (2015), in his work, used tractors equipped with automatic pilots that realized the planting of the sugar cane. The objective was to reduce the variation of spacing between the planting, in response, a reduction in the loss during harvesting was obtained, increasing the yield of the plantation.

In the United States, corn and soybean plantations were suffering from increased soil moisture due to the increased precipitation rate. The simple measurements of the daily moisture indexes associated with soil infiltration potential led researchers to have significant improvements in the statistical models, facilitating the best choice of planting season and the use of suitable machinery (URBAN et al., 2015).

Sensors that determine the electrical conductivity of the soil and the pH reduce the amount of limestone to be applied for the correction, avoiding that the applied excess is leached. In the study of Almeida and Guimarães (2016) the spatial behavior of pH and macronutrients was verified: phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg) and sulfur (S) in the soil, searching for geostatistical models That would permit adequate planning of the use of correctives and fertilizers in the property, thus contributing to the sustainable management of coffee production in the municipality of Araguari-MG. As a conclusion, geostatistics has contributed to the planning of fertilization, providing a better use of fertilizers in the production of coffee.

With the AP the soil management becomes more sustainable due to the better management of the plantation, generating better conditions for the crop without the necessity of the expansion of new planting areas; Especially when associated with conservation practices such as no-tillage and automated machines. In addition to ensuring the implementation of new technologies as automatic harvesting systems by the fact that the planting is more organized.

Water resources

Conflicts of access to clean water will be inevitable and will continue to grow unless there is a radical change in society and lifestyle. There is a lot of talk about sustainable development, but it still has a high cost. As it will not benefit the current generation, this concept has not yet been given due importance. The hope lies in the concept of Sustainable Society, which, instead of modifying the mode of production, would lead the nation to conscious consumption and resource sharing (Pinto, 2017).

According to a study carried out by the United Nations Food and Agriculture Organization (FAO, 1998), every ten liters of fresh water used in the world, seven liters are for agriculture, or almost 70%. This is because the greatest challenge today is to end hunger in the world, and producing food demands water that is currently limited.

Much of the water used in agriculture is lost by evaporation or because the soil is already saturated with water, resulting in the leaching of nutrients and could seriously damage the crop. In Brazil, less efficient and water-intensive irrigation methods are used, which are: surface spreading, central pivot and conventional spraying (TELLES, 1999). According to Silva and collaborators (2017), the rational and sustainable use of water in rural areas should be a priority, given that agricultural activity has the highest consumption of this precious liquid among all productive sectors and that water is vulnerable to change And should be monitored for use in agricultural crops and thus avoid unnecessary waste in the current context in the pursuit of sustainable development.

With the severe water crises that many countries are surpassing, water waste is not acceptable and it is necessary to implement more efficient irrigation systems, in order to reduce the amount of water used in agriculture. In Brazil, but specifically in Pernambuco, in the São Francisco Valley, on a farm producing table grapes, an experiment was carried out by EMBRAPA's Precision Agriculture Network, where, through a systemic survey of the area, Drainage of soil in an area of 1.6 hectares. Then, with this information, the producer applied a smaller amount of water to the places where there was a greater amount of water, so a reduction of 800 liters of water per plant was observed in certain parts of the area in 115-day cycle (BIROLO, 2015).

Souto et al., 2017, through Thorntwaite and Mather (1948-1955), performed an analysis of rainfall indices and evapotranspiration of the studied municipality, Camalaú-PB, in order to determine the annual water balance of that region. As a result, they obtained a water deficit of 740.3 mm / year for 2014. The fact is that with these values, it becomes possible to replenish this water in the exact quantity, without the waste of this resource or the lack of it for the culture.

In addition to maps are also used the software in irrigation. Queiroz et al. (2008) used the PivoRFusuario application, which identifies the position of the pivot irrigation system, which is activated through a remote control system and then based on the reading made by a tensiometer, the application Calculate the required water depth for a given area of the plantation and automatically adjust the percentage for the sector where there is a water deficit.

It is extremely important to reduce water use, especially in agriculture, since it is one of the most used of this natural resource, the use of PA promotes this reduction. By being able to survey the needs, even of small areas, it is possible to control, both temporal and quantitative, the use of water, thus showing the producer new possibilities of forms of irrigation.

Precision agriculture and its paths

Precision Agriculture arouses a fascination with technology and the future it represents. To the more conservative, however, it tends to generate an opposite position of caution and discomfort from the new or overly new. After a decade and a half in the country, there are still the fascinated and the more conservative positions. However, the advance is undeniable, there has been maturity, the market has established itself and the academy has brought results that are scientifically supported (INAMASU and BERNARDI, 2014).

As the objective of strengthening the set of research, teaching and development actions in the area of agriculture, the Ministry of Agriculture created the Brazilian Precision Agriculture Commission (CBAP) on September 20, 2012, through Ordinance 852. This commission has the function of promoting sustainable and social development, competing with agribusiness and benefiting society. Its main objective is the diffusion and supply of Precision Agriculture tools and technologies, precisely with the development of labor training programs (MAPA, 2017).

Despite the many benefits of using the PA, there are still several possibilities for research and development that need to be improved. It is necessary to stimulate and expand the development and innovation of national PA technologies and the validation of technologies from other countries to Brazilian cropping systems (BERNARDI et al., 2015).

Conclusions

Considering the variables studied, it was observed that the introduction of new technologies, such as sensors, software, automated tractors and analysis methodologies, which are used by precision agriculture in cultivation, considerably reduce environmental problems linked to conventional agriculture, and it is possible To obtain a higher productivity, without the need to expand the cultivation areas, since, with the use of AP, a better optimization of the area is achieved.

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