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Economic, social and environmental analysis of greenhouses in the Municipality of El Arenal Hidalgo, to determine if they are sustainable

Análisis económico, social y ambiental de los invernaderos del Municipio de El Arenal Hidalgo, para determinar si son sustentables

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Abstract

The present investigation is aimed at analyzing whether the greenhouses of the Municipality of El Arenal, located in the eastern area of the Mezquital valley, Hidalgo, are sustainable from an economic, social and environmental point of view. Food production, being one of the fundamental activities for society, should be a sustainable activity to ensure food supply. This is where the importance of determining whether the productive activity of greenhouses is sustainable or not is important. Due to the aforementioned, this work will be carried out by collecting and analyzing relevant information that allows determining the operating characteristics of the greenhouses established in the municipality of El Arenal Hidalgo, with the purpose of determining whether they comply with the conditions of economic, social and environmental sustainability, this through the application of a survey.

Greenhouse, Sustainability, economic, social, environmental

Resumen

La presente investigación va dirigido a analizar si los invernaderos del Municipio de El Arenal, ubicados en la zona este del valle del Mezquital, Hidalgo son sustentables o sostenibles desde el punto de vista económico, social y ambiental. La producción de alimentos al ser una de las actividades fundamentales para la sociedad, debería ser una actividad sustentable para asegurar el abasto alimentario, es aquí que la importancia de determinar si la actividad productiva de los invernaderos es sustentable o no. Por lo anteriormente comentado, este trabajo se llevara a cabo mediante la recopilación y análisis de la información relevante que permita determinar las características de operación de los invernaderos establecidos en el municipio de El Arenal Hidalgo, con la finalidad de determinar si cumplen con las condiciones de sustentabilidad económica, social y ambiental, esto mediante la aplicación de una encuesta.

Invernadero, Sustentabilidad, Económico, Social, Ambiental

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Introduction

El Arenal has a surface area of 125.90 km2, which represents 0.60% of the total surface area of the state, it is located 20 kilometres from highway number 85 Pachuca - Actopan, it is located between parallels 20° 13' north latitude, 98° 55' west longitude, with an altitude of 2,040 metres above sea level. Two rivers are located in its territory; the Panuco and the Moctezuma River Basin, as well as some streams and wells. Its soil is from the Mesozoic stage, of a calcareous type because it has lime in its components; the use of the soil is seasonal agriculture and pasture (INAFED, 2010).

Greenhouses, being a controlled production system, increase the effectiveness of production, but do not ensure its sustainability. In the case of protected crops (greenhouses), it is known that they have an impact on the environment, such as chemical waste, plastics and organic waste; however, this type of crop provides protection against adverse environmental factors, regardless of geographical location.

It is estimated that a 2000 m2 greenhouse generates 4 direct and 10 indirect permanent jobs, which is why this technology should be considered as a factor for rural development in marginalised areas. The impact of the introduction of protected crops brings with it a positive increase in the quality of life, food security, economy of a region and therefore in the overall progress of the nation (Hernández-Díaz et al., 2006).

The sustainability of greenhouses depends on many factors such as: the type of substrate used, nutrients (post-harvest waste generated), energy, income (economic profitability), and must also include the modifications that greenhouses generate in the ecosystem (changes in the landscape, modifications in the composition of water and soil) (Montero et al., 2008; Alonso, 2004).

The simultaneous distribution of water and fertiliser can generate losses in terms of fertilisation efficiency (Montero et al., 2008). Fertigation in the long term can also bring problems that affect the sustainability of the system, changing the characteristics of the water, for example: salinity increases, due to the accumulation of sodium chloride and increasing concentration of nitrates and pesticides, and when released into the environment it would contaminate surface and groundwater, as well as the physicochemical modification of the soil (texture, structure, electrical conductivity, pH, bulk density, cation exchange capacity, etc.), intoxications and deaths, and the use of fertilisers (Montero et al., 2008).), intoxications and deaths caused by pesticides are largely due to the lack of protective equipment, poor handling, as well as ignorance of their handling, representing a high risk of direct or indirect contact with these substances (Gómez-Arrollo et al, 2013).

Methodology

This work was approached in four stages and was aimed at producers in the primary sector, specifically in greenhouse production. In the first stage, a census of greenhouses in the municipality of El Arenal was carried out. As a second stage, a questionnaire with two sections (economic-social and environmental) was structured in order to identify the main social, environmental and economic risk factors. In the third stage, students of the Industrial Design Engineering programme of the Polytechnic University of Francisco I. Madero were trained in the mechanics of the application of the designed questionnaires. In the fourth stage, the questionnaire was applied and the information collected was analysed.

Results and discussion

This section shows the analysis of the socioeconomic, environmental and productive factors in the 30 greenhouses present in the municipality of El Arenal, Hidalgo, in order to determine the conditions in which the greenhouses are found in these areas and to determine if they are sustainable or not.

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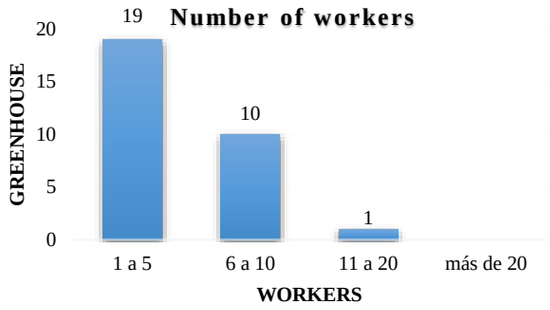
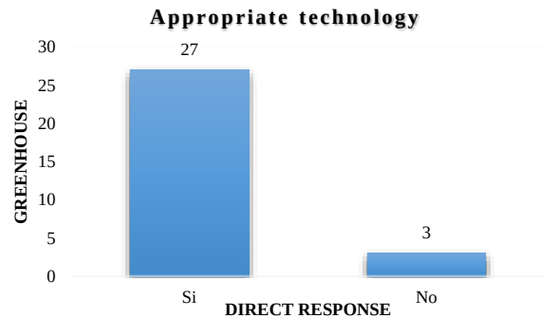


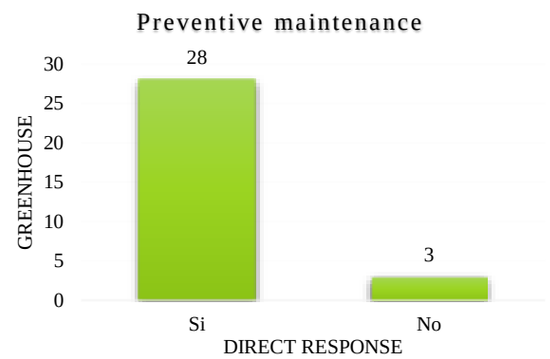
Graphic 1 Number of workers

Graphic 1 shows the number of workers employed by the producers, showing that 63.33% have between 1 and 5 workers, 33.33% between 6 and 10 and between 11 and 20 workers only 3.33%, so it can be considered that they do not generate good economic conditions (profits, contribution to public expenditure) and social conditions (direct and indirect employment, social security, etc.).



Graphic 2 They have adequate technology.

Graphic 3 shows whether or not the greenhouse has adequate technology for its operation. On average, almost 90% responded that it does have adequate technology, while only 10% responded that it does not.



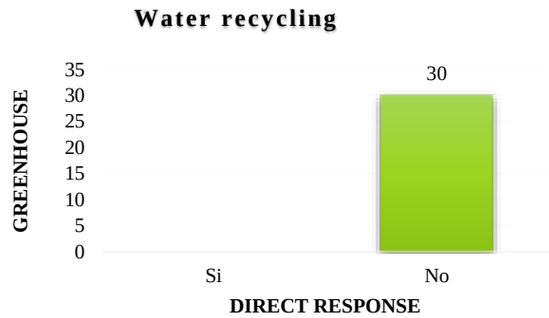
Graphic 3 Preventive maintenance is carried out

Graphic 5 shows whether or not preventive maintenance is carried out on their installations and/or machinery, 93.33% answered yes, only 6.67% did not.

The implementation of a preventive maintenance programme will increase production efficiency, as it prevents the failure of infrastructure and/or equipment due to use and the passing of time. In the event of corrective maintenance, it will affect yields because it will cause a degree of stress on the crop, i.e., there will be failures in the irrigation system and in temperature control, mainly

Graphic 4 Types of financing.

Graphic 7 shows that 96.66% of the surveyed producers use their own resources, 3.34% are only financed by a banking institution, i.e. they do not have financing from a governmental institution.



Graphic 5 Tax registration

It is noticeable that 60% of the greenhouse owners are not registered with the tax authorities, only 40% are registered.

In the ecological aspect, in graph 6, it is observed that 100% of the respondents do not recycle water, in general the producers, regardless of the product (crop), have not considered the term agricultural sustainability, because they have not implemented the technology of using biofertilisers or good agricultural practices..

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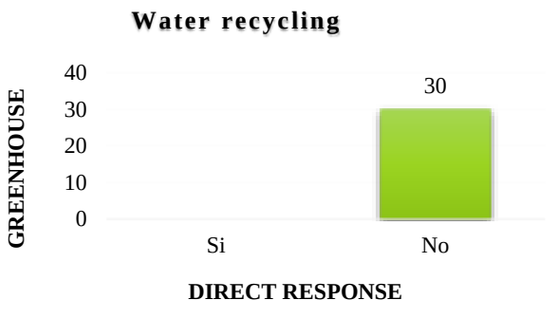
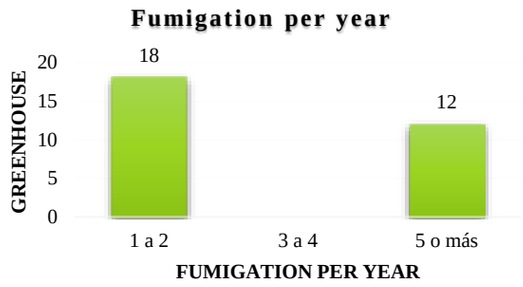
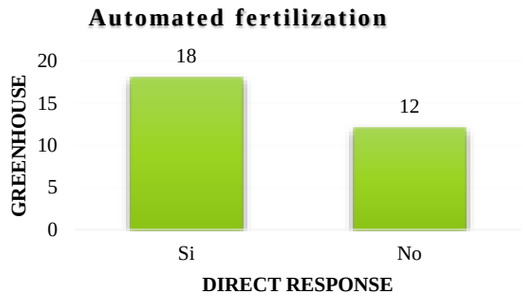


Graphic 6 Recycle water

Irrigation and fertigation are widely used in greenhouses because they allow an easy distribution of nutrients. Fertiliser use efficiency is still very low, as only 30-50% of nitrogen (N2) and 45% of phosphorus (P) is taken up by the plant. In order to make efficient use of fertilisers, it is necessary to make formulations with a better nutritional balance that cover all their requirements without affecting production, as well as to design strategies for integrated pest management (Good Agricultural Practices) (Alonso, 2005; Montero et al., 2008).



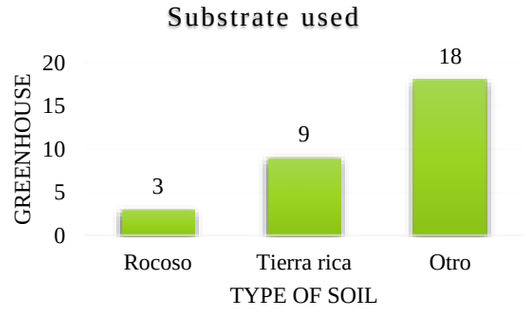
Graphic 7 Frequency of spraying per year



Graphic 8 Automated fertilisation

Regarding the use of pesticides and fertilisers in the greenhouses, it can be seen in graph 7 that 60% of the greenhouses are sprayed 1 to 2 times a year, while 40% of the greenhouses are sprayed more than 5 times a year.

On the other hand, 60% of the respondents have an automated fertilisation system and 40% do not have an automated fertilisation system (graphic 8), which may indicate that they make irrational use of fertiliser and/or pesticide products. The average consumption of fertilisers is estimated at 1700 kg/ha and pesticides at 35 kg/ha for vegetable crops.



Graphic 9 Type of substrate

Finally, the type of soil (substrate) used in the greenhouses in the municipality of El Arenal is more predominant other than rocky and rich soil, with 60% (graphic 9).

Conclusions

Most of the greenhouses are small, so it can be considered that they do not generate the economic conditions, they do not have financing from a governmental institution, 60% of them are not registered with the tax authorities. Another important fact is that the surveyed producers responded that they do not implement any type of training in their production unit, that their personnel require training in at least one area, such as specialised courses in the agronomic management of the crop and in the proper handling of pesticides and fertilisers. 100% of the respondents do not recycle water, do not use biofertilisers, nor do they implement good agricultural practices.

From the above it can be concluded that the majority of the greenhouses are not sustainable in economic, social and environmental aspects, the latter being the one that is not fulfilled in all greenhouses and requires the most attention.

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