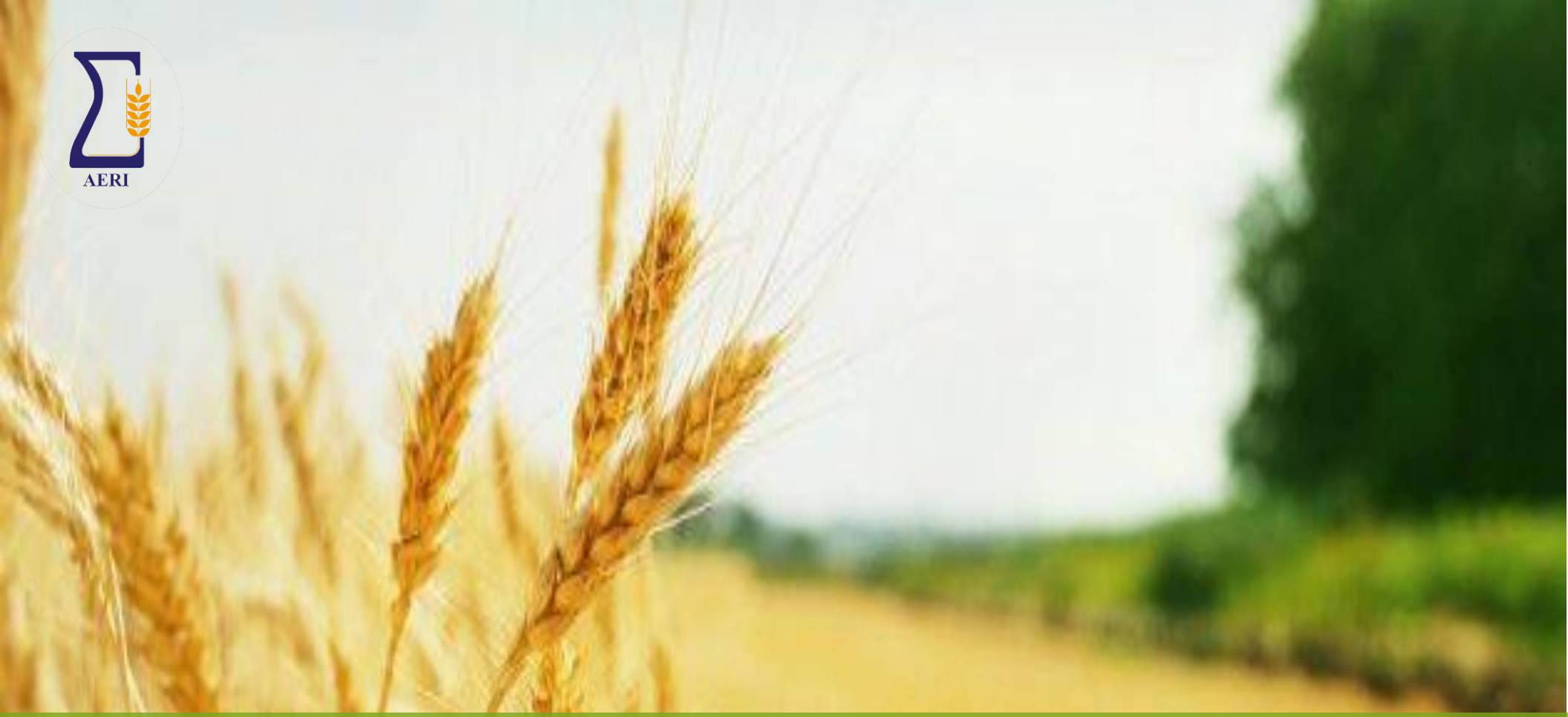

AERI

Abstract of Research Reports

Greenhouse Engineering

2020

Fluid Dynamics Modeling and Structural Redesign of an ARC Greenhouse

J. Javadi Moghaddam*, D. Momeni and Gh. Zarei
E-mail: j.javdimoghaddam@areeo.ir

Abstract

The purpose of this project is to study and to investigate the design of an arc greenhouse. This study includes analysis of structural strength and resistance to standard loads applied to the greenhouse. The effect of roof vents on greenhouse ventilation has also been investigated in this study. In this design, the effect of wind on the structure is considered as horizontal load and the effect of dead, live loads and all loads that are expected to affect the structure are calculated. After examining the greenhouse structure under this loading and calculating the stress and maximum displacement created in the structure, a redesign was carried out to improve the design quality of the structure. This redesign is done to increase the structural strength against the loads on the greenhouse, reducing the weight of the structure per unit area. In order to do this, first, the archery greenhouse with default specifications is modeled in software, then based on loading according to greenhouse standard, stress analysis is performed on it. In the next step, the dimensions of the structure were designed so that the stresses of loading at each stage of refinement were lower than in the previous step. Also for aerodynamic analysis of the external wind, the greenhouse unit designed by the relevant software was placed in the wind tunnel to design the greenhouse exterior so that the wind would move in a regular flow. In the design of this greenhouse, the free ventilation design for generating uniform and gentle winds inside the greenhouse has been calculated in this simulation, the wind enters the greenhouse from the outside and, depending on the shape of the valve, creates a different air profile inside the greenhouse. The results show that using the pigeon-wing valve, the greenhouse air velocity is faster than the bus valve. After redesigning the desired greenhouse, increased strength and structural strength have been demonstrated against external loads. So that the structure is able to withstand the stresses caused by combined and maximum loading after re-design. All comparisons and results of the redesign are presented by the forms of stress distribution, displacement distribution, and coefficient distribution. In addition, the results show that increasing the strength of the redesigned structure is associated with weight loss per unit area. In other words, the redesign of the structure was done in a way that while increasing the strength and stability of the structure against the maximum stress caused by the combination of external loads and the most critical loading standard on the structure, the weight of the structure was reduced by 1.5 kg per unit area. In this project, simulations and stress and ventilation analysis of the propouse structure for a single-span greenhouse are designed, of course, this design can be extended to multipurpose greenhouses.

Key words: Fluid, Greenhouse, Octagonal Plane, Robust, Structure, Wind

Determination of Energy Consumption of Greenhouse Cucumber Production in Khorasan Razavi Province

M. H. Saeidirad*, S.Zarifneshat, A. Rohani, s.h. Motamedoshariati, M. Emami and M. Naseri and D. Momeni
E-mail: Saiedirad@yahoo.com

Abstract

Greenhouse cultivation has a high energy consumption due to off-season production. Increasing energy efficiency in greenhouse crops is one of the most important parts of energy studies in agriculture, and any success in increasing energy efficiency in greenhouse crops can make optimal use of valuable energy resources. The purpose of this study was to determine the total energy requirement in different stages of greenhouse cucumber production and to determine energy indices, and to compare the energy consumption status of greenhouses in Mashhad with other areas. In order to achieve the research objectives and gather information needed in this study, a questionnaire was developed which included questions about greenhouse characteristics such as area, structure, heating, cooling and ventilation, amounts of fuel and electricity consumption, cropping system, crop yield, different energy inputs, the cultivation and harvesting period, area and time of operation. Data collected by completing a questionnaire for 30 randomly selected greenhouses. The results showed that most energy consumption (95.77%) related to the fuel requirement for greenhouse heating. In addition, energy ratio indices, net energy efficiency and energy productivity in greenhouse production of Mashhad were 0.014, -6346470 and 0.025, respectively.

Key words: Cucumber, Energy efficiency, Greenhouse

Evaluation of Greenhouse Crops Water Use Efficiency in South of Kerman Province

E. Moghbeli Dameneh*, A. Aein, M. MokhtariSataiy and M. HasanBaluchi

Abstract

Today, the world faces challenges of more Production by less water consumption in providing food security. Understanding how to develop, manage, and consume water resources is the key to tackling the challenge. The most logical solution is to increase the production or yield per unit of water consumption, which is called water use efficiency or water productivity. One of the ways to increase productivity is through the use of controlled Culture medium and greenhouse for the production of different types of products. Although the water requirement and water consumption in the greenhouse is lower than open environment, but its precise determination and adaptation of the irrigation program to the water requirement of different plants is too important. In this study, yield and water use efficiency of five important greenhouse plants in south of Kerman province were investigated. The results showed that the average amount of water consumed in greenhouses in the south of Kerman province is 11240 m3/ha which is more than the water requirement of the greenhouse plants. The physical water use efficiency in cucumber, tomato, eggplant, pepper and strawberry was 17.90, 16.82, 9.32, 7.85 and 2.74 kg/m3, respectively and the average was 10.93 kg/m3. Also, the economic water use efficiency in these products was 19.5, 36.9, 18.1, 30.1 and 15.8 respectively, and the average was 24.1 1000Rials/m3.

Key words: Economic Water Use Efficiency, Physical Water Use Efficiency, Water Requirement

Evaluation of Fuel Efficiency in Conventional Heating Systems in gGreenhouses

D. Momeni, S.Sadeghi, F. Keshavarzpoor, Gh. Zarei, G. Hosseini and F. Ghasemi
E-mail: D.Momeni@areeo.ir

Abstract

Greenhouse culture is one of the methods of production in agriculture sector that is highly dependents on energy. Therefore, if the efficiency of greenhouse heating systems will be improved, it will have good effects on the energy consumption of the greenhouse sector in the country. In this project, in order to determine the efficiency of fuel consumption of conventional heating systems in greenhouses, data were taken in some greenhouses in Tehran, Markazi and Alborz provinces. For this purpose, thermal requirements of greenhouses were calculated. Then by using long-term meteorological statistics, climate suitability graphs were drawn. For determining of fuel efficiency, in addition to recording thermal images in the greenhouse, the status of exhaust gases such as CO, CO2, HC, O2 and NO_x were recorded in the greenhouse. The results showed that the greenhouses in Tehran, Alborz and Markazi provinces need 3.5, 6 and 5 months of heating, respectively. The size of the burners were selected regardless of the heating needs of the greenhouse and the average efficiencies of the burners used in the greenhouses of these areas in Tehran, Markazi and Alborz provinces were 60, 81 and 85%, respectively. Investigation of the pollution status of heating systems in these areas also showed that the percentage of CO pollution in greenhouses in Tehran province with an average value of 0.886% compared to Markazi and Alborz with an index of 0.0474 and 0.66% is the highest. The same results were obtained for CO2, with Tehran, Markazi and Alborz greenhouses accounting for 23.03, 3.442 and 3.085 % respectivly. Regarding HC, greenhouses in Tehran province with 21.64 ppm had a more unfavorable situation than Markazi and Alborz with an index of 10.75 and 9.75 ppm. The oxygen output of heating systems for Markazi, Alborz and Tehran, respectively, were 23.27, 23.99 and 23.37%. Regarding NO_x pollutants, the condition of Tehran's greenhouses with 13.36 ppm was more unsatisfactory than the greenhouses of Markazi and Alborz provinces with 6 and 2.7 ppm. Factors such as using of non-standard heating systems, improper installation of heating systems and exhaust and non-standard greenhouses were the most important factors in the creation of these pollutants.

Key words: Greenhouse, Heating System, Carbon Monoxide (CO), Carbon Dioxide (CO2), Unburned Hydrocarbons (HC), Oxygen (O2), Nitrogen Oxides (NO_x)

Agricultural Engineering Research Institute (AERI)

Postal Address: P.O.Box 31585, Karaj, Iran