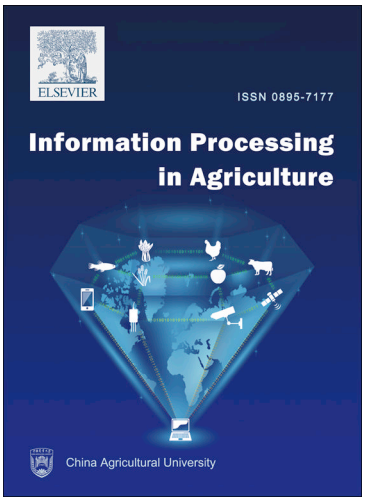
Accepted Manuscript



Impact of high strength electromagnetic fields generated by Tesla transformer on plant cell ultrastructure

Anna Rusakova, Igor Nosachev, Vladimir Lysenko, Ya Guo, Alexander Logvinov, Evgeniya Kirichenko, Tatyana Varduny, Sergey Cherednikov, Olga Chugueva

PII: S2214-3173(17)30012-4
DOI: http://dx.doi.org/10.1016/j.inpa.2017.05.002
Reference: INPA 84

To appear in: *Information Processing in Agriculture*

Received Date: 24 January 2017
Revised Date: 3 May 2017
Accepted Date: 12 May 2017

Please cite this article as: A. Rusakova, I. Nosachev, V. Lysenko, Y. Guo, A. Logvinov, E. Kirichenko, T. Varduny, S. Cherednikov, O. Chugueva, Impact of high strength electromagnetic fields generated by Tesla transformer on plant cell ultrastructure, *Information Processing in Agriculture* (2017), doi: http://dx.doi.org/10.1016/j.inpa.2017.05.002

Impact of high strength electromagnetic fields generated by Tesla transformer on plant cell ultrastructure

Anna Rusakova[a], Igor Nosachev[b], Vladimir Lysenko[a]*, Ya Guo[c], Alexander Logvinov[a], Evgeniya Kirichenko[a], Tatyana Varduny[a], Sergey Cherednikov[a], Olga Chugueva[a]

[a]Academy of Biology and Biotechnology, Southern Federal University, Rostov-on-Don, Russia
[b]Department of Physics, Southern Federal University, Rostov-on-Don, Russia
[c]School of IoT Engineering, Jiangnan University, Wuxi, China
1

Abstract

Non-thermal effects of direct electric fields and alternating electromagnetic fields (EMF) have been successfully used in a number of studies and applications in agriculture and biotechnology. Among different kinds of high strength EMF generators, the Tesla transformer (TT) is known as a widely applied, low cost, and troubleproof device, which generates EMF in the range of 2-8 MHz. Despite of a number of developed and perspective applications of high strength EMFs in agriculture and biotechnology, the EMFs generated by TT, as well as the 1-50 MHz range of high strength EMF still remain unexplored in the fields of plant physiology, ultrastructure studies and biochemistry. In this work, we have shown that TT-EMFs (4 MHz) induced fast stem and petiole bending, disappearance of cell organelles, vacuolar membranes, and increase of a non-photochemical chlorophyll fluorescence quenching in petioles. It is intriguing that such fatal effects can be evoked in plants by EMFs which are well known as harmless for man at the applied strength and frequency.

Keywords: Tesla transformer; steam bending; electromagnetic fields; organelle destruction; photosystem II

1. Introduction

A lot of efforts has been made to use biological effects of direct electric and alternating electromagnetic fields in agriculture and plant biotechnology since the pioneering works by Karl Lemström in 1904 [1, 2], which has shown that high strength direct electric fields stimulate plant growth [3].

It is generally accepted, that biological effects of the alternating electromagnetic fields (EMFs) are represented by two groups: "thermal" and "non-thermal" [4]. EMFs with the level of surface power density more than 10 mW/cm (it may be in the case of ultra-high frequency

Abbreviations: FFT – Fast Fourier Transform; EM – electromagnetic (fields); PSII – photosystem II; Fv – variable fluorescence; Fm – maximal fluorescence after dark adaptation; PAM – pulse amplitude modulation of fluorescence; DCMU – 3-(3′,4′-Dichlorophenyl)-I,I-dimethylurea (diuron);

*Corresponding author
E-mail adresses: anna.rusakowa@yandex.ru (A. Rusakova), igor.nosachev@mail.ru (I. Nosachev), vs958@mail.ru (V. Lysenko), guoy@jiangnan.edu.cn (Y. Guo), a.k.logvinov@yandex.ru (A. Logvinov), Kiriche.evgeniya@yandex.ru (E. Kirichenko), Varduny@yandex.ru (T. Varduny), sergejt55@mail.ru (S. Cherednikov); Chugu@rambler.ru (O.Chugueva)