

PROTECTION OF CROPS FROM INSECTS USING MICROWAVE FREQUENCY: A REVIEW

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ABSTRACT

The passage of time, technology merged itself with the daily life of human being. We see a lot of progress in the field of Electronics, but we are not able to make full use of such technology. One such area for improvement is the agriculture field. This system presents the protection of crops from insects using Microwave Frequency. The frequency range of microwave is from 3MHz to 300GHz. The insects are exposed to microwave frequency (MW) electromagnetic field at different frequencies. The proposed system replaces integrated pest management method and use of chemical fumigation to protection of crops using Microwave Frequency.

Keyword: *Electromagnetic field exposure, Crop Losses, Insect Control, Microwave Frequency.*

1. INTRODUCTION

All over the world the food supplies on Insects and pests constitute a major threat. The annual production losses due to pest in India are estimated at US\$36 billion [8]. Agricultural commodities produced on the fields have to undergo multiple operations such as harvesting, threshing, winnowing, bagging, transportation, storage, and processing before they reach the consumer, and there are appreciable losses in crop output at all these stages. The pests cause 15-20% yield loss in food and crops [11]. Nowadays health has become a major issue to maintain. It all could be maintained by proper and organic vegetation & intake. There is a lot of use of pesticides & fertilizer in farming which is not organic & due to that many health problems occur which can also affect human beings, so we can implement a system which protects the crop from insects using Microwave frequency. It has anthropogenic radio frequency electromagnetic field which has a range of frequency that exposure to insects that attack the crop without damaging the yield of crops. The use of chemistry fumigation continues and efficient uses of Microwave methods for insect control are still to be accepted. Due to the use of Microwave energies there are no chemical residues on the product, it will directly impact on product quality.

1.1 Review

In this section, brief review of protection of crops from Insects using microwave frequency.

S.O. Nelson proposed RF dielectric heating frequencies involve between 1 and 100MHz or Microwave heating frequencies involve above 500MHz [1]. Radio frequency treatment at 13.6 and 39MHz required for insect control without damaging to crops. Frequency can affect to insects depend upon species & their development stages. RF treatment at frequencies between 10 to 90MHz to control the insects. RF and MW methods not come into practice, because they have been costly as compared to chemical control method. It experimentally concludes, the Radio Frequency Treatments at frequency between 10 to 90MHz have achieved control of insects treated in grain.

S. O. Nelson, P. G. Bartley, Jr., K. C. Lawrence proposed work on the dielectric properties of adult insects of the four stored-grain insect species like rice weevil, red flour beetle, sawtoothed grain beetle, and lesser grain borer measured in this paper were all similar, although the sawtoothed grain beetle had generally higher dielectric constants than the other three species [2]. Measurements of the RF and microwave dielectric properties of adult rice weevils and hard red winter wheat were obtained for frequencies upto 12 GHz. In measurement four stored-grain insect species over the frequency range from 200 MHz to 20 GHz at temperatures from 10 to 70°C.

S. Wang, J.Tang reported the present and potential quarantine treatment for both domestic & international markets Include chemical fumigation, ionizing radiation, controlled atmosphere, cold treatment. The use of chemistry fumigation continues and efficient uses of RF and MW methods for insect control are still to be accepted. Due to the use of RF energies there is no chemical residues on product. It will directly impact on product quality and complete killing of insects [3]. The Researcher proposed the RF and MW heat method to control pests in nuts during a short time period without product quality damage. This method is attractive because it is quick and safe.

S. Sivani , D. Sudarsanam It shows the effect of RF-EMF from cell towers and wireless devices on the biosphere [4]. Animals depend on Electromagnetic field for their orientation and navigation through earth's atmosphere are confused by much stronger and constantly changing artificial fields created by technology. On plants study it shows the browning of trees tops is often observed near cell towers. It concludes that there is a long term impact but one can relocate the cell phone towers away from densely populated areas, increasing height of towers or changing the direction of the antenna. 900-1800MHz frequencies affect the nervous system of human beings. It was also concluded to do further research in this field.

Aurore Avargues Weber, Martin Giurfa proposed a conceptual learning by miniature brains [5]. The study was conducted on honeybee *Apis mellifera*, where it can learn and memorize the local cues which characterized places of interest for the food sources. In this the free-flying honeybee are trained to choose the visual targets paired with sucrose solution as equivalent of nectar reward. Naturally these bees use sky-based information as a navigation compass. The essential task is therefore to identify and characterize the circuit that mediate concept learning in the bee brain.

Ipsita Das, Girish Kumar and Narendra G. Shah developed insect control method using microwave energy is to identify a balance between minimized thermal impact on the product quality and complete killing of the insect population [6]. Microwave (MW) disinfestations of stored food products and its principle and experimental results from previous studies in order to establish the usefulness of this technology. Disinfestation methods are chemical fumigation, ionizing radiation, controlled atmosphere, conventional hot air treatment, and dielectric heating, that is, radio frequency and microwave energy. Microwave disinfestation is considered as safe and competitive alternative method to other quarantine methods and can avoid problems of food safety and environmental pollution. Different food products infested with major insects are complete mortality that is, 100% could be achieved using microwave energy.

Alfonso Balmori it shows that exposure at levels that are found in the environment (in urban areas and near base stations) may particularly alter the receptor organs to orient in the magnetic field of the earth [7]. These results could have important implications for migratory birds and insects, especially in urban areas, but could also apply to birds and insects in natural and protected areas where there are powerful base station emitters of radiofrequencies. Radio frequency fields in the MHz range disrupt insect and bird orientation. In the radiofrequency range, the rapid development and increased use of wireless telecommunication technologies led to a substantial change in the radio-frequency electromagnetic field (RF-EMF) exposure.

G.S.Dhaliwal, Vikas Jindal proposed Insect cause injury to crops directly or indirectly in almost all the portions like stem, bark, root, flowers, fruits, leaves, buds and shoots. In 2007-08, due to insect pests India get suffering from crop loss of about US\$ 36 billion [8]. The deployment of transgenic crops has decrease the pesticide use. Emphasis should have eco-friendly approaches such as use of culture practices, insect resistant varieties, natural enemies, transgenic crops. The biopesticide based strategies is fully exploited to reduce crop losses to the minimum. The IPM programs are used to reduce crop losses without affected the quality of environment.

Dylan B. Smith , Galina Bernharth , Nigel E. Raine , Farah Ahmed reported this protocol is developing which allows fast and cost effective brain reconstruction, and which can be easier to scientific community. The challenge face during research were a) Sample preparation b) Scanning of specimens c) Image segmentation and validating the biological veracity of the data [9]. This protocol describe steps for sample preparation tissues staining Micro-CT scanning and 3D reconstruction and even image analysis.

Arno Thielens, Duncan Bell, David B. Mortimore, Mark K. Greco, Luc Martens, Wout Joseph have implemented the Used of Micro-CT imagining obtaining relativistic models of real insects. This shows the change in insect's behavior, physiology and morphology overtime [10]. Adsorption of RF energy was demonstrated in insects between 10-50Ghz. Voxelling precision in the order of 5-20micrometer is obtained required for accurate electromagnetic simulation. The software used for the 3D model of the insects was TomoMask. This study evaluated that the absorption of RF-EMFs in insects as a function of frequency. All insects show a dependence of the absorbed power on the frequency with a peak frequency that depends on their size and dielectric properties.

Mandeep Rathee, Pradeep Dalal proposed a study on Insects pests causes 15-20% yield loss in food and crops. When climate changes & other agronomic factor has strongly affected diversity. Also, IPM measures are used to manage insect's pests [11]. Increased global trade in agriculture has increased chances of the introduction of exotic pests. Contributing factors towards the future changes in pest problems are climate change, change of genotypes, modification of culture practices, use of high yielding varieties, excessive use of fertilizers, injudicious use of pesticides, absence of natural enemies.

2. ON FIELD SURVEY

To examine the roles and challenges of small holding agriculture in India, we have visited some few farms near by are listed below:

1) Grape farm: we conclude that the pesticides usage on the fruit is for every 2-3 days regularly without fail or else it would damage the yellowish pigment on leaf and grapes as well. The insects harmful or cause is thrips, worms and butterfly.



Figure 1: Grape Farm



Figure 2: Grape Leaf

2) Cauliflower: This needs extra nutrients and requires approx 5-10 fertilizers. Aphid, thrips, cabbageworm these insects affect the cauliflower. At least it takes 2 and half months to growth and fertile



Figure 3: Cauliflower Farm



Figure 4: Cauliflower Tuber

3) Chinese Cucumber: this can be attacked by aphids, cucumber beetles. Cucumber will be ready for harvest in 55-65 days from sowing. There low amount of pesticides is used in a Playhouse setup. Harvesting was conducting by organic methods on field



Figure 5: Chinese Cucumber Polyhouse



Figure 6: Growing Chinese Cucumber

3. CONCLUSIONS

In this review paper, the study of protection on crops from insects with the use of microwave frequency is presented. Protecting the crops yields from different agents including pests, weeds, insects and other organisms that cause damage to the agricultural crops. Thus to yield high crop production, farmers need to protect the crop from these pests and insects. We planned to design a system which radiates microwave frequency in the range of 1GHz. Oscillator is a source of microwave frequency, using oscillator and with the help of antenna it radiated in the farm which protects crops from insects.

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