RESEARCH COMMUNICATION Volume - 10 | Issue - 09 | September - 2021 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

CYBERNETICS AND BOTANY- NOVEL TECHNOLOGICAL APPROACH IN AGRICULTURE.

Botany

Anjali Naik* Associate Professor in Botany, SBES College of Science, Aurangabad (MS)-431001. *Corresponding Author

Asmita Daspute Asst. Professor in Environmental Science, SBES College of Science, Aurangabad (MS)-431001.

ABSTRACT

It is a well-known fact that plants respond to environment in a number of ways. That plants respond to light & water and convert these stimuli to manufacture food is a basic knowledge. Scientists are now trying to harness the sensory abilities of plants like their responses to touch, sound, hearing and smell, and convert these to mechanical or electronic display. These plants are called cyborg plants. Rather than using traditional sensors, scientists are experimenting with plants' innate sensing abilities to create interfaces e.g. sensing (signals inside plants), and response (plant movement, color change, leaves opening/closing, growth etc.), Plants as interfaces as separate but within nature itself. "Plants can sense and they can display the detectable response" is the theme of this review paper.

KEYWORDS

The word "Cybernetics" was first used by Norbert Wiener, in his book from 1948 of that title, as the study of control and communication in the animal and the machine. Nowadays, the term is broadly used to describe "control of any system using technology." There is also a consideration on combining artificial systems with biological systems. Based on this concept development of cyborgs-short for "cybernetic organisms"- has attracted the attention of scientists to combine biological and technical elements.

In agriculture, artificial sensors which are conventionally used devices, that pick up information on physical or chemical conditions — such as temperature, barometric pressure, salinity, humidity, pH, light intensity or radiation — and stores or broadcasts that information. These are external electronic devices set up at regular intervals across a field or greenhouse. These sensors monitor the air or ground for water, for pollutants, nutrients etc. Developing sensors within plants with the help of nanobiotics to sense environmental changes and display their response electronically, is the latest concept that integrates biological inputs from plants and converting them to electronic signal displays. These cyborg plants act as natural biosensors and may be termed as plant-robot hybrids!

Plants' have in-built, natural sensing abilities to create interfaces e.g. sensing of light, moisture, smells, touch etc.(signals inside plants), and response (plant movement, color change, stomata of leaves opening/closing, growth etc.), "Plants can sense and they can display the detectable response" is the theme of developing cybernatic plants. For developing such plants acting as sensors for environmental changes, Nanobionics technology has also been applied which uses nanomaterials on living organisms and helps in creating electronic display of their responses to various stimuli. On the experimental basis, this technology has been used to produce 1. Plant-robots to capture more light, 2. Plant-robots to move plants towards the source of light, 3. Bomb detector Spinach Cyborgs which can successfully detect the presence of explosive materials, and, 4. Electricity storing Roses.

Dr. Harpreet Sareen of MIT Media Lab, has created a robotic plant (wild mustard) that acts like a light sensor. This plant-robot cyborg uses electrodes,light detectors, and wheels to save a plant from perishing.

The plant's leaves can sense the small electrical signals within the leaves that respond to the presence of light.

When there is inadequate light, photosynthesis and food production is hampered.

These plants then detects the light nearby, give signals to the wheels of its robotic planter, which autonomously moves toward the light source. By embedding leaves with carbon nanotubes, Michael Strano, and P. Dubbs at MIT, USA have transformed spinach plants into sensors that can detect nitro-aromatic chemicals in explosives and produce signals by emission of infrared light. Once the camera detects the infrared light, the computer connected to it emails out a warning of detection of explosives and wirelessly relay that information. to a handheld device similar to a smartphone.

Similar pollutant chemical detecting plant sensors can also be devised in future.

Eleni Stavrinidou working in bioelectronics at Linköping University in Sweden successfully created rose plants with the ability to conduct electricity through them by using the ability of plants to produce food through photosynthesis. Plants can take light from the sun and turn it into electrical energy. She and her team developed a PEDOT-S polymer (which conducts electricity) can be absorbed by rose plants turning them into electronic devices .Roses dipped in a solution of carbon polymer, capable of working as transistors to start and stop flow of electrons.The polymer progressively penetrated the flower's vasculature system, where it formed a true electrical circuit, which the researchers confirmed could conduct and store electricity. For the first time ever, Flowers can be used to house biochips.

CONCLUSION:

These are the attempts in bridging characteristic and natural operations of plants with the digital world. Each desired synthetic function is grown, injected carefully or placed in conjunction with a plant's natural functions. The goal of the scientists working in this field is to make use of sensing and expressive abilities of nature for our interaction devices. Merging synthetic circuitry with plant's own physiology could pave a way to make these plants responsive to our interactions. Such carefully constructed and grown Cybernetic plants May be deployed in the improvement of different aspects human life.

REFERENCES:

1. Anne Trafton, 2016 | MIT News Office
2. Kathryn Hulick, Feb 23, 2017 / Science News For Students
3. Rima Sabina Aouf, 2018: www.dezeen.com/2018/12/07/mit-elowan-cyborg-botany-plant-robot-hybrid
4. Stavrinidou, E., Gabrielsson, R., Gomez, E., Crispin, X., Nilsson, O., Simon, D. T., & Berggren, M. (2015). Electronic plants. *Science advances, 1*(10), e1501136.
5. What a Plant Knows (2012): A Field Guide to Senses- Daniel Chamovitz