Original Article

Internet Of Things Based Pest And Growth Management System Using Natural Pesticides & Fertilizers For Small Scale Organic Farming

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DOI: 10.47750/pnr.2022.13.S08.565

Abstract

Pesticides is a biological agent such as antimicrobial, virus, disinfectant or bacterium that incapacitates, deters, kills pests and protect humans from vector-borne diseases such as schistosomiasis, malaria, dengue fever etc. Human health is at danger due to the extreme use of pesticides on plants which also cause rigorous effects on the environments too. Pesticides can cause chronic adverse health effects as well as acute adverse health effects that can take place months or years after revelation. In addition, intentional, unintended or high occupational exposure to pesticides can end result in hospitalization and death. Organic farming is a holistic production management system that uses ecologically based biological fertilizers and pesticides derived mainly from plant wastes, animal and cover crops from nitrogen-fixation. Organic farming uses smaller quantity of pesticides, decrease nitrate leakage into surface water and groundwater, reduces erosion of soil and recycles cattle's wastes back into the farm. Because of environmentally friendly nature of the organic farming it is measured as a feasible alternative in contrast to chemical based farming. Additionally, to pesticides, organic pest control incorporates cultural, genetic and biological controls to diminish pest damage. The advantages the farmers are gaining by adapting the IoT program are twice. It has helped farmers raise crop yields and cut costs. IoT is intimately related to automation, so it requires fewer workers and not as much of human interaction. IoT in organic farming allows obstacles to be removed and all the issues that take place throughout farming processes to be minimized. IoT plays a most important role in detecting the pest infections at the correct time to avoid this crisis. In this paper, We have proposed IoT based pest & growth management system using natural pesticides and fertilizers. IoT based pest management system using organic pesticides involves the acceptance of ecologically sound and scientifically strategies as precise by the international and national organic production standards. This method promotes the development of the plant with enriched vitamins as well as other health factors in the productions of plant.

Keywords: Organic farming, Internet of Things, Organic Pesticides, Organic Fertilizers

1. INTRODUCTION

Pesticides are chemical substances or mixtures of chemical substances that are largely used in public health safety programs or in agriculture in order to defend plants from pests, diseases or weeds. Various microorganisms including protozoans, bacteria and viruses can cause microbial contamination in food processing facilities, hospitals and public health clinics. Antimicrobial products or pesticides anticipated to control theses microorganisms and help out to prevent the extend of numerous diseases. Avian flu, also called bird flu, is an illness that occurs mainly and naturally in birds. Antimicrobial pesticides products used to destroy avian influenza virus on non-living surfaces and to help avoid the increase of avian flu viruses. Insecticides, herbicides, fungicides, rodenticides and plant expansion regulators are typical examples. Deet, Boric Acid, Dursban, Propoxur, Dursban, glyphosate, DDT, Acephate ,Malathion etc are examples of specific synthetic chemical pesticides. These products are also used in other less known applications such as in pet shampoos, maintenance and development of non-agricultural areas like sport fields and public metropolitan green areas, building resources and boat bottoms in order to get rid of or avert the presence of unwanted species, commercial and household uses (e.g., control of termites and roaches).

Many of the pesticides have been allied with environmental and health issues; and the farming use of certain pesticides have been neglected. Disclosure to pesticides can be through contact with the inhalation or ingestion, skin. The route and time period of exposure, the type of pesticide, and the health status of individual (e.g. healthy/injured skin and nutritional deficiencies) which tend to influential factors in the possible health result. Acute (Immediate) health effects from exposure of pesticide includes Nausea, irritation of the throat, nose and skin causing flaming, blisters and rashes as well as itching and stinging, diarrhea, dizziness and death. Chronic (long term) health effects include harm to kidneys, lungs, liver and other body organs; cancer and other diseases; nervous system and brain damage ; birth defects and other reproductive harm; disruption of endocrine system and immunotoxicity. Young children and infants are more susceptible than adults to poisonous effects of pesticides. Farm workers and pesticide applicators are more at risk because they obtain greater exposures.

It has been regarded that the organic food which are being manufactured through the traditional techniques tend to apply the organically generated pesticides and other aspects. The current range of traditionally grown foods covers various dairy related products and other fresh fruits and vegetables. Since the late 20th century, the importance of consuming organic food has evolved exponentially and now is poised to grow multifold n the next 5 years. It also improves and promotes health of agro ecosystem including soil biological activity, biodiversity, and biological cycles. The overall of organic farming are advantageous to the environment. Certified organic manufacture methods excludes the use of synthetic pesticides and fertilizers, thus dropping the pollution of watersheds and soils as well as chemical runoff. Smaller-scale organic farming often is linked with considerable support for the environment and other key aspects. Moreover there is a continued focus on the Large-scale organic food products as the consumers are now realizing on its importance to have a good and healthy lifestyle.

Pest management in organic farming relies on crop rotation, use of organic pesticides, use of resistant crops, raise in predators for pests' natural control and boost in genetic diversity along with the careful use of animal husbandry and water resources. The importance of using organic pesticides are highly welcomed among the producers and farmers as this is mostly created from natural and living organisms like specific bacteria type, they tend to address the issues from insects and other soil related issues in a unique way.

The Internet of Things is the association of devices with software, networking, electronics and sensors that enables the communication, sharing of data and interface between these substances. The IoT technology in farming is more resourceful due to the following reasons:

Connectivity worldwide through any app.
Faster admittance
Efficiency of time
Proficient Communication
Less human efforts

The consequential crop yield increases and reductions in operating costs and overhead make organic farming more competitive. In addition, this can advantage from IoT implementation not just for large-scale agricultural activities, but organic
farms, small family farms or even rooftop gardens. Hence the product worth is increasing and consumers are having strong high-class product. The IoT transforms the agri-tech sector as never before by enabling growers and farmers to conquer the vast challenges they face. Farmers are more likely to be affected by unforeseen changes in the economic downturn, environment and many other hazards. Pests are the greatest adversary of farmers and they harm their crops, so the farmer has to undergo losses or spend lots of money available to save whatsoever is possible. The IoT for weather or climate monitoring is possibly the most admired among farmers. As the devices are united with smart farming sensors and they gather various data from atmosphere and sent it to the cloud to record the environmental condition.

The IoT based pest management system using organic pesticides enable in efficient handling of the infection and protect the plant against harmful pests and other insects. The technology is more user friendly and can enable the producers to effectively use in controlling the pest.

2. LITERATURE SURVEY

R. Venkatesan et. al., (2018) [1] have suggested a research. In this study, they described the management of key products includes the exact moment of using these products and in right quantity help in managing the pest in an effective manner.

Pramoda Kalkura, Puneet Raj B, Suhas Kashyap N, Surya,Mrs. Ramyashree (2021) [2] contributed research. This work describes a software modeling system for pest control using pest identification. Farmers should use an Android app to take photos of pests. The error image must then be loaded into the software. A database of insect images is also retrieved for consideration. The training image set was evaluated against the test images for simplicity. Convolutional neural network classifier is designed to identify insect classes.

Geraldine et. al. (2019) [3] contributed to the research article. The research provides more useful insights on pesticides, and their overall composition and strategies against agricultural pests. The thesis also presents chemical information on specific pesticides, their role in integrated crop protection, their degradation, answer questions and applications for sustainable crop protection.

Oguh CE, Okpaka CO, Ubani CS, Okekeaji U, Joseph PS and Amadi UE (2019) [4] proposed a study. This article describes new types of insecticides with an emphasis on insect characteristics and possible selection of beneficial animals. Many of the newer pesticides used today remain in the soil for several years and increase the build-up of toxins in the air, water and soil. This mixture of materials was found to be harmless to humans, animals and without any effort to harm the environment. Herbicides are generally highly biodegradable and inert and have very low toxicity to animals and humans

due to their ecologically benign nature. This review article explains important natural pesticides, their origin and mode of action, mode of action.

Lukmanul et.al., (2020) [5] contributed a research paper. This thesis deals with natural or biological pesticides for agricultural pests, including bacteria, viruses, herbicides, insects, fungi and pests. Pesticides can be divided into several different categories such as insecticides, antimicrobials and integrated plant protection products. Pesticides are an important part of an integrated crop protection system, resulting in safer and greener alternatives to chemical pesticides. Matthías (2019) [6] on the research has mentioned on the need to analyse thebasic effect of key pesticide towards the control of insects among the crops and also proides the presence of N.tenuiis on the crops

Sumitra Arora, Mukesh Sehgal, D.S. Srivastava, Sanjay Arora and Sushil Kumar Sarkar (2019) [7] contributed a study. In this study, they helped identify environmentally friendly pesticides. To compare and determine risks between NIPM and IPM programs, Environmental Impact Quantification (ELQ) was used as the pesticide risk factor model. Using this model, EIQ values were calculated for 32 commonly used topical pesticides, based on the frequency, amount, and percentage of main ingredients.

Ravesa Akhtar, Shabir Ahmed Sofi (2021)[8] contributed to the research. This research paper states that the application of technologies using IoT data analytics in agriculture will generate new profits by increasing the quality and quantity of products from the agricultural sectors so that the demand for food increases. Such global advances are shaking up the latest agricultural practices and providing new and better opportunities with many proactive measures. The paper explores the potential and power of computing technologies, including wireless sensor networks, machine learning, data analytics and the Internet of Things in agriculture. This articles states a novel method in forecasting the infection among the plants and trees especially on apple also provides the impact of technology development in precision farming from the farmers. These techniques have been incorporated into traditional farming practices.

3. PEST MONITORING AND IDENTIFICATION METHOD

Image processing based methods are used to detect the error in machine learning algorithms. Image processing techniques are used to detect and identify various pests. Automatic extraction and detection is performed using median filters and background models. An image-based insect recognition system using shape feature and support vector machines (SVM) is proposed. A sound sensor monitors the sound level of insects. An ultrasonic pest detector is designed with an infrared sensor, an ultrasonic sensor and integrated into a global system for a mobile communication device. Pests can be detected due to changes in soil moisture, changes in color of plant leaves, changes in temperature using sound sensors. Ultrasonic sensors detect insect sounds by collecting ultrasonic signals generated by the feeding patterns of insects in the field. . There will be a certain frequency

Powered by an ultrasonic sensor that repels or kills crop pests. Sustainable agricultural practices are suggested. This approach proposes an automated information system for organic and resource-intensive agriculture.

3.1. Disease Identification

Sensor nodes are deployed at field locations. End users can monitor data through the sensing layer that provides comprehensive real-time information about the growing area. Data entity management is divided into sensors with wireless communication, network sensor nodes, intelligent data processing systems and analytical data blocking technology. Data transmission and reception takes place in the IOT with the help of a number of sensors that collect, analyze and manage extensive data about plant diseases and pests in the cultivation area.

3.2. Proposed Method

Pesticides containing natural substances like neem, garlic, etc. Plant-killing organic pesticides called organic pesticides can be used to prevent the growth of harmful insects. Water sources and soil are likely to be contaminated with pesticides. Organic pesticides do not harm the surrounding environment. People living in urban or semi-urban areas find it difficult to grow plants in their homes on a large scale. Therefore, the art of gardening has been adopted on a small scale. Figure 1 shows garden vegetables that are widely distributed. Estimate the number of plants to be grown in 5*5 km². The farm seems to me, there is a high probability of plant stress due to many pathogens.

3.3. Determination of Fertilizer

Suitable for all types of vegetables and crops, this IoT-based home gardening system has established organic fertilizers. The inorganic fertilizers used in this process are as follows.

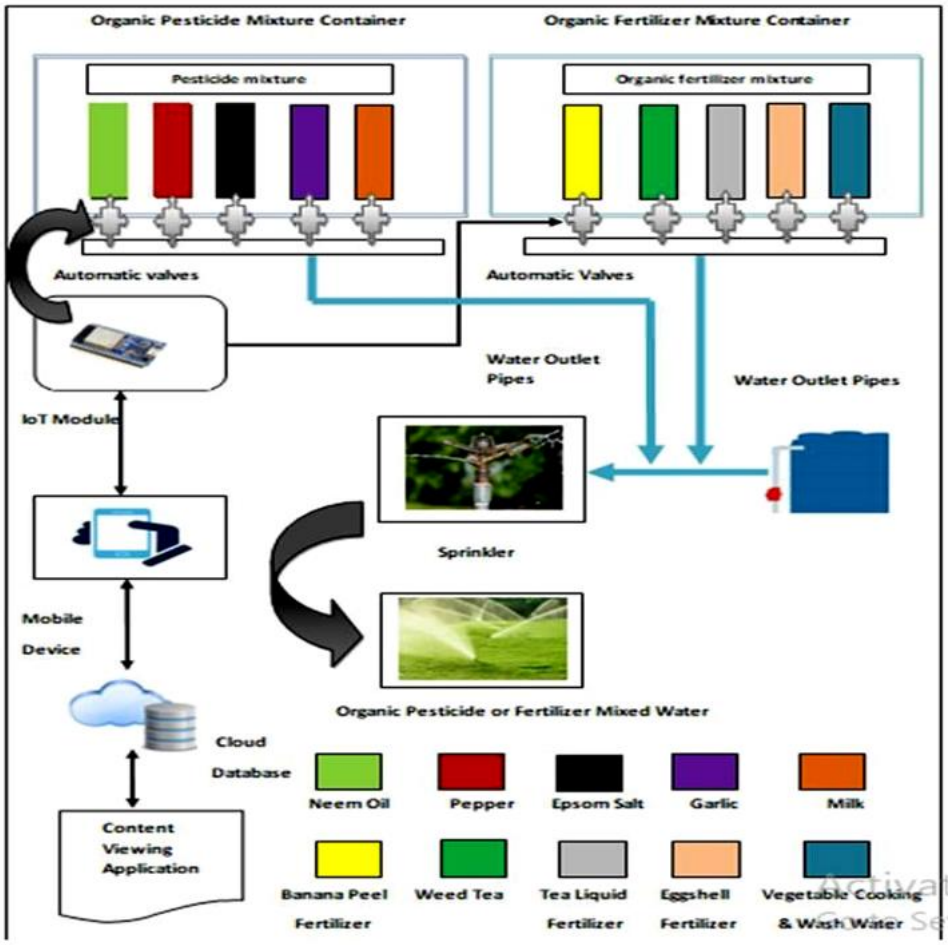

Fig. 1. Proposed IoT based pest & growth management system

Eggshell fertilizer:

Eggshells are loaded with calcium and less amount of potassium. Squash clean eggshells and put in a Mason jar fill with water. After a week or so then eggshell fertilizer is ready to use for plants. It can even help out prevent blossom end rot.

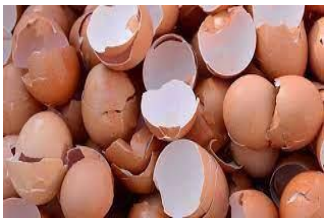

Fig :2 Eggshell Fertilizer

Vegetable cooking or wash water:

This liquid fertilizer contains all the vitamins. We dilute this liquid about half and half with water and sprinkle it to all kinds of plants.

Fig: 3 Vegetable Cooking Water

Weed tea:

Grass and weeds are high in nitrogen and the water help out break them down and make these nutrient elements available for plants. To create weed tea , put grass clippings and weeds in a 5-gallon container. Add water little inches above the weeds, cover up and allowed to marinate for 3 days. Mix this liquid with water in a 1 to 10 ratio. Use this weed tea to water plants.

Fig: 4 Weed Tea

Tea liquid fertilizer:

One of the best liquid fertilizers. Lots of fruits and vegetable plants such as blueberries, tomatoes, roses are blossom best in acidic soil. We recycle used tea to help acidify vegetable soil. first wash the used tea with lukewarm water then put used tea in a 5-gallon container and cover with water and a lid. After few days simply pour off the liquid and dilute this liquid to a 1 to 10 ratio and water acid loving plants with tea liquid fertilizer.

Fig: 5 Tea Fertilizer

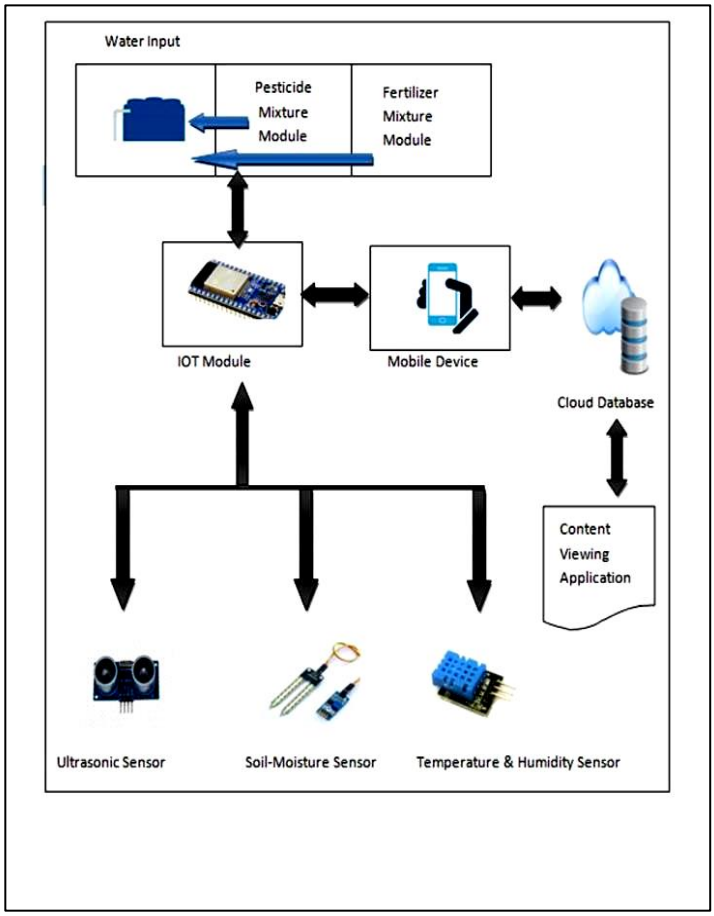

Fig. 6. Proposed IoT based pesticide & growth management system

3.4. Determination of Pesticides

This IoT-based pesticide horticulture system is set up to adapt to all types of vegetables and crops. The following are biological control agents for use in this program.

Neem Spray
Neem oil contains 50 natural pesticides. Neem juice is the world's most effective natural disinfectant. Preferred for its antifungal properties and safe for animals, birds and humans. Neem oil works as a perfect insecticide on insecticidal plants when applied as a top dressing. Neem oil blocks the breathing holes of insects and eventually kills them.

Garlic Spray
Garlic is an inexpensive pesticide used in the garden. It can easily handle pests. This "Green" pesticide smell. Irritating insects that can be controlled with garlic powder include armyworms, beetles, slugs, ants, cockroaches, cockroaches, cockroaches, cockroaches, cockroaches. Garlic paste can be used on all types of vegetables, flowers, plants, fruits and herbs. Garlic paste should be poured under leaves where insects have ample opportunity to lay eggs for protection..

Pepper Spray
To protect the plant from animal and bird attacks, cayenne pepper spray is used because it produces an unpleasant plant. Drinking pepper mixed with water hydrates. Cutworms, aphids, spider mites and lace bugs are pests of cayenne pepper spray. Pepper spray is the best defense against flying insects that feed on the entire plant. To improve crawling insects, cayenne pepper dipped in cayenne pepper can be dusted around the base of the plant.

Epsom Salt Spray
"Epsom salt" is a type of salt originally found in Epsom, England. Epsom salt spray contains water-soluble magnesium chloride, which is important for plant growth.

Milk Spray
Powdered milk blocks the natural antibiotics found in raw milk. One part milk to 9 parts water makes an antifungal home spray that helps reduce fungal infections in plants. The spray helps prevent the growth of mold such as milk mold. Mold is one of the fungal diseases. It can attack all types of trees, plants, vegetables and evergreens. Mold occurs when the temperature is high and humid.

Therefore, people must manually inspect their plants to ensure that pathogens are mainly caused by microbes, bacteria, etc. Instead, in our practice, plants are classified (Figure 1) according to diseases caused by seasons and other conditions and climate changes. In this case, the pesticide mixture is kept in its special container and the flow is controlled all the way through the controlled automatic valve in the mixture container which is connected to the Arduino with the IOT module which allows the automatic flow of the pesticide mixture. controls to maintain inventory by automatically configuring ports in their containers on cloud data centers, mobile devices and displays.
Figure 6 shows the proposed IoT-based pest control system using organic pesticides. This Valves are installed on the drain pipe connected to the sprinkler system. The pesticide mixture is now mixed with water from a tank hose that connects directly to a spray system that delivers pesticide-infused water to the plants. This pest control can also be done by monitoring different plants using sensors like thermal cameras, biosensors, fluorescence for different diseases. and an organic insecticide compound sprayed on infected plants. It can also be combined with a robotic sprayer that mixes pesticides with the spray water. Depending on field conditions, concentrations of pesticides may be added to the water.

The proposed system has advantages
Which can be seen below.
1. Reduction of harmful substances: Organic growth of plants occurs with natural methods.
2. Strictly controlled: All plant diseases caused by biological conditions and pathogens should be monitored regularly.
3. Minimal maintenance: Automatic production makes it easy to reduce the workload.
4. Environmentally friendly: does not harm the surrounding environment, ie. Toxic waste is free and does not pollute the earth andWater source.
5. Adaptable: Can support any type of home or environment.
6. Temperature control: Maintains a constant temperature around the breeding ground. In tropical climates, the cooling effect stabilizes the surrounding atmosphere

Some of the disadvantages are as follows.
1. Area: A defined location/area to be subdivided; A small space cannot be used.
2. Complexity: For beginners, new technology will be difficult to understand.
With very few drawbacks, the new system can be used to improve organic farming for all environments.

4.RESULT
a) Vegetables Productivity
Rajendran et al (1999) has reported thatproduction from organic farming may be less in preliminary years, but the yields augmented increasingly under organic farming equating the crop yields under inorganic crop growing by sixth year.In this research project, we observed the productivity of small vegetable crops for almost 2 years. The study revealed that the production of small vegetable crops after applying this proposed system was less in initial year but the yields increased gradually in 2nd year.

b) Soil Fertility Status

Organic carbon builds up was observed in organically fertilized small vegetable crops. Regular addition of organic liquid fertilizers in a require amount improve soil quality and fertility. There was 29% increase in organic carbon and 10% raise in soil carbon as compared to traditional farming system over a time of only two years. Organic carbon is a good sign of soil excellence because it improves soil biological and physical properties and moreover works as reservoir for nutrients.

c) Produce quality and Nutritional

Security Organic produce food contains more minerals, trace elements, vitamins, enzymes and even cancer fighting antioxidants than traditionally grown food. (Bhattacharya and Chakraborty,2005) The taste, quality and essence of produced vegetables improves using this system mainly through augmented vitamin C, dry matter, protein quality and content, reduces disease and storage losses, reduced free nitrates in vegetables. The produced vegetables have better texture, colour and physical attributes. Organic fertilized tomato, cabbage and pea, the Vitamin C content raised by 25, 10 and 26 percent respectively while lycopene content in tomato get better by 29 percent. Potatoes have more glowing surface than chemically treated tubers.

d) Environmental Sustainability

Produced vegetables have considerably less pesticide residues than traditionally grown vegetables. Organic liquid pesticides naturally break down in the environment, leaving no residual movement after a moderately short time. Using this system, produced crops are significantly lower in nitrate content than traditionally grown vegetables. It is well known that nitrates in foods are injurious for human. Organic liquid pesticides are careful in what pests they control. It can decrease potential damage to non-target species such as pollinators and various others valuable insects.

5. CONCLUSION

The article presents a critical analysis on the adoption of technology in order to enhance the crops production. Chemical pesticides applied to agricultural crops can cause poisoning in humans or other organisms. Most people use toxic pesticides to reduce the pesticide content of their crops, but these harmful pesticides pose many potential environmental and health risks. When organic pesticides contain natural ingredients, they protect the environment and also fight pests. It increases the quantity and quality of the harvest. Thus, insecticides are the best way to handle the pest management process.

REFERENCES

1. Venkatesan Ramachandran, G. Jaspher W. Kathrine, K. Ramalakshmi, (2018), Internet of Things Based Pest Management Using Natural Pesticides for Small Scale Organic Gardens, in Journal of Computational and Theoretical Nanoscience ·
2. PramodaKalkura, Puneeth RajB, Suhas KashyapN, Surya, Ms.Ramyashree (2021), Pest control management system using organic pesticides, Global Transitions Proceedings 2 (2021) 175-180
3. Geraldin M.W.Lengai, James W.Muthomi, Ernest R.Mbega (2019), Phytochemical activity and role of botanical pesticides in pest management for sustainable agricultural crop production, Scientific African 7 (2020) e0023
4. Oguh C. E., Okpaka C. O. , Ubani C. S. , Okekeaji U. , Joseph P. S. and Amadi E. U. (2019), Natural Pesticides (Biopesticides) and Uses in Pest Management- A Critical Review, Asian Journal of Biotechnology and Genetic Engineering 2(3): 1-18, 2019; Article no.AJBGE.53356
5. Lukmanul Hakim Samada and Usman Sumo Friend Tambunan (2020), Biopesticides as Promising Alternatives to Chemical Pesticides: A Review of Their Current and Future Status, OnLine Journal of Biological Sciences 2020, 20 (2): 66.76
6. Marianne A. Soares, Mateus R. Campos, Luis C. Passos, Geraldo A. Carvalho, Marcelo M. Haro(2019), Botanical insecticide and natural enemies: a potential combination for pest management against Tuta absoluta, Journal of Pest Science volume 92, pages1433–1443
7. Sumitra Arora, Mukesh Sehgal, D. S. Srivastava, Sanjay Arora & Susheel Kumar Sarkar (2019), Rice pest management with reduced risk pesticides in India, Environmental Monitoring and Assessment volume 191, Article number: 241