A study on “Pesticide Endosulfan” problem using Neutrosophic Cognitive Maps (NCMs)

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ABSTRACT
In this paper we use a tool called Neutrosophic Cognitive Maps (NCMs) defined by W.B. Vasantha Kandaswamy and Florentine Smarandache in the year 2003. In this paper we study to identify the cause of using Endosulfan in agriculture using NCMs which leads to most dangerous side effects in human beings faced by the peoples of South Indian state of Kerala (Kasargod and Palakkad Dts.). A detailed report on the harmful effects faced by the people with the usage of pesticide in India was telecasted in Star T.V. dated June 24, 2012 “Satyameva Jayathe” anchored by film star Amir Khan.

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Definition 1.8: If the equilibrium state of a dynamical system is a unique state vector, then it is called a fixed point. Consider the NCM with C₁, C₂, ..., Cₙ as nodes. For example let us start the dynamical system by switching on C₁. Let us assume that the NCM settles down with C₁ and Cₙ on, i.e. the state vector remain as (1,0, .... ,0, 1). This neutrosophic state vector (1,0, .... ,0, 1) is called the fixed point.

Definition 1.9: If the NCM settles with a neutrosophic state vector repeating in the form
A₁ → A₂ → .... → Aᵢ → A₁, then this equilibrium is called a limit cycle of the NCM.

Definition 1.10: Let P be the problem under investigation. Suppose let {C₁, C₂, ..., Cₙ} be n concepts associated with P (n very large). Now divide the number of concepts {C₁, C₂, ..., Cₙ} into classes S₁,...,St where the classes are such that
(1) Si∩Si+1 = Ø where (i = 1,2,...,t-1)
(2) U Si = { C₁, C₂, ..., Cₙ }
(3) |Si| ≠ |Sj| if i ≠ j in general.

Now we obtain the NCM associated with each of the classes S₁,...,St. We determine the relational matrix associated with each Si, . Using these matrices we obtain a n × n matrix. This n × n matrix is the matrix associated with the Combined Overlap Block NCM (COBNCM) of blocks of same sizes.

Definition 1.11: Finite number of NCMs can be combined together to produce the joint effect of all NCMs. If N(E₁), N(E₂), ..., N(Eₚ) be the neutrosophic adjacency matrices of a NCM with nodes C₁, C₂, ..., Cₙ then the combined NCM is got by adding all the neutrosophic adjacency matrices N(E₁),..., N(Eₚ). We denote the combined NCMs adjacency neutrosophic matrix by N(E) = N(E₁) + N(E₂)+.....+ N(Eₚ).

“Problem definition and Justification for using NCMs Model”

Endosulfan is a polychlorinated hydrocarbon pesticide used in agriculture. Endosulfan introduced in 1950s, it emerged as a leading chemical used against a broad spectrum of insects and mites in agriculture and allied sectors. Endosulfan was introduced at a time when environmental awareness and knowledge about the environmental fate and toxicology of such chemicals were low and not mandatory as per national laws. But now it is being detected as an important cause of pesticide poisoning in many countries. It has been identified with a range of chronic effects including cancer, cerebral meningitis, skin diseases, vision loss and mental disorders and infertility of women. Endosulfan is widely considered to be a Persistent Organic Pollutant (POP) but was not included in the initial list targeted for phase out under the Stockholm Convention.

The purpose of the study is to identify the cause of using endosulfan in agriculture which leads to most dangerous side effects. Usage of endosulfan is most likely to occur when the need for food production increases. Prevention of usage of endosulfan depends on the effects of Govt. and local citizen organizations to the preventive and proactive measures. Moreover the data is an unsupervised one and also there is uncertainty and indeterminacy in the concepts. Hence Neutrosophic tool alone has the capacity to analyse these concepts. Hence it is chosen here.

Adaption of NCMs to the problem

Using the linguistic questionnaire and the experts opinion we have taken the following eight concepts {C₁, C₂, ..., C₈}.

The following concepts are taken as the main nodes for our problem.
C₁ – Population increases
C₂ – Increase of food productivity
C₃ – Need for pest control
C₄ – Availability of Endosulfan easily
C₅ – No awareness of the effect of Endosulfan
C₆ – No knowledge on alternatives to Endosulfan
C₇ – Govt. indifference to the owners of farms for using Endosulfan.
C₈ – No strict punishment from the Govt side for the usage of Endosulfan in farms.

Now we give the neutrosophic graph with C₁, C₂, ...,C₈ as nodes and also the neutrosophic directed graph with the same nodes.
In vegetable cultivation many fields trials have been carried out on alternative pest control methods focusing on herbal pesticides. In some studies, botanical pesticides were found more effective than endosulfan in controlling greenhouse pests. In Asian region farmers have developed their own combinations and methods of pest control using chillies, garlic, asafetida, cow urine and many other plant materials. Many cashew farmers have tried organic method and application of neem oil. Alternative pesticides and organic farming are encouraged in tea plantations and the use of endosulfan is being eliminated. Sadly, [1] awareness about non pesticide management is negligible in our country. Subsidies to be implemented on organic farming and use of insecticides need to be stopped on an immediate basis. There is anyways enough stress and other kinds of pollution that is harming us. We don’t want our foods to be harmful as well. Let us all raise a voice!

Reference