

# Chapter 1

## Fuzzy Expert System in Agriculture Domain

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### ABSTRACT

*Agriculture is an important source of livelihood and economy of a country. Decision making plays an important role in various fields. Farmers are the backbone of agriculture. They need expert systems to make decisions during land preparation, sowing, fertilizer management, irrigation management, etc. for farming. Expert systems may suggest precisely suitable solutions to farmers for all the activities. Uncertainty deals with various situations during sowing, weed management, diagnosis of disease, insect, storage, marketing of product, etc. Uncertainty is compounded by many facts that many decision-making activities in agriculture are often vague or based on perception. Imprecision, vagueness, and insufficient knowledge are handled using the concept of fuzzy logic. Fuzzy logic with expert systems helps find uncertain data. Fuzzy expert systems are oriented with numerical processing.*

### INTRODUCTION

Agriculture sector plays an important role for mankind and three fourth of the entire population in India depends on agriculture. Agriculture is very crucial for the society which we live, the food item we eat, clothes we wear and job we do. 18% of Indian gross domestic products and 50% of employment depends on agriculture. India is the world largest producer of rice, wheat, pulses, spices and its products. Computers and Information technology has made its way to all the crops and update information for decision making. In this competitive world, to succeed in farming the use of computer and its technology helps in decision making. Farmers need advice in all the farming activities such as land preparation, sowing, irrigation management, fertilizer management, pest management and storage for production of crops. The decision making technology provides the farmers with right information at right time, which helps to enhance the yield of agriculture.

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Artificial intelligence is branch of computer science, the machine behaves in a way as human thinks and considered as an intelligent system. Expert system is an application-oriented branch in Artificial Intelligence. Expert system helps to model the knowledge of experts in needful areas such as diagnosis, planning, forecasting etc. Expert system is not only constructed with knowledge but also the experience of domain experts is used. The system can be operated by less educated person or layman. Many decision making application has been developed in the crop growth and pest population areas. PESTDEC (G.G Wilkersan and J.W.Mishoc,1990) model was developed for soybean growth and velvet been caterpillar to improve the decision making capabilities. In agriculture, the problems are always imprecise, uncertain and unknown information. The results from the expert system are colorfully expressed to improve the decision making. In the field of agriculture, the expert system gets knowledge from individual areas such as Agronomy, Plant pathology, Crop Physiology, Entomology, Agricultural Meteorology, Horticulture, Processing into a framework for farmers.

Fuzzy logic is one of the soft computing methods. Soft computing is used in the area if the information is impreciseness, vagueness and thus gives simple, quick and adequate solution for the problems. Fuzzy logic (FL) is a powerful reasoning method to handle uncertainties and vagueness. Mathematical principles are used in FL to represent knowledge with membership rather than crisp membership function used in classical binary logic (Lotfi A Zadeh, 1965). Fuzzy logic in expert system handles imprecise information in the field of agriculture which gives good outputs. Fuzzy expert system uses Fuzzy logic, membership function and rules for reasoning about data. In Fuzzy expert system expertise knowledge are applied to solve problems, classification and modeling in diverse area of Agriculture.

## **FUZZY LOGIC**

Fuzzy logic acts in the way as that of human. It helps to model our sense of word and from that, the decision are made. As it thinks like a human, it is termed as intelligent system. Fuzzy logic follows many value logic in which truth values of each variable shape is real numbers between 0 and 1. In computer science, fuzzy logic handles imprecise and vague, ideas may be represented as “low”, “medium” or “high”. Fuzzy logic used in the field of agriculture for decision making.

### **Characteristics of Fuzzy Logic**

The Characteristic of fuzzy logic are (Chennakesava R. Alavala, 2008)

1. Fuzzy logic deals with matter of degree.
2. Fuzzy logic deals with exact reasoning; it does not deal with approximate reasoning.
3. In fuzzy logic, knowledge is the collection of fuzzy constraints as variables.
4. Elastic constraints are propagated during the process of Inference.

Fuzzy logic is a powerful reasoning method to handle uncertainties and vagueness. FL uses mathematical approach to represent knowledge with membership functions rather crisp membership function are used in classical binary logic (Lotfi A Zadeh, 1965) which was coined by Lotfi A Zadeh. Normally traditional logic uses true and false values, while fuzzy logic values between Zero and One to define the degree of truth. FL helps to frame words, with the help of words; rules are derived (Lotfi A Zadeh,

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