Chapter 10
A Predictive Fuzzy Expert System for Crop Disease Diagnostic and Decision Support

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ABSTRACT

Soybean accounts for 38% of the total oilseed production in India, and around 50% of the total oilseed production in Kharif season. This crop has shown tremendous growth over the last four decades with an average national yield of 1264 kg/hectare. Currently, soybean is severely attacked by more than 10 major diseases. Yield losses due to different diseases ranges from 20 to 100%. Timely detection of soybean crop disease would help farmers save their money, effort, and crop from being destroyed. This chapter presents a case study on the development of a decision support system for prediction of soybean crop disease severity. The outcome of this system will aid farmers to decide the extent of disease treatment to be employed. Such predictions make use of human involvement, and thus are a source of ambiguities. To deal with such ambiguities in decision making, this decision support system uses fuzzy inference method based on triangular fuzzy sets.

INTRODUCTION

Agricultural production and food security are two interwoven aspects that determine the future of a developing nation. In India agriculture is an important economic sector that looks to improve the methods and other processes in order to obtain good results and to increase the productivity. Drivers like market structures, ecological conditions, and political climate influence the agriculture in India. Thus, appropri-

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ate solutions are required that considers these dynamic and interwoven drivers and variables (Ahearn et. al., 1998 & Nehru and Dhareshwar, 1994). Viewpoints of various stakeholders are also important while providing solution (Meynard et. al., 2017).

In India, Soybean is mainly grown in the province of Madhya Pradesh, Karnataka, Maharashtra, Rajasthan, Chattisgarh, and Gujrat. This important crop is having a great potential of lessening the protein energy malnutrition and at the same time becoming ideal food of this malnourished country. In the beginning, Soybean was free of diseases and insects in India, whereas ongoing cultivation and continuous increase in area has led to enhancing insects, diseases and other issues. Figure 1 shows different factors, including biotic and abiotic diseases, socio economic factors, weather conditions, land, labour etc., that affect the production of Soybean in India. Since many years, the cultivation of this crop has been implemental in improving the soci-economic structure of a significant number of farmers in the rain-fed agro ecosystems of India (Narolia et. al., 2017). Every kind of agricultural planning has some role to play, and that is reasonable as not all are completely controllable.

Perspectives on agricultural innovation, rural development and hi-tech changes in cultivating frameworks are liable to a noteworthy change in viewpoint. Agricultural development services increasingly work with a participatory methodology. They put forward the farmers as the chief decision makers, extension workers as process catalyst and scientists as knowledge sources. The previous development strategies deserted the variety of developments that developed from the perception of the farmers (Fazey et. al., 2014).

Presently the agricultural diagnostics consider a context-mechanism-outcome trail and also the on-farm research and social surveys are the elements of the change process (Raymond et. al., 2010). These

Figure 1. Factors affecting soybean production