

A review paper on decision support system/expert system developed on mango

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ABSTRACT

Agriculture being a primary source of income in the country is the backbone of Indian economy. And being a primary and important source of income, ICT has played a significant role in the extension services and information sharing in agriculture. To get high yield and high profit, farmers require advance or expert knowledge to take decision during soil preparation, seed selection, fertilizer management, pesticide management, water scheduling, weed management. Decision Support System are now being used into agriculture sector and are proved to be most efficient tool for interchange of knowledge and facts. This paper explains need of DSS in agriculture and review of various DSS/expert systems in agriculture. A Project on DSS on Mango for U.P. state according to various Agro-climatic zones of India has been proposed as mango is one of most important horticultural crop and has a wide distribution all over the country.

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INTRODUCTION

Decision support systems is a computer programme that contains expert knowledge about a particular problem domain, that is able to solve the problems at a Level equivalent to or greater than human expert (Fadzilah and Nureize 1928). It can be either fully automated or human-powered or a combination of both (Ramil and Suhaimi, 2008). It can be used as training tool in agriculture sector, because of its explanation facility. The system needs to achieve the expert knowledge, to achieve the target of high yield, so that depending on that information, farmers can take appropriate decision. DSS focuses on the flexibility and adaptability to

accommodate changes in the environment and the decision making approach of the user (Prasad and Babu, 2006; Baig *et al.*, 2005 and Castro and Garcia-Torres, 1995). DSSs include knowledge-based systems and acts as an interactive software-based system to help decision makers compile useful information from a combination of raw data, documents and personal knowledge or business models to identify and solve problems and make decisions (Goodell *et al.*, 1990).

Need of DSS in agriculture:

Need of information support:

In this information age, the available information

from various sources is growing at remarkable rate and this information is primary requirement and considered as the heart of Agriculture. Numerous researches are being performed and new results are discovered at the research Institutions (Yelapure and Kulkarni, 2012 and Mishra *et al.*, 2014). These results are accumulated in the form of reports and dissertation. The work performed by the researchers in the labs do not till the implementation level due to lack of proper channel between researcher and farmers (Dath and Balakrishnan, 2013). The lack of proper decision support system to disseminate timely, relevant farming advice has been observed as a major block for adopting researcher advice (Prasad and Sinha, 2002 and Negied, 2014). So need of hour is virtual expert who can give personalized expert advice to a large community of farmers, specific to their need and aspiration considering various knowledge bases, since it is almost impossible for any human expert to consider every piece of available information before arriving at optimal decisions (Khan *et al.*, 2008; Edrees *et al.*, 2003 and Tatte and Nichat, 2013). But these DSS have some inherent drawbacks and they do not provide recommendation like human expert (Roach *et al.*, 1985 and Salunkhe and Rai, 2014).

Expert system for decision making:

The conventional decision support system has predefined set of input data. The data is preceded as directed by the algorithm to reach the conclusion and results. Algorithm is always an important part of any IT too development as knowledge is represented in the form of Algorithm (Sasmito, 2011). If knowledge of problem gets changed then Algorithms need to be changed or rebuilt. Also solving new problem in same domain needs to develop new system. Against this, human expert tend to follow intellectual approach rather than algorithm (Babu *et al.*, 2012). The expert system works with cognitive approach so that the changes in knowledge do not change whole structure of the developed system.

Review of different DSS/ expert system in agriculture sector:

The primary objective of DSS is to significantly enhance the capacity of (smallholder) farmers, retailers and extension agents by providing localized advice. The advisory service will be customized, combining advanced geo-data and better agronomic practice into actionable crop-specific advice for farmers. Below are the DSS which have been developed by Indian Council of Agriculture and Research on different crops.

Indian Institute of Pulses Research has developed

a web-based PulsExpert system (Devraj and Jain, 2011) for the major pulse crops namely chickpea, pigeonpea, mungbean and urdbean. The puls expert contains information related to diagnoses of the disease and identification of insects affecting the crops and suggesting preventive and control measures.

Indian Institute of Horticultural Research Institute, Bangalore developed an expert system for the grape cultivators to help the field personnel to give timely and correct advice to the farmers. It determines the best strategy required at certain times by the farmers (Jamsandekar and More, 2013).

Expert System on Seed Species (EXPSS) is developed on seed species by IASRI (<http://www.iasri.res.in>) and covers 10 seed species namely ajwain, anise, caraway, cumin, cerely, coriander, dil, fennel, fenugreek, nigella and provides complete information about seed management. It guides farmers in diagnosis of pests and diseases for seed species and suggest preventive/curative measures.

Expert System on Maize (Agri Daksh) (Yadav *et al.*, 2012 and Marwaha, 2012) is developed by IASRI. It has five parameters *i.e.* variety selection, cultural practices, disease diagnosis, insect identification and post harvest technology.

Decision Support System for insects pests of rice and cotton based cropping systems is also developed by Central Research Institution for Dryland Agriculture, Santoshnagar, Hyderabad (Coughlan and Huda, 2008; Patel and Kadam, 2016 and Prasad *et al.*, 2006).

The Decision Support System developed on Mango crop are Amarpalika, Mango Resources Information System, Management of Malformation Disease of Mango, Mango production information system.

Amarpalika:

An expert system for the diagnosis of pests, diseases and disorders in Indian mango. Amarpalika (Rani *et al.*, 2011).) diagnose 14 different pests including eight diseases and six insects in Indian mango varieties. The proposed expert system makes diagnosis on the basis of user response made against queries related to particular disease symptoms. The knowledge base of the system contains knowledge about symptoms and remedies of 14 diseases of Indian mango tree appearing during fruiting season and non-fruiting season.

Mango resources information system :

Mango resources information system (Akankasha and Deep, 2014 and Rajan *et al.*, 2013) was developed for management of phenotypic, genetic, molecular, chemical and other available information on indigenous and exotic mango cultivars. The information system is enriched with 682 accessions with the details of fruit, leaf and other characteristics. It has a collection of 26 expressed sequence tag (EST) and 285 nucleotide sequences present in mango varieties which contains complete and partial genomic sequences having the molecular type, generally genomic DNAs, m-RNAs and unassigned DNAs. The protein information section is enriched with a collection of proteins present in different cultivars of mango. A description of various chemical components of different *Mangifera* species and cultivars are included in this information system.

Expert system for management of malformation disease of mango:

The expert system for management of malformation disease of mango (ESMMDM) is a crop and disease specific expert system for crop protection. It has been developed for the use of farmers and agriculture extension workers and predicts the incidence of the malformation disease in the mango crop and suggests an appropriate integrated management scheme for its cure. Etiological and epidemiological knowledge accumulated from long-term research under both laboratory and field conditions have been used in this expert system (Hasan *et al.*, 2015 and Chakraborty and Chakrabarti, 2008).

Agri exchange:

Agri exchange (APEDA, 2011) is the name given to the Trade portal. An attempt, first of its kind has been endeavoured by APEDA, Govt. of India, where online trading is the specialty. The portal has been provided a shape by the joint collaboration of UNCTAD and Ministry of Agriculture. A global platform has been provided to buyers and sellers in the Agri business world to offer negotiate and transact a deal. Up to date information on the 612 products (approx) related to APEDA and products that does not falls under the purview of APEDA has been hosted on the portal and reliable data sources like UN Comrade, FAO and DGCIS has been used for

the statistics.

Mango production information system :

The Mango production information (Camungao *et al.*, 2013) system is a web-based information system that provides all related information about the production of mango to farmers. The design and development of a web-based information system provides a faster dissemination about mango. The web-based information systems cover the information on mango varieties, products and also include the parts and stages of growth of a mango. The presence of a web-based information system on mango production is very efficient and reliable with such information facts about mango plants, nutritive value, products and management of mango pests and diseases.

Conclusion:

Various systems have been developed on Mango and other crops. But there is no system available on Mango for U.P. state according to different Agro-climatic zones of India and as IT system is a technological way to deliver agricultural knowledge from books, research papers, thesis etc to actual implementation level *i.e.* at Growers, so the work is undertaken at National Research Centre, New Delhi. Application of expert systems and DSS in agriculture sector have become popular due to increase in the use of Information and Communications Technology (ICTs) has brought significant benefits to the agricultural sector, such as improving households' agricultural production, generating new job opportunities and encouraging people to adopt healthier practices and more effective risk management techniques. Recent research shows that ICTs can play an important role in farmers' ability to access agricultural information and extension services.

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