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S Sridevy
Associate Professor, Department of Computer Science, Physical Sciences & Information Technology, AEC&RI, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

M Djanaguiraman
Associate Professor, Department of Crop Physiology, Crop Physiology, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

Corresponding Author:
S Sridevy
Associate Professor, Department of Computer Science, Physical Sciences & Information Technology, AEC&RI, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

A Glance at agricultural decision support systems

S Sridevy and M Djanaguiraman

Abstract
Recent years in agriculture, there have been a lot of constraints such as climatic change, water scarcity, shrinking of lands due to human encroachment, labour shortage, soil nutrition, pests and diseases etc., which leads to decline in agricultural productivity. In order to feed the growing-hungry population, there is a need for strategic and tactical management in agriculture to increase the yield. Decision Making Process (DMP) plays a vital role in meeting the population requirements. Leveraging Information Communication Technology (ICT) in Agriculture aids in the development of decision making information system called Decision Support System (DSS) that helps the farmers to take suitable decisions in a timely manner for maximizing productivity and reducing inputs and their costs. DSS is integrated with simulation models, databases for soil, weather and crops, statistics and other information technologies. It is a relevant, timely, user-friendly system to assist and manage crop cultivation and suggests the appropriate site-specific agronomic practice and recommendations to the farmers without affecting the environment. Parameters such as weather, soil properties, water level and pest and disease incidence are taken into consideration in DSS thereby facilitating the crop management. The main goal of DSS is to increase the agricultural productivity by utilizing the available limited resources. This paper reviews the DSS in existence and their benefits in agriculture.

Keywords: decision making process, crop management, simulation models, site-specific agronomic practice recommendations, information communication technology

Introduction
Traditional methods of agriculture which include ploughing using bullocks followed by plough, sowing based on crop calendar, irrigation methods such as furrow irrigation, basin irrigation, fertilizers and manure application and harvesting were practiced by farmers based on the knowledge acquired from the ancestors. But, in the present scenario, due to various constraints in agriculture, farming community requires an advanced technology to maximize their productivity which can be satisfied by an information system called Decision Support System. Due to water scarcity, it is not so possible for furrow or basin irrigation where the loss of water occurs as well as the growth of weeds exists. This can be overcome by the drip irrigation system and tile drainage. Through DSS, the field can be irrigated on the basis of soil moisture contents thereby reducing water loss. Soil nutrients play an important role in plant growth. Soil nutrients do not remain constant on all places. It varies from place to place. When fertilizers are applied on to the field to enrich the nutrients manually, it may result in excess or deficit. Through Variable Rate Technology (VRT), fertilizers can be applied to the field based on the soil requirements. Major agricultural loss is due to pests and diseases. Disease occurs when the weather is favourable for the pathogen to survive. Diseases can be forecasted by the weather forecasting system integrated with DSS. Farmer, being not aware of the future market value may sell his/her produce in the market which does not yield the desired profit. Through Market Information System (MIS), it can be overcome thereby the produce can be sold in the market at appropriate time for profitable market value. Post harvesting loss can be avoided by weather forecasting system as well as market information system.
Thus, Information Technology (IT) is utilized for aiding the agricultural practices.

Decision support Systems
Different authors have defined the term DSS (Decision Support System) in various ways based on their point of view. Some of them are:
According to Finlay (1994), DSS is a computer based system that aids the processing or decision making [1].

Turban (1995) has defined it specifically as "an interactive, flexible and adaptable for supporting the solution of a non-structured management problem for improved decision making" [2]. Sprague and Carlson (1982) described DSS as "interactive computer based systems that help decision makers to solve unstructured problems using data and models" [3].

Architectural components of DSS

According to Sprague and Carlson (1982), DSS consists of Database Management System (DBMS) which stores information, Model Base Management System which integrates models and dialog generation & management system which provides user interface to manage system [3].

Applications of DSS in agriculture

1. Nutrient management
2. Irrigation management
3. Pest and disease management
4. Weather forecasting
5. Crop Simulation
6. Marketing

Nutrient Management

Nutrient is essential for the plant growth. If the soil nutrient is insufficient for the plant, it is enriched with the application of fertilizer. Soil nutrient varies from place to place, hence the requirement of nutrient varies accordingly. The constant application of fertilizer throughout the field may lead to either surplus or deficit conditions. Thereby efficient utilization of fertilizer reduces fertilizer costs and at the same time increases the yield without affecting the environment. Site-specific Nutrient management is practiced efficiently with the help of DSS. Some of the DSS on Nutrient management are

FarmN is a web-based farm model for nitrogen management that assist farmers on the production and losses of N on a particular farm [4]. PLANET (Planning Land Applications of Nutrients for Efficiency and the Environment) is anutrient management decision support system for farmers to adopt best management practice in the use of organic manures and fertiliser [5]. Decision Support System on fertilizer recommendation in crops developed in India is useful in maintaining soil health by utilizing optimum resources [6].

Irrigation Management

Water is one of the challenges among farmers. There is a great demand for water in today's world. Water scarcity is the major problem faced by the farmers. On account of this demand, there is a need for the technology to meet the farmers requirements. This can be solved by Decision Support System. Hydro-Tech is an irrigation decision support system that helps in determining crop water requirements and irrigation scheduling in real-time irrigation management [7]. CropIrri is an irrigation management decision-making system thataids in irrigation plan by predicating soil water content in root zone and crop water requirements using meteorological data [8]. Trop Rice is an integrated rice management system used for irrigated rice areasin Asia.

Pest and Disease Management

Plant protection plays an important role in determining yield and quality of the agronomic produce. Pest and Disease Management DSS has to be integrated with weather forecasting DSS as weather plays a major role in the disease occurrence. Disease occurs when a weather favours the pathogen the pathogen to survive. One of the insect forecasting tools is SOPRA which renders monitoring, managing and providing control measures for the diseases [11]. RICEPEST is a pest management model simulating yield losses due to various rice pests. This model is widely used in Tropical Asia [12]. Grape MilDeWs is an expert based DSS for Integrated Pest Management against grapevine powdery mildews and downy mildews caused by *Eryisiphenecator* and *Plasmoparaviticola* respectively [13]. Mobile based Expert System (ES) has been developed in TNAU which consists of three components. One of the components is the Crop Doctor which provides the symptoms, identification and control measures of a disease through which the disease can be interpreted by comparing the direct observation of primary and secondary symptoms of a diseased plant with the images in the ES [14].

Weather Forecasting

Weather forecasting plays an important role in sowing, irrigation, disease prediction, harvesting etc. The primary function of weather based decision support system is to forecast the weather and facilitates the planning for sowing and harvesting. During harvesting, if it rains, there occurs a huge loss to the farmers. It can be avoided by forecasting the weather. Farm specific Agro Advisory Service is provided in which farmers database is created, weather based as well as other farm related advisories are sent to the farmers through SMS. Even smallholding farmers are benefited by these services [15-17].

Crop Simulation: Information need for agricultural decision making at various levels has been increasing rapidly due to increasing demand for agricultural products and increased pressure on land, water and other natural resources [18]. The DSSAT (Decision Support System for Agro technology Transfer) based crop models have been used extensively in predicting the growth and yield of crops of about 42 crops, as a crop management tool and in climate change studies. DSSAT basedmodels are used for evaluating various agronomic practices for optimum crop production [19].

Market Information System (MIS) [20].

Farmer's effort from tillage to harvest relies on effective marketing. As agricultural products are of different nature (perishable, bulkiness, price fluctuations etc.,) than industrial products, they has to be marketed at right time with right price with an accurate market information. This can be achieved with the help of MIS. FAO defines MIS as "A service, usually operated by the public sector, which involves the collection on a regular basis of information on prices and, in some cases, quantities of widely traded agricultural products, from rural assembly markets, wholesale and retail markets, as appropriate, and dissemination of this information on a timely and regular basis through various media to farmers, traders, government officials, policymakers and others, including consumers". The main purpose of MIS is to provide timely and accurate market information thereby helping the farmer's and entrepreneurs in effective marketing decision making. Market intelligence systems and marketing information models are designed to provide marketing insights and support the decision makers [21].

Some of the MIS and it's services

a. **e-Choupal system of ITC:** Farmer's are accessed with the different agricultural crop-specific websites via internet kiosks which is set up in the village. The e-Choupal is connected to the websites created in local languages for the targeted farmers.
b. **National News Service (NNS):** The MIS services include market research and analysis on specific products, frequent updates on demand and prices of products.

Indian Agribusiness Systems Private Limited (IASL):
It provides the information on

- prices at major national and international markets
- price trend forecasting
- crop forecasting
- weather news and its impact
- demand supply analysis
- expert opinion

It also provides daily details on prices, arrivals and stocks from major agricultural markets in India.

c. **Agriculture MIS of Indian Government-Agmarknet:** To ensure fair returns to farmer's, Government of India had initiated several measures such as regulated markets, co-operative markets etc., But, Farmers are not benefited much due to the absence of timely and accurate agricultural market information to make good marketing decisions. To address this issue, Government of India has started a scheme called "Agricultural Marketing Information System Network (AGMARKNET)" that establish an information network for speedy collection and dissemination of market related information, price related information, infrastructure related information thereby improving efficiency in agricultural marketing.

Conclusion

In ancient times, Farmers did not have mobile phones and they were unaware of the technologies and development. Now, Due to advanced development in technology, there is an increased reachability and accessibility of mobile phones among farmers. Through which they acquire knowledge on agricultural practices and started to implement technologies to maximize their productivity and their income. Thus, this paper reviewed the benefits of Decision Support System in Agriculture.

References

1. Finlay PN. Introducing Decision Support Systems. NCC Blackwell; Blackwell Publishd'žžers, Oxford, UK; Cambridge, MA; c1994.
2. Turban E. Decision support and expert systems: management support systems. Prentice Hall, Englewood cliffs, NJ; c1995.
3. Sprague Jr RH, Carlson ED. Building Effective Decision Support Systems. Prentice-Hall, Inc., Englewood Cliffs, NJ; c1982.
4. Jorgensen MS, Detlefsen NK, Hutchings NJ. Farm N: A decision support tool for managing Nitrogen flow at the farm level. EFITA/WCCA; c2005.
5. Gibbons MM, Fawcett CP, Warings RJ, Dearne K, Dampney PMRD, Richardson SJ. Planet Nutrient Management Decision Support System–A standard approach to fertilizer recommendations. EFITA/WCCA; c2005.
6. Vishwajith KP, Bhat A, Sahu Pradip. Decision support system for fertilizer recommendation: A case study. Indian Journal of Agronomy. 2014;59:344-349.
7. Todorovic Mladen, Riezzo, Erminio Efisio, Buono V, Zippitelli Mario, Galiano A, *et al*. Hydro-tech: An automated smart-tech decision support tool for eco-efficient irrigation management. International Agricultural Engineering Journal; c2016;25:44-56.
8. Zhang Yi, Feng Liping. CropIrri: A Decision Support System for Crop Irrigation Management. IFIP Advances in Information and Communication Technology. 2009;317:90-97. 10.1007/978-3-642-12220-0_14.
9. Bell MA, Chung CL. Trop Rice: A decision support tool for filling the researcher farmer knowledge gap. In: Roetter, R., Van Keulen, H., Laborte, A.G., Hoanh, C.T., Van Laar, H.H. (Eds.), Systems Research for Optimizing Future Land Use in South and Southeast Asia. SysNetREs. Pap. Ser. No. 2. Los Banos (Philippines), International Rice Research Institute; c2000; p. 217-266.
10. Damos P. Modular structure of web-based decision support systems for integrated pest management. A review. Agron. Sustain. Dev. 2015;35:1347-1372.
11. Samietz J, Graf B, Hohn H, Schaub L, Hopli HU. Forecasting tool SOPRA. Paper presented at the EPPO Conference on 'Computer Aids for Plant Protection' in Wageningen, the Netherlands; c2006 October.
12. Willocquet L, Savary S, Fernandez L, *et al*. Structure and validation of RICEPEST, a production situation-driven, crop growth model simulating rice yield response to multiple pest injuries for tropical Asia. Ecol Mod. 2002;153:247-268.
13. Léger Bertrand, Naud Olivier, Bellonmaurel V, Clerjeau M, Delière L, Cartolaro P, *et al*. GrapeMilDeWS: A Formally Designed Integrated Pest Management Decision Process against Grapevine Powdery and Downy Mildews; c2010. 10.4018/978-1-61520-881-4.ch012.
14. Abinaya A, Arthy KG, Karthickeyan C. Perception of farmers over mobile application on Tnau expert system.
15. Sehgal V, Singh M, Verma R, Vashisth A, Pathak S. DSS for monitoring agro-meteorological and crop conditions in India using remote sensing for agro-advisory services; c2015.
16. Soyemi Jumoke, Adesola Adesi. A Web-based Decision Support System with SMS-based Technology for Agricultural Information and Weather Forecasting. International Journal of Computer Applications. 2018;180:1-6. 10.5120/ijca2018916338.
17. Lahiri B, Borah S, Marak N, Anurag T. Development of mobile phone based agro-advisory system through ICT mediated extension approach in North-eastern Himalayan region of India. Journal of Applied and Natural Science. 2017;9:1808-1814. 10.31018/jans.v9i3.1443.
18. Jones JW, Hoogenboom G, Porter CH, Boote KJ, Batchelor WD, Hunt LA, *et al*. The DSSAT cropping system model. European journal of agronomy. 2003 Jan 1;18(3-4):235-65.
19. Hundal S, Kaur P, Singh H, Ghahreman N. Dynamic crop simulation models and their applications: Indian experience with DSSAT models; c2010.
20. Gauravjeet D. Study of Agriculture marketing Information systems models and their implications; c2015.
21. Kotler P. Marketing Management: Analysis, Planning and Control, Prentice Hall, New York; c1988.