An Integrated Decision Support System for Intercropping

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ABSTRACT

Intercropping, which is the agricultural practice of growing two or more crops in the same land area, is not currently yielding adequate result especially in Africa. Some of the benefits of intercropping are improved soil fertility, protection against pests and diseases and eventual increase in farm yield. Despite the advantages of intercropping such as improved soil fertility, protection against pests and diseases and eventual increase in farm yield, this farming practice is still faced with some challenges. Some of the problems that are militating against the success of intercropping are inadequate planning, bad crop management and lack of required intercropping expertise. Consequently, this has resulted in inadequate reward for farmers and a general decline in crop production, especially in developing countries. This work presents an Intelligent and Integrated Intercropping Decision Support System for Intercropping (IDSS-I) for improved crop production. IDSS-I is driven by data, knowledge and model driven for proper planning and efficient decision making in intercropping. The design adopts a forecasting component that provides farmers with the estimated yield and income depending on the size of land, soil type and weather condition. This will make farmers to be able to adjust the crop mixture and quantities before planting. It uses expert system for pest and diseases management and fertilizer application. The implementation was carried out using JAVA and SQL. The usability testing revealed 85% acceptance of the tool among the contacted 10 large scale farmers. It was also confirmed that the system provided 95% diagnosis information for 90% common Africa crop diseases. This justifies the significance of IDSS-I.

Keywords: DSS, Farmers, Farming, Food Security, Intercropping, Yield

INTRODUCTION

Presently, there is food shortage all over the world, especially in developing countries. This is because crop production is declining which is leading to high cost of food items. Crop production is declining because of lack of adequate expertise and technology to support farming activities. It was also discovered that some farmers have left the farming business because of lack of adequate reward. Some other previous studies have also identified that crop production is declining and requires major attention.

In developing countries, very few agricultural managers or farmers have generally taken...
interest in Information Technology for better decision making and improved economic efficiency of rewards. This is because there are few or no agricultural support tools at their disposal.

Intercropping is the growing of two or more crops simultaneously on the same piece of land. Intercropping is a cropping system that leads to improvement in the fertility of soil and hence increases the crop yield. It also serves as a way for providing resistance against pest and diseases, weed suppression, reduction of erosion and insurance against total crop failure due to abnormal weather condition. However, a major concern in intercropping is how to efficiently mix crops on farms in order to have optimum yield since these crops have different soil requirements, different weather condition, different methods of fertilizer application, and different methods of pest and diseases management. Also, the right selection of crops or pastures best suited or having complementing effects on one another into each paddock on the farm for production and resource conservation is a complex process.

Decision Support System (DSS) is proposed to effectively manage intercropping activities for improved efficiency. In many situations the quality of decisions is important. Techniques for disciplines such as statistics, economics, and operations research have been deployed for making rational choices. More recently, these methods, often enhanced by a variety of techniques originating from information science, cognitive psychology, and artificial intelligence, have been implemented in the form of computer programs, either as stand-alone tools or as integrated computing environments for complex decision making. Such environments are often given the common name of decision support systems (DSSs). The concept of DSS is extremely broad, and its definitions vary, depending on the author’s point of view.

Turban (1995) defined DSS specifically as “an interactive, flexible, and adaptable computer-based information system, especially developed for supporting the solution of a non-structured management problem for improved decision making. It utilizes data, provides an easy-to-use interface, and allows for the decision maker’s own insights”. Power (2003) defined DSSs as all types of information systems that support decision making. DSS integrates a user-friendly front end to often-complex models, knowledgebases, expert systems, and database technologies (Jones, 1989; Power, 2002).

Decision support systems are gaining an increased popularity in various domains, including business, engineering, the military, and medicine. They are especially valuable in situations in which the amount of available information is prohibitive for the intuition of an unaided human decision maker and in which precision and optimality are of importance. Decision support systems can aid human cognitive deficiencies by integrating various sources of information, providing intelligent access to relevant knowledge, and aiding the process of structuring decisions. They can also support choice among well-defined alternatives and build on formal approaches, such as the methods of engineering economics, operations research, statistics, and decision theory.

The farming sector has seen an increasing interest in the potential of decision support systems (DSS) in recent years. It has been recognised that computer based Decision Support Systems (DSSs) have well established tradition with agriculture by playing significant roles in farming activities. The concept and practices of DSS offer great potentials for improved cropping system. In this work, a Decision Support System (DSS) is proposed to support for the realisation of efficient intercropping system. The idea is that if intercropping is supported by DSS, there will be improvement in the quantity of yield hence, more income to farmers. This will consequently enhance the living standard of the farmers and the community at large. Also, more farmers will then be encouraged to stay in the business. Since in farming, proper planning is paramount and decisions are often
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