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UTILITY OF PRECISION AGRICULTURE PRACTICES FOR SUSTAINABLE BIO-DIVERSITY MANAGEMENT IN INDIA

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ABSTRACT :

The agricultural sector has the unique ability to provide society with a positive contribution to biodiversity whilst producing food. Agriculture is at the origin of many ecosystems with high biodiversity and contributes to the maintenance of a diversity of species and a large gene pool. Even if agricultural land serves first and foremost towards the production of healthy and high quality food and renewable raw materials, the preservation of biodiversity and sustainable agricultural activity are inextricably linked. In such scenario precision agriculture has become a cornerstone of sustainable agriculture, since it respects crops, soils and farmers. Sustainable agriculture seeks to assure a continued supply of food within the ecological, economic and social limits required to sustain production in the long term. Precision agriculture therefore seeks to use high-tech systems in pursuit of this goal. The present paper tried to show the utility for adoption of precision agriculture for farmers in developing country like India to achieve efficient crop production with sustainable bio diversity conservation. Precision agriculture collects and interprets huge amount of data from the field so as to understand the causes of variability and propose strategies for field management, biological species geographic distribution models, based on ecological niche concepts, combine species presence and absence points with environmental biotic and abiotic data, in order to generate models that describe probabilistic distributions of that species – represented as geographical distribution maps for biodiversity management.

Keywords:
Crop production management, Environmental protection, Bio Diversity, economies of return etc.

INTRODUCTION :

The Indian green revolution is also associated with negative ecological /environmental consequences. The status of Indian environment shows that, in India, about 182 million ha of the country's total geographical area of 328.7 million ha is affected by land degradation of this 141.33 million ha are due to water erosion, 11.50 million ha due to wind erosion and 12.63 and 13.24 million ha due to water logging and chemical deterioration (salinization and loss of nutrients) respectively. On the other end, India shares 17 per cent of world's population with 2.5 per cent of geographical area, 1 per cent of gross world product, 4 per cent of world carbon emission and hardly 2 per cent of world forest area. The Indian status on environment is though not alarming when compared to developed countries, it gives an early warning to take appropriate precautionary measures. The Indian green revolution is also associated with negative ecological /environmental consequences. The status of Indian environment shows that, in India, about 182 million ha of the country's total geographical area of 328.7 million ha is affected by land degradation of this 141.33 million ha are due to water erosion, 11.50 million ha due to wind erosion and 12.63 and 13.24 million ha due to water logging and chemical deterioration (Stalinization and loss of nutrients) respectively.

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LITERATURE REVIEW :

Precision agriculture is based on a set of resources that allow field variability management. The main idea is to identify areas which present different levels of productivity, and offer an individual treatment for each of them, managing these differences. This concept dates from the 80s and started a revolution in the resources management (Robert, 2002). Since site-specific management, site-specific farming, or precision farming, alternative names for precision agriculture, has been directed to intensive data and technology usage, resulting in relevant researches, such as those presented in Plant (2001), Zhangh et al. (2002) and Korduan et. al (2004), and a large amount of products, systems and devices for rising production profitability, improving production quality and helping environment protection. Some examples of precision agriculture purposes include soil properties study for the application of fertilizers in variable rate, and the main aims and other potential benefits of its adoption are to increase productivity, sustainability, crop quality, food safety, rural welfare and economic development. Its users have many information systems to choose from, but usually the systems are monolithic and able to perform specific tasks only, e. g.Productivity management or soil fertilizer mostly furnished by equipment manufactures and with no relationship between each other. Nevertheless, precision agriculture requires the integration of the tools used in all steps performed, requiring from the user the expertise to deal with many software packages, with different GUIs (Graphical User Interface) and data formats, and sometimes demanding other software packages for data conversion, in order to use the output of a package as the input for the next (Murakami, 2006).There are also more complete packages, which incorporate database and field equipment connectivity,GIS (Geographical Information System) functionalities and other useful characteristics for precision agriculture. Despite that, many authors identified relevant requirements that they do not cover (Saraiva, Massola, Paz, 1997; Saraiva, Massola, Cugnasca, 1998; Lütticken, 2000; Sorensen et al., 2002; Pedersen et al., 2003; Korduan, Bill, Böling, 2004; Adrian, Norwood, Mask, 2005): decision support systems and management must be designed for meeting producers specific needs; systems should have GUIs that could be customized for different user profiles, because a friendly interface is paramount for users with little software expertise; easy and automated methods, programmable according to the user rules, should be able to be included, and the user should be able to control and access analysis functions and parameters, in order to be able to try new and more applicable solutions; rule-based knowledge should be possible, so as to refine and adapt the system to local practices and preferences, reducing learning curve and technical support needs; systems should be interoperable with other software packages, local or remote, via Internet, using open patterns – these are fundamental for integration with distributed and legacy systems; systems should have scalability, metadata support and low cost.

Role of precision farming in Bio Diversity Management :

Precision agriculture aims to optimize field-level and Bio Diversity management with regard to:

- Crop science: by matching farming practices more closely to crop needs (e.g. fertilizer inputs);
- Environmental protection: by reducing environmental risks and footprint of farming (e.g. limiting leaching of nitrogen);
- Economics: by boosting competitiveness through more efficient practices (e.g. improved management of fertilizer usage and other inputs).

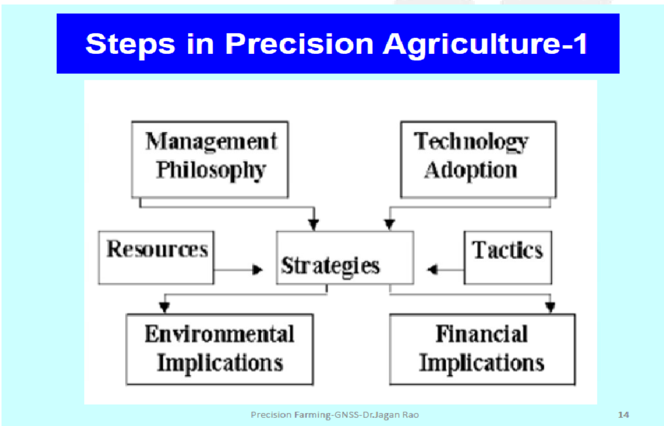
Reasons for Adoption of Precision Farming in India

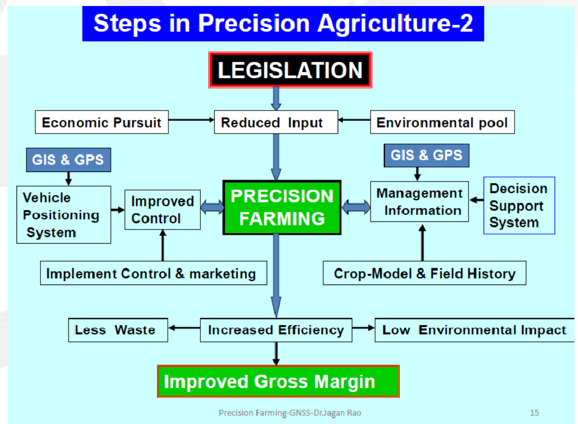
i) Fatigue of Green Revolution

Green revolution of course contributed a lot. However, even with the spectacular growth in the agriculture, the productivity levels of many major crops are for below than expectation. We have not achieved even the lowest level of potential productivity of Indian high yielding varieties, whereas the worlds highest productive country have crop yield levels significantly higher than the upper limit of the potential of Indian HYV's.

ii) Natural Resource Degradation

In this context, there is a need to convert this green revolution into an evergreen revolution,which will be triggered by farming systems approach that can help to produce more from the available land, water and labour resources, without either ecological or social harm





Basic Steps in Adoption of Precision Farming

The basic steps in precision farming are,

- i). Assessing variation
- ii). Managing variation and
- iii). Evaluation

i) Assessing variability

Assessing variability is the critical first step in precision farming. Since it is clear that one cannot manage what one does not know. Factors and the processes that regulate or control the crop performance in terms of yield vary in space and time. Quantifying the variability of these factors and processes and determining when and where different combinations are responsible for the spatial and temporal variation in crop yield is the challenge for precision agriculture.Techniques for assessing spatial variability are readily available and have been applied extensively in precision agriculture. The major part of precision agriculture lies in assessing to spatial variability.Techniques for assessing temporal variability also exist but the simultaneous reporting a spatial and temporal variation is rare.

ii). Managing variability

Once variation is adequately assessed, farmers must match agronomic inputs to known conditions employing management recommendations. Those are site specific and use accurate applications control equipment.The potential for improved precision in soil fertility management combined with increased precision in application control make precise soil fertility management as attractive,but largely unproven alternative to uniform field management. For successful implementation,the concept of precision soil fertility management requires that within-field variability exists and is accurately identified and reliably interpreted, that variability influences crop yield, crop quality and for the environment.

iii)Evaluation

There are three important issues regarding precision agriculture evaluation.

- Economics
- Environment and
- Technology transfer

The most important fact regarding the analysis of profitability of precision agriculture is that the value comes from the application of the data and not from the use of the technology Potential improvements in environmental quality are often cited as a reason for using precision agriculture. Reduced agrochemical use, higher nutrient use efficiencies, increased efficiency of managed inputs and increased production of soils from degradation are frequently cited as potential benefits to the environment.

Strategies for implementaion of Percision Farming

A strategy for implementaion of Percision Farming in bio- diversity managment includes:

- **Predictive approach:** based on analysis of static indicators (soil, resistivity, field history, etc.) during the crop cycle.
- **Control approach:** information from static indicators is regularly updated during the crop cycle by:
- **sampling**: weighing biomass, measuring leaf chlorophyll content, weighing fruit, etc.
- **remote sensing:** measuring parameters like temperature (air/soil), humidity (air/soil/leaf), wind or stem diameter is possible thanks to Wireless Sensor Networks[6]
- **proxy-detection**: in-vehicle sensors measure leaf status; this requires the farmer to drive around the entire field.
- **aerial or satellite remote sensing**: multispectral imagery is acquired and processed to derive maps of crop biophysical parameters.

Limitations in Implimentation of Percision Farming

There are many obstacles to adoption of precision farming in developing countries in India are as follows.

- Culture and perceptions of the users
- Small farm size
- Heterogeneity of cropping systems and market imperfections
- Land ownership, infrastructure and institutional constraints
- Lack of local technical expertise
- Knowledge and technical gaps

CONCLUSION :

Precision agriculture is based on a set of resources that allow field variability management. The main idea is to identify areas which present different levels of productivity, and offer an individual treatment for each of them, managing these differences. Precision farming basically depends on measurement and understanding of variability, the main components of precision farming system must address the variability. It requires the requisition, management, analysis and output of large amount of spatial and temporal data. In Indian prospective for sustainable Bio diversity through precision farming the changes in agricultural policies are also necessary to promote the adoption of precision farming. There are basically two policy approaches: regulatory policies and market based policies. The former refer to environmental regulations on the use of farm inputs and later refer to taxes and financial incentives aimed at encouraging growers to efficiently use farm inputs. Along with the policy measures efficient and productive agricultural land use,ensuring a sufficient income for farmers, can be brought in line with nature conservation objectives as a result of which farmers are prepared to adapt their farming methods to enhance biodiversity and that ecoinnovation,Also Indain farmers need financial as well as non-material support to better align their economic interests with biodiversity targets.

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