ISSN–0974–0759 | ●●● Article ●●● |Visit us : *www.researchjournal.co.in*|

Precision farming for horticulture

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Summary: Precision farming for fruits and vegetables is expected to become much more widespread in the twenty-first century, symbolizing a better balance between reliance on traditional knowledge, information management and intensive technologies. Five main areas or categories are important: the role of computers, global positioning systems (GPS), geographical information systems (GIS), remote sensing, Variable rate technology, computer system and DRIS and SSNM for precision farming in horticulture. This article discloses each of these in the context of Indian horticulture and confirms that precision farming has the potential to reduce over application of inputs, optimize financial performance and enhance horticultural production.

Professor Pierre C. Robert who is considered as the father of precision farming defined precision farming as precision agriculture is not just the injection of new technologies but it is rather an information revolution, made possible by new technologies that result in a higher level, a more precise arm management system (Dutta *et al.*, 2011). It basically means adding the right amount of treatment at the right time and the right location within a field. Precision farming uses modern technology like remote sensing and in country like India where majority of the farmers are having land holding average of 1-2 acres only, it was felt difficult to use aerial remote sensing to get detailed information of natural resources, particularly soil and other alike details. Remote sensing with increased special solution to the possibility of applying precision farming method to smaller areas has also been made applicable. It is a scientific approach to improve the agricultural management by application of information

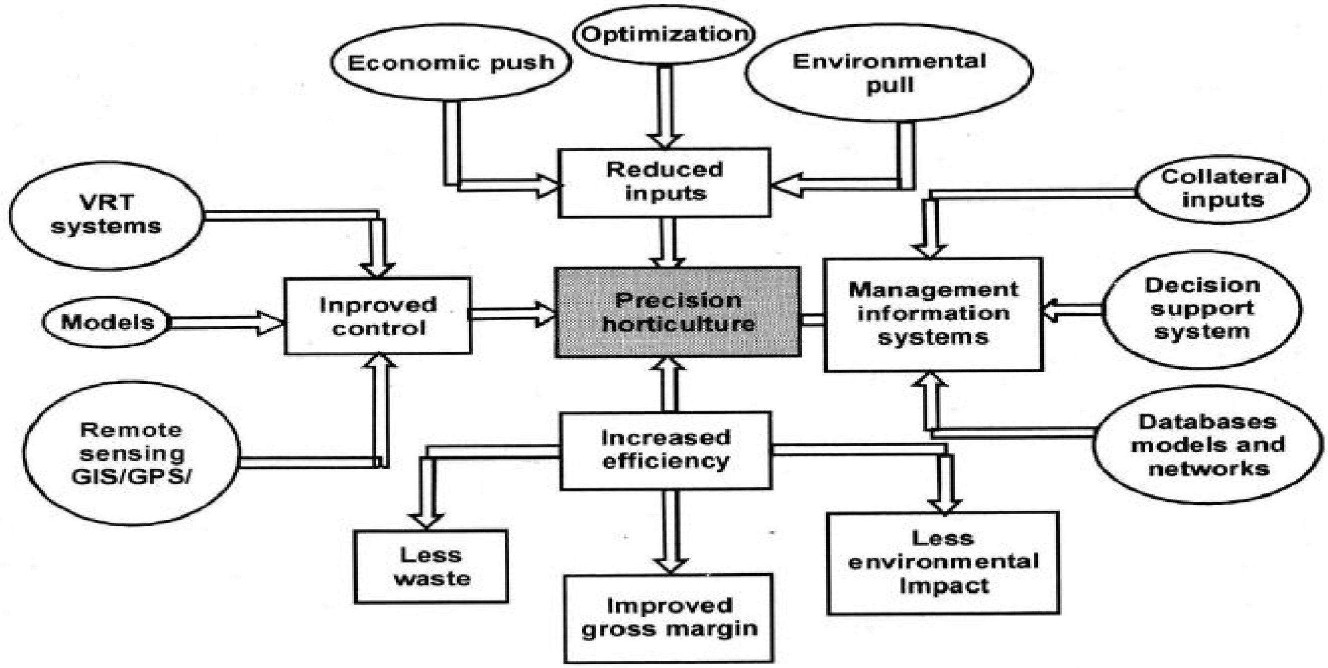

Fig. 1 : **Technologies for precision farming**

technology (IT) and satellite based technology to identify, analyze and manage the special and temporal variability of agronomic parameters (e.g. soil, disease, nutrient water etc.) within field by timely application of only required amount of input to optimize profitability, sustainability, with a minimize impact on environment. In this present scenario, the major challenge arising are shrinking land and depleting water and other related resources in agriculture (Mondal *et al*., 2011). There is need for promoting farmer friendly location specific production system management technologies in a concerted manner to achieve vertical growth in horticulture production dully ensuring quality of produce and better remuneration per unit of area with judicious use of natural resources. In this endeavour, precision farming aims to have efficient utilization of resources per unit of time and area for achieving targeted production of horticultural produce.

Components of precision farming for horticulture:

Global positioning system (*GPS*): Positioning system works by the help of different constellations of satellites. Developments of these different positioning systems are the main technological milestone, which made precision agriculture concept a reality. GPS provide accurate positioning system for field implementation of variable rate technology (Singh and Singh, 2005). It controlled application of inputs by equipments, identify the precise location of farm equipment within inches, fertilizer and pesticides can be prescribed according to the soil properties. Global positioning system (GPS) developed by US Department of Defense (DOD).

Geographic information system (*GIS*): Geographic information system (GIS) is an important system which includes organized collection of computer hardware, software, geographic data and personal designed to efficiently captured, stored, update, manipulate, analyse and display all forms of geographically referenced information (Dutta *et al*., 2011). The science of GIS includes data management and modelling, enabling a shift form mapping to spatial reasoning. GIS contain base map like topography, soil type, nutrient level, soil moisture, pH, fertility, weed and pest intensity map it can also integrate all types information and interface with other decision support tools, so these maps and information are used for application of recommended rates of nutrients or pesticides.

Remote sensing (*RS*): Remotely sensed data, obtained either by aircraft or satellite, containing electromagnetic emittance and reflectance data of crop can provide information useful for soil condition, plant growth, weed infestation etc. This type of information is cost effective and can be very useful for site-specific crop management programs. It is a useful technology for precision agriculture as it can give data for parameters of the field relatively easily. In general, we see the reflected sun light that is formed by the ultraviolet wave lengths, the visible light (Red, green and blue) and the infrared. The green plants are absorbing the red and blue wave lengths and reflect the green and the infrared (Narayan, 2005). Measuring the reflected wavelengths with multi spectral cameras we can measure the vigour of the plants or any problem like disease, nutrient deficiency or water logging etc. We can correlate soil colour to the organic matter, moisture etc. Light reflectance (sun or some artificial light source) has been used in precision agriculture in the form of vegetation indices. The most used of them is the Normalized Vegetation Index (NDVI).

Variable rate technology (*VRT*): Existing field machinery with added electronic control unit (ECU) and onboard GPS can fulfil the variable rate requirement of input. Spray booms, spinning disc applicator with ECU and GPS have been used for patch spraying. All information gathered should result in a better management of the formed zones. VR means that the appropriate rates of inputs will be applied leading either to reduced inputs, costs and environmental effects or improved yields and quality. Two methods are used to apply VR (Dutta *et al*., 2011). The first called map based, is based on historical data (previous or present year). Process control technologies allow information drawn from the GIS (prescription maps) to adjust fertilizer application, seeding rates and pesticide selection and application rate, thus providing for the proper management of the inputs. The second, named sensor based, uses sensors that can adjust the applications rates on the go. The sensors detect some characteristics of the crop or soil and adjust the application equipment. VRA can be applied to all inputs. Both systems have advantages and disadvantages. The on the go sensors are more acceptable by the farmers. Probably using a mixture of both will offer most advantages in the future.

Computer system: Computers have help to define precision farming in terms of management strategy that uses information technologies for decision making. Precision farming requires the acquisition, management, analysis and output of large amount of spatial and temporal data. Computer software in precision agriculture has become better with time (Mondal *et al*., 2011). For precision farming, the knowledge needed is that for managing variability on the farm, knowledge that is requisite for decisions making. Therefore, in this system, computers and related software have become capital inputs.

DRIS and SSNM for precision farming in horticulture: Diagnosis and recommendation integrated system (DRIS) represent a holistic approach to the mineral nutrition of crop and has an impact on the integrated set of norms representing calibration of plant tissues, soil composition, environmental parameters and farming practices as the functions of the yield of a crop. Once such norms are developed, it is possible to make a diagnosis of the conditions of the crop thereby isolating the factors, which are likely to be responsible for limiting the growth and production. The most important advantages of DRIS approach are its ability to make a diagnosis at any stage of crop development and to list the nutrient in the order of importance, which are responsible for limiting the yield (Singh *et al.*, 2009). Diagnosis and recommendation integrated system has been developed to fulfill the diagnosis and predictive use of the leaf analysis. Soil test-based site-specific nutrient management (SSNM) offers a tangible option to address these nutritional constraints and to harness the productivity potential of specific orchard sites.

References:

Dutta, R., Stein, A. and Bhagat, R.M. (2011). Integrating satellite images and spectroscopy to measuring green and black tea quality. *Food Chem.*, **127** (2) : 866-874 .

Mondal, P., Basu, M. and Bhadoria, P.B.S. (2011). Critical review of precision agriculture technologies and its scope of adoption in India. *American J. Exp. Agric.*, **1**(3): 49-68.

Narayan, L.R.A. (2005). Remote sensingproviding important inputs. The Hindu Survey of Indian Agriculture, pp168-170.

Singh, D.K. and Singh, S.K. (2005). *Physiology and postharvest management of horticultural produce*, Agrotech Publications, 33-38 pp.

Singh, V., Jinny, Dashora, L.K. and Sdhukla, K.B. (2009). An outlook on fruits and vegetables dispensation waste and its exploration. *Agrovet. Buzz.*, **1**(5): 14-17.

Received : 20.12.2018 *Revised : 06.04.2019* *Accepted : 20.04.2019*