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Smart Farming Technologies in Agriculture in India

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Abstract:

This work finds the possibilities and constraints for an integrated use of agriculture and other species growth model and earth observation techniques. The assimilation of information derived from earth observation sensors into agriculture growth models enables regional applications and may also help to improve the profound knowledge of the different involved processes and interactions. Both techniques can contribute to improved use of resources, reduced agriculture production risks, minimized environmental degradation, and increased farm income.

Up to now, agriculture growth modeling and remote sensing techniques mostly have been used separately for the assessment of agricultural applications. Agriculture growth models have made valuable contributions to, e.g., yield forecasting or to management decision support systems. Likewise, remote sensing techniques were successfully utilized in classification of agricultural areas or in the quantification of vegetation characteristics at various spatial and temporal scales. Multispectral remote sensing approaches for the quantification biophysical variables are rarely realized.

Keywords: Yield, Agriculture Models, data, next generation, Remote Sensing

1.INTRODUCTION

In the present scenario of the world, the timely information about the resources plays an important role. Proper planning and managing the resources sustainability is significant. Rapid urbanization and urban sprawl have significant impact on conditions of urban ecosystems. Changes in land use and land cover are directly linked to many facets of human health and welfare, including biodiversity, food production and the origin and spread of disease. One of the major problem and threat for sustainability is fast growth of concrete jungles practically in developing countries like India [1,3]. Therefore, accurate and updated Information on the status and trends of urban resources is needed to develop strategies and efficient planning and management of the resources of the regions for sustainable development and to improve the livelihood of cities to avoid the unplanned developments of colonies are taking place at faster pace. The satellites play a vital role to provide the timely and cost-effective information about the resources of the area. With the easy availability and improved quality of multi-spatial and multi-temporal remote sensing data as well as new analytical techniques, it is now possible to monitor urban land cover/ land-use changes and urban sprawl in a timely and cost-effective way [2,4,5].

Basic aim of this study is to analyse the Remote Sensing Data that was received from the National Remote Sensing Agency (Space Department, Government of India); The analysis is done through Integrating Spectral, Temporal and Spatial Features of the Objects. Here the multi-spectral remote sensing data is used to find the spectral signature of different objects of the regions for the land cover classification, how the use of land changes according to time and also performed the temporal analysis to analyse the impact of climate over the surface [3,6,7].

For efficient planning and management of agribusiness, the classified data in a timely manner is needed, for these satellites are the best and trusted resources to provide the data in a timely manner. The multispectral satellite data helps us to analyse the new things (e.g vegetation, contrite structure etc), which are not possible in visible band. Satellite data can have a large view of the surface, which is not possible otherwise. These advantages of the satellite can be utilized for proper planning and management. Satellite data is very much cost effective. If ground surveys are performed then cost of surveys will be very much high [8,9,10]. The aim of this work is to optimize the land use pattern for economically and environmentally sustainable urban development. This analysis can be used for following applications:

- Monitoring the unauthorized development of the colonies
- Deforestation,
- Agricultural planning and management
- Water resource planning
- Infrastructure planning etc.

In our country hyper spectral and very high-resolution satellites would be available in near future which will boost up usefulness of data can provide us very useful data, now it is up to us how it processes and extract the useful information from this data[10,11].

2. CHALLENGES OF COMBINING MODELS AND REMOTE SENSING INFORMATION

Data advances as simulation modeling and remote sensing assume an essential part in agricultural research and in rural creation frameworks. A considerable specialized advancement has been made in both, which is as yet proceeding because of the expanding conceivable outcomes computer hardware and software programming and innovative advancement, joined with more prominent learning on demonstrated and observed frameworks. Although remote sensing and agriculture growth modeling have proven their usefulness and applicability, such methodologies are integrated here.

Concerning the remote sensing issue, the recovery of bio and geophysical parameters is an imperative field of research, and the possibility of separating such data in an operational way with a high level of precision strongly affects current research work [12,14]. Important parameter recovery requires the accessibility of proper reversal calculations, as well as that privately created models can be connected to a broad local context. The issues of operational use and territorial exchange (extraction to bigger provincial ranges) are essential, when needing to consolidate remotely sensed data with agriculture development models for regional analysis. Expanded procedure information and the simultaneous changes have prompted the advancement of muddled agriculture development models, requiring a somewhat huge measure of data parameters. This makes it fairly difficult to apply the point-based model discoveries to a local spatial connection [17,18]. Here remotely-sensed data can be connected effectively to the farming models and help to over-come this issue. Combination of remote sensing and reproduction displaying can be synergetic in different ways. The Aim of the exploration are on:

- The utilization of assessments of biophysical variables that can be utilized to re-introduce the agriculture model
- Using the spatial aspect of remote sensing pictures to upscale simulation results to obtain regional results

3. TRADITIONAL FARMING vs SMART FARMING

TRADITIONAL FARMING	SMART FARMING
1. The same set of crop-cultivation methods are used throughout the region.	1. Each farm is examined to determine the best crops and water needs for maximum efficiency.
2. Errors occur due to the manual management of all field and financial data individually.	2. Cost-effective early identification and application just in the affected area
3. Geo-tagging and zone identification are not possible.	3. Field and financial data in one location, with easy reports that illustrate profitability, yields, and patterns.
4. Application of Excess amount of fertilisers and pesticides in the field.	4. Farm zones are detected using satellite photography.
5. There is no way to anticipate the weather.	5. Weather forecasting and analysis

4. METHODOLOGY

In the proposed researched attempt is made to overcome the above deficiencies by evolving a systematic methodology explained.

1. Select a region of interest and collect the satellite image for this region. The land-based objects will be identified using image-processing technique. Image cluster of similar pixels characteristics can be formed by C-mean algorithm in the following steps [16].

2. Having formed the image clusters in above steps, the area of the agricultural land will be estimated. The soil type can be identified which will help in estimating the agricultural yield of the region of interest. This step will require use of fuzzy-neural technique applied to image processing. This technique can also be used for identifying the disease infecting the crop [19].

3. A simulation model of precision agriculture will be developed with inputs like land area, irrigation facility, atmospheric conditions, soil conditions. The model would estimate the crop yield and compares it with target and feedback the error to the model input. This works in an iterative manner till a converged solution is obtained [20,27].

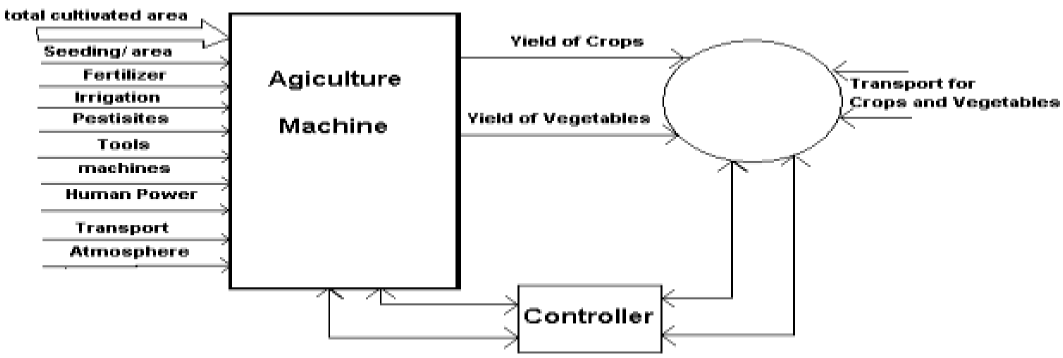

Fig1. Agriculture model

Agriculture Architectural Model

In this research work the productivity of land of certain region of the country is analysed by taking data through Remote Sensing. Productivity of land depends on a lot of factor, certain factor, which are dominant factor, are included in our analysis. We can also explain the cost related to production of certain area of Land and net Profit related to the agriculture. By analyzing the productivity of land by taking different data for input and related output. One can predict most favorable combination of input for certain region of hectare of land. This result as a reference is useful to increase the productivity of land [18,24].

In order to grow crops optimally farmers need to understand how to cultivate those crops in a particular area, taking into account a seed's resistance to weather and local diseases, and considering the environmental impact of planting that seed. For example, when planting in a field near a river, it's best to use a seed that requires less fertilizer to help reduce pollution. Once the seeds have been planted, the decisions made around fertilizing and maintaining the crops are time-sensitive and heavily influenced by the weather. If farmers know they'll have heavy rain the next day, they may decide not to put down fertilizer since it would get washed away. Knowing whether it's going to rain or not can also influence when to irrigate fields. With 70 percent of fresh water worldwide used for agriculture, being able to better manage how it's used will have a huge impact on the world's fresh water supply. Weather not only affects how crops grow, but also logistics around harvesting and transportation. When harvesting sugar cane, for example, the soil needs to be dry enough to support the weight of the harvesting equipment. If it's humid and the soil is wet, the equipment can destroy the crop. By understanding what the weather will be over several days and what fields will be affected, better decisions can be made in advance about which fields workers should be deployed to. This is what research work is focusing on to optimize the input parameter require for agriculture [25,26].

Modeling parameter

There are 15 types of input parameters used in this agriculture model, as given below:

Sr.No.	**parameters**	**Sr.No.**	**Parameters**
1	Man Power	9	Relative humidity of land
2	Type of Land	10	Solar energy
3	Total amount of fertilize	11	Wind
4	Pesticides needed	12	pH of land
5	Seed amount	13	Fencing
6	Irrigation needed	14	Rainfall
7	Technology	15	Quality of minerals
8	Temperature		

Man power (a)	70	80	90	100	110	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	**90**
Land (b)	1	1	1	1	1	2	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**1**
Fertilizers (c)	250	250	250	250	250	250	250	100	200	300	400	500	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	**250**
Pesticides (d)	2	2	2	2	2	2	2	2	2	2	2	2	1	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	**2**
Seed (e)	100	100	100	100	100	100	100	100	100	100	100	100	100	100	150	100	100	100	100	100	100	100	100	100	100	110	100	100	**100**
Irrigation (f)	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	10	30	40	20	20	20	20	20	20	20	20	20	15	**20**
Technology (g)	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	10	30	20	20	20	20	20	20	20	20	**20**
Temperature (h)	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	25	35	30	30	30	30	30	30	**30**
Relative Humidity (i)	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	45	55	50	50	50	50	**50**
Solar Radiation (j)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.6	0.5	0.5	**0.5**
Wind(k)	5	5	5	5	5	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	6	**5**
Ph Value (l)	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	**2**
Fencing.(m)	1	2	2	2	2	1	1	1	1	1	1	1	1	1	1	2	2	2	2	1	1	1	1	1	1	1	1	1	**1**
Rain Fall (n)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**1**
Minreals (o)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**1**
Yield (y)	4437	4460	4482	4060	4037	4382	4282	4362	4442	4042	3962	3882	4382	3982	3982	4382	3982	3882	4382	3982	4448	4048	4462	4062	4445	4082	4442	4042	**4482**

Figure Showing Summary of Optimization Results

Y= -0.8a-6.67b-0.103c-13.33d-0.267e-0.84f-1.6g-1.1053h-1.6i-106.67j-13.33k+1.67l-3.33m+0.067n-3.33o+4503.468 *The above equation is the approx. optimized equation.*

Where a= Man power; b=Land; c=Fertilizers; d=Pesticides; e=Seeds; f=Irrigation; g=Technology; h=Temperature; i=Relative humidity; j=Solar radiation; k=Wind velocity; l=pH; m=Fencing; n=Rainfall; o=Minerals

Now, by substituting the optimized values of all the modeling parameters the optimised Yield can be obtained.

3. INNOVATIVE TECHNOLOGIES TO ENHANCE SMART FARMING IN INDIA

Indians are a somewhat orthodox people. They believe that the methods or traditional practises that have been employed in agriculture from ancient times are the finest. However, as the population grows and technology advances, techniques must evolve as well. Indian farmers must adapt innovative technology to improve smart farming in order to achieve this. Some technologies that could be improved are listed below [12,33].

Fig2: Showing the view of Emerging Agriculture Technologies.
Source: https://cdn.punchng.com/wp-content/uploads/2020/10/16182052/Agric-Tech.jpg

Product advancements

There is a necessity for product innovation. Those items that have been around for a long time and need to be updated. As a result, new technologies have been launched to the market that are specifically tailored for new types of meals. Those items that are unable to cultivate are put to the test in a laboratory [17].

Marketplaces on the internet

This approach established a fluid link between buyers and sellers, as well as promoting real-time pricing. Farmers may use the digital marketplace to lease equipment, connect with local consumers, or pool resources for better insurance [11,27].

Software for operations

It will be extremely beneficial to farmers in terms of making better operational decisions, saving money, and tracking resources and production.

Tools for enhancing your abilities

There is a need for skill development in Indian agriculture. Farmers produce what their parents or forefathers taught them. They have no idea how to use the new technology that have been brought to them. For this reason, farmers should have access to skill-building equipment on the market.

5. BENEFITS OF SMART FARMING IN INDIA

- Precision agricultural technology can help India reduce production costs, increase output, and better use natural resources by refining and expanding their use.
- It has the potential to transform Indian farm management by increasing profitability, productivity, sustainability, crop quality, environmental protection, on-farm quality of life, food safety, and rural economic development.
- Irrigation in wheat fields in Punjab and Haryana, insecticides in cotton fields, and fertiliser treatments in oil palm plantations in South India, as well as coffee and tea gardens in eastern India, can significantly cut production costs while simultaneously reducing chemical pollution.
- When water supplies are few, it can help to improve irrigation efficiency.
- Farmers may utilise forecasting to prevent and manage issues like as water stress, nutritional shortage, and pests and diseases.
- It also expands prospects for skilled employment in agriculture and introduces new techniques for assessing multifunctional elements, including non-market activities.
- It plays an important function in monitoring greenhouse conditions in agricultural areas.

6. CONCLUSION

Agriculture, like virtually every other area of our contemporary life, is being transformed by technology. Thanks to cutting-edge agricultural technology, the produce on your table tonight will have arrived sooner, fresher, and more cost-effectively. In the coming decades, agriculture technology will become increasingly automated.

The methodology required for strategy producers to advance precision cultivating at farm level is having the following inputs:

1. Advance the accuracy cultivating innovation for the particular farmers who have adequate danger bearing limit as this innovation might require capital investment.

2. Recognizable proof of specialty ranges for the advancement of product particular natural cultivating.

3. Urge the farmers to adopt water accounting protocols at farm level.

4. Advance utilization of miniaturized scale level watering system frameworks and water sparing strategies.

5. Support investigation of spatial and worldly variability of the info parameters utilizing essential information at field level.

6. Develop an arrangement for proficient exchange of innovation to the farmers.

7. Give complete specialized reinforcement backing to the farmers to create pilots or models, which can be recreated on an expansive scale.

8. Strategy support on acquisition costs, in plan of agreeable gatherings or self-help groups.

9. Assignment of fare advancement zones with important base, for example, cold storage, processing and grading facilities.

The developments of agriculture sector will rely on the analyst's capacity to lead such sort of study, with certainty from the ecological and farmers communities that progressions will further the environment and the effectiveness of farming yield. The precision agriculture will also provide a platform for industrial corporate and will increase social activities which in turn help the rural India in improving the livelihood through high-tech farming. The Government of India can facilitate in this process by giving soft loans and sops to the small industry so that they get engaged in precision agriculture activities. High-tech precision agriculture therefore can help in bringing next green revolution in India and can produce tremendous rural wealth in a sustainable and environmentally sound way.

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