

## **CROP YIELD FORECAST MODELING AND TOOL FOR CROP INSURANCE USING MOBILE CAMERAS AND AI**

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### **Executive Summary:**

Traditionally the area and the yield were estimated by 'Patwaris' at village level, block level and were aggregated from district to state to national level. With advent of technology 'Fasal' scheme was implemented by ISRO in determination of crop area and yield followed by crop cutting experiment. However the yield estimates are available only after crop has been harvested. By that time it's too late to take corrective measures to deal with shortages and surpluses.

On experimental basis, crop models are known to give correct yields under laboratory condition, however the same had not been applied on wide area on account of large variability in field conditions.

We at BKC WeatherSys (of which Bkc Aggregator is an off shoot) have been experimenting with running a DYNAMIC crop model taking salient points of temperature, rainfall, humidity, sun shine and also the management practices which are responsible for determination of yield.

BKC WeatherSys a company of reputation having 20 years of experience in weather technology has executed successfully a number of turnkey contract and prestigious, national organization such as Indian Meteorological Department, Indian Air Force, Indian Navy, and DRDO etc. BKC WeatherSys launched an app in order to help the farmers get weather advisories in advance. It also helped BKC in running the crop models individually for each farmer at the back end. Crop model was run for soybean (2017) and actual yield as determined by SOPA were correlated. Our result showed remarkable accuracy. Buoyed by this success 'WeatherSys' started working for winters crops and farmers of Punjab and Haryana were asked to send pictures of wheat crop. Based on plant physiological factors and parameters discovered from time series pictures, yields were determined. This exercise was done for two winter crops of wheat in collaboration with an International organization of repute who were testing use of camera pictures for crop insurance purposes. BKC WeatherSys had been trying to develop algorithm for combining yield determination by dynamic crop modeling and correct them by using pictures sent by farmers.

The finding demonstrated that crop model together with picture analysis could be a dependable tool for yield prediction well before the crop is harvested by farmers. Such a promising technology from national point of view, signals the demand and supply gap ahead the time. It can be used for picture based crop insurance too. Our progress during winter season for wheat in Punjab and Haryana has shown promising results. Our innovation perhaps

holds future of crop insurance. We are applying AI for this. Bkc LLP has already developed and tested a tool for use by agriculture crop insurance industry eliminating subjectivity and corruption plaguing the crop insurance in India.

## **Introduction**

Aggregator LLP is an offshoot of BKC WeatherSys, India's first private sector weather forecasting company founded in 1989 . BKC's weather data for agriculture clients have included RML, as well as IFFCO Kisan Sanchar Limited (IKSL) to whom BKC has been providing weather data for over 5700 taluks in India. BKC granulates weather forecast for 600,000 villages every day which forms backbone of their Fasal Salah App.

Furthermore, BKC delivers highly customized and actionable crop advisories along with market information that is used by farmers in almost all states of India

In this document, we present BKC's Intelligent Agriculture Platform (IAP), metGIS AGRO, that delivers highly customized and timely agricultural advisories to individual farmers to increase productivity and incomes. Our IAP utilizes data-environmental, agronomic, soil, high resolution weather data and predictions, and satellite imagery, uses techniques including numerical weather prediction, remote sensing, and crop modeling, to deliver practical and affordable agricultural recommendations through mobile phones. Advisories encompass alerts for adverse weather conditions to advice for optimal planting, crop planning, disease and pest forecasting, and input management. Market intelligence and pricing in mandis are also provided to farmers. Recommendations are delivered as text or voice messages, or through smart phone applications in the local language.

The platform is coded for two-way communication and continuous improvement: it not only pushes advice, but also incorporates information from farmers and field staff into its database to improve its forecasting abilities.

An important addition as been provision for farmers to send pictures of their crop. Each of these pictures are Geo-located and carry information of shape, size, greenness etc. Our scientific approach has made it possible to extract a number of parameters from the pictures which exhibit plant health and onset of pest, diseases , dryness entropy etc which have direct impact of yield of crop. These captured parameters are used in running an Artificial Intelligence program which predicts yield. Simultaneously dynamic crop models are run for each farmer/ plot which calculates the projected yield in real time based on weather parameters such as temperature, radiation use efficiency , soil moisture, leaf area index etc. Both these approach gives accurate idea of the yield that the farmer will ultimately harvest. The actual harvest figures obtained from the farmers helps us calibrate yield .

Furthermore time series pictures obtained for the geo-located fields helps us determine the area under cultivation. Thus using this method one can have total yield estimate over large area before the crop is actually harvested.



## OUR USP !!!

### Fasal Salah: Key Features

**Your Village - Your Farm - Your Crop - Your Advisory**

Auto-Monitor a crop from sowing till harvesting.  
Real Time Alerts for YOUR village for YOUR crop.



- High resolution weather forecasts.
- Customized crop advisory updated in real-time for any time access.
- Mandi Prices from nearby Mandis and E commerce platform
- Read and Hear the advisory in regional languages.

## TOOLS USED

BKC's proprietary ICT platform, **metGIS AGRO**, is designed to simplify management, analysis and visualization of agricultural and meteorological data. This proprietary platform is a proven technology developed through over 10 years of experience handling complex meteorological data for organizations like India Meteorology Department and the Indian Air Force with user inputs from the Indian Agricultural Research Institute. metGIS AGRO empowers an agronomist to access data from a variety of sources and formats, provides a complete tool set for data display, manipulation, analysis and image processing, and allows for automated delivery of personalized advisories and bulletins via text & voice messages and e-mails in the local language (Figure 1). metGIS AGRO powers our Smartphone App, **FASAL SALAH**, that is currently in use by farmers in over 23 states. This platform is coded for two-way communication and continuous improvement: it not only pushes advice and alerts, but also incorporates information from farmers and field staff to improve its dissemination abilities.

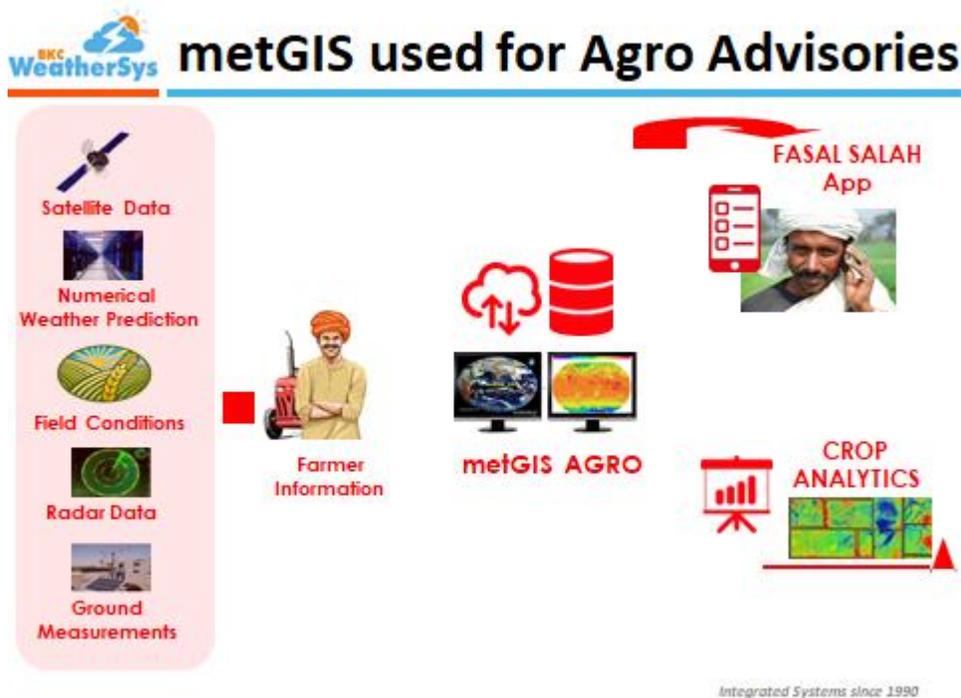


Figure 1. Our Intelligent Agriculture Platform, metGIS AGRO, allows for seamless integration of crop science with real-time field data, weather data & forecasts, for analytics that automate advisory generation, and dissemination in text, voice messages, or through a smartphone app.

Our IAP has been specifically developed to support an individual farmer to optimize their crop yield and predict production, and delivering to them directly an interface for monitoring their specific crop.

This platform will serve as an indispensable tool, with ancillary services for the farmer, from sowing to market.

## OUR PRESENCE

Our main project office is in Noida, UP and corporate office is in Nehru Place, New Delhi. We also maintain staff in Pune, Chennai, Orissa, Chandigarh, and at project sites as need be. Our agriculture advisory services are in use in 23 states in India,

## OUR INNOVATIONS

Personalized crop advisory services do not exist in India due to the complexity of agro-climatic zones and crops across India. Achieving scale in providing context-driven and hyper localized advice across crop varieties and agro-climatic zones to individual farmers simply cannot be achieved without the use of an intelligent technology platform.

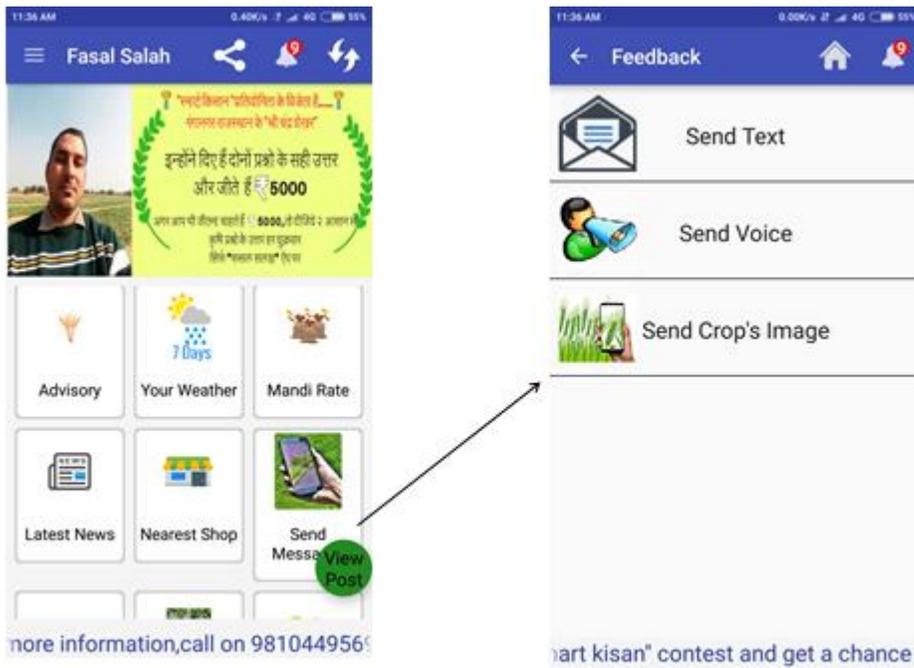
Our innovations lie in:

- 1. Developing ICT Technology for Achieving Scale:** Our science and technology solution can deliver scale by reaching each and every farmer, and brings together weather forecasts with agronomy on the same technology platform to drive analytics and information dissemination.
- 2. Real-time Weather Updates in the face of Climate Change and Changing Cropping Patterns:** In the face of changing weather patterns, timely high resolution weather forecasts, and their effect on crop health are the need of the hour. We use weather data and hyperlocalized forecasts that are updated in real-time and utilized in an automated manner for crop modeling.
- 3. Crop Monitoring:** Targeted prediction of prudent farming practices, crop monitoring, and yield prediction, given a farmer's crops, local soil and weather conditions, socioeconomic characteristics, access to inputs, and other variables requires predictive analytics with a number of data sources and a robust database for continual refinement of recommendations and yield estimates.

## OUR APPROACH TO YIELD DETERMINATION

### **Step 1. We seek farmers to send their crop pictures**

Farmers are trained and sensitized to send pictures in specific manner.



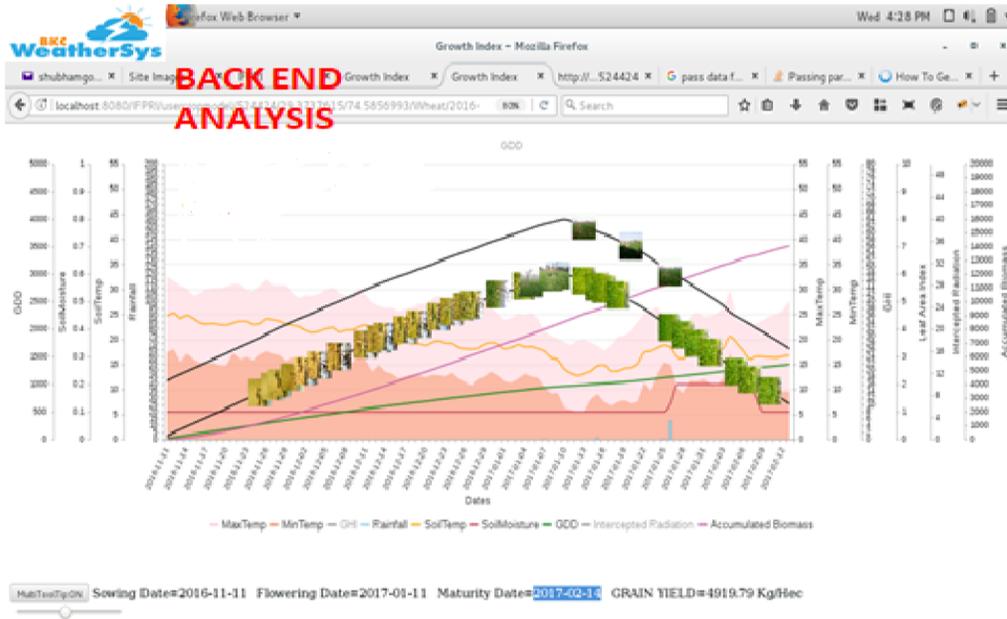
## Step 2; Pre-process pictures for analysis



Farmers sent pictures are analyzed using advanced picture processing tools.

## Step 3. Back End Analysis

- Dynamic crop model is run in real time.
- Pictures are analyzed simultaneously.



#### **Step 4. Application of AI for yield determination.**

Our innovation is ready to be rolled out on multicrop and multi-national basis. Resources to be needed to expand the farmer network and adding more crops for yield estimation.

**We have demonstrated and field tested capability to determine crop yield using farmers sent pictures and crop models using Fasal Salah App.**

Sincerely,

Jaya Singh, Ph. D.

(For BKC WeatherSys Pvt. Ltd.)

