Crop Monitoring System in Bangladesh, Main Challenges, Recent Initiatives and Prospects

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Overview of the presentation

- A brief discussion of DAE
- Existing crop monitoring system in Bangladesh
- Main Challenges
- Recent/Future Initiatives
A brief discussion of DAE

- The Department of Agricultural Extension (DAE) is a service oriented government organization under the Ministry of Agriculture.
- DAE is the largest extension service provider to the grass root level in Bangladesh.
- DAE has considerable manpower - 26,042.
- DAE is responsible for about 14,090 extension workers (SAAO).
- DAE is working with a number of national and international partners.
Existing Crop Monitoring System in Bangladesh
Methodological overview

- Previous years achievement
- Meeting with BBS, SPARRSO
- Area & yield finalization at HQ & sent to MOA
- Area & yield compilation & finalization in region level
- Area & yield compilation & finalization in District level
- Area & yield compilation & finalization in Upazila level

Crop Monitoring system
- Multi sectorial Target fixing committee
- National demand, Trend, Govt. policy, Market policy, Inputs

National Crop production target
- National crop production target breaks down into district wise

Crop cutting with BBS in Block level
- Reporting on stage wise crop situation
- Reporting on final transplanted area

Area & yield estimation & compilation in block level
- Cross checking by monitoring officer (D/AD office)

Advice on Technology adoption & management practices, Surveillance, Damage assessment
- Send to Region (AD)
- Send to District (DD)
- Send to Upazila (UAO)
- Send to Block (SAAO)

Implementation plan in Upazila level

BADC
- Send to District (DD)

BARI
- Target breaks down into block wise

Committee Members

SPARRSO

BINA

MOA

SCA

BANGLADESH BANK

MFDM

BRRI

BARC

BSRI

BBS

JUTE Dept.

Who are the Members of the target fixing committee?

Committee Members

SPARRSO
- BARI
- MFDM
- MOA
- SCA
- BANGLADESH BANK
- BADC
- DAE
- BBS
- BINA
- BARC
- BSRI
- BBSI
- JUTE Dept.

Send to Region (AD)
Send to District (DD)
Send to Upazila (UAO)
Send to Block (SAAO)

Field visits, farmers motivation & justify

Implementation plan in Upazila level

Give feedback to UAO office

Send to Region (AD)
Send to District (DD)
Send to Upazila (UAO)
Send to Block (SAAO)

National crop production target breaks down into district wise

Area & yield compilation & finalization in region level

Area & yield compilation & finalization in District level

Area & yield compilation & finalization in Upazila level

Area & yield finalization at HQ & sent to MOA

Bottom up approach
Monitoring Team in DAE

- Normal monitoring team *(Field level)*
- Season based special monitoring team *(HQ)*
- Monitoring cell under FSW *(Control room, HQ)*

Daily data collection over phone, email, Fax-

- ✓ Crop production status
- ✓ Stage of crop production
- ✓ Rainfall status
- ✓ Fertilizer status
- ✓ Damaged area by natural disaster if occur
Pest/disease surveillance

Upazila

Surveillance block 1
Surveillance block 2
Surveillance block 3
Surveillance block 4
Surveillance block 5

Weekly Monitoring
By SAAO/SAPPO/AEO

Report send to Upazila
Report send to district
Report send to Region
Necessary action taken by PP Wing
Main Challenges of Crop Monitoring System in Bangladesh

- Conventional crop monitoring system (Eye estimated/farmers interview) hardcopy based reporting)
- Time consuming and compilation problem (Handwritten report by SAAO, hardcopy based)
- Fragmented land
- Crop zoning based crop production not followed
- Farmers are not aware with new technology and adoption
- Lack of vehicle support
- GIS & RS based crop monitoring system not followed
Contd. Main Challenges of Crop Monitoring System in Bangladesh

- Unavailability and disorganized data *(Week recording system)*
- Lack Farmers database
- Insufficiency of ICT facilities, reluctant to use ICT
- Depending tendency on Govt. support *(Agril. Inputs, intensive)*
- Insufficient budget
- Lack of training of the monitoring team
- No well organized format for crop monitoring
- Number of different crops in an area
- Farmers are not aware with crop production plan/ crop statistics
Recent initiatives for crop monitoring

- Online reporting system (district level)
- Voice messaging (HQ to Upazila and Upazila to block)
- Phone monitoring (HQ to Upazila/block)
- Video messaging (Through YouTube)
- Linkage with BBS (Mid term meeting with BBS for standing crops)
- Development of Mobile Apps
- Development of farmers database
- Video conferencing
- Use of GIS technology
- Establishment of SAAO office
- Farmers advisory center (3 centers in a block)
Online reporting system

- Crop production status
- Stage of crop production
- Rainfall status
- Fertilizer status

Recent initiatives for crop monitoring
Recent initiatives - Use of GIS technology

Displaying crop production data onto Google Earth

Aman_2014-15.kmz
Area, production & yield maps of Wheat in Bangladesh

1. Wheat area (ha)
2. Wheat production (MT)
3. Wheat yield (MT/ha)
Prospects/Future Initiatives

Satellite Image based Crop Monitoring Services

- Crop growth monitoring
- Crop area estimation
- Yield forecasting
- Crop cutting sampling
- Land use/cover maps
Crop Cutting Sampling

Using random sampling based of block wise satellite index value

- Based on NDVI/LAI/Chlorophyll index value, classify all the blocks in a Upazila in 3-5 classes
- Identify high to low productive blocks in a Upazila
- Choose categorical samples from different clusters for crop cutting
- Select 5-10 % fields from each class for crop cutting
NDVI measurement for crops using GreenSeeker Handheld Crop Sensor

The GreenSeeker is an optical sensor that is used to measure plant biomass and display as NDVI

- Biomass measure
- Plant canopy variations
- Nutrient status and fertilizer application
- Crop condition/stress
- Pest and disease impact
- Yield potential

Data can be used -

24 – 48” (60-120 cm)
Comparison of Pixel-based and Object-based Methods for Agricultural Land use Classification using Terra/ASTER Satellite data

Objectives:

- Comparison of pixel based and object based image classification methods.
- To identify the method which is better for typical Bangladesh agricultural environment with its small-spaced fields.
Comparison between pixel-based and object-based approach

Pixel-based method:
Classifies the image according to certain spectral information (pixel value).

Object-based method:
Classifies the image not only pixel values but also spatial measurements that characterize the shape of the segments.

Terra/ASTER Satellite data

Data processing UTM reprojection

Pixel-based image analysis

Supervised classification

Training sample selection

Classify image with MLH classifier

Classified image

Ground truth data and ancillary data

Knowledge About land cover types

Object-based image analysis

Multi resolution image segmentation

Create general classes

Selecting sample objects

Classify image with NN classifier

Export classified image to ERDAS

Error matrix with ground truth data

Comparison between pixel-based and object-based approach

Error matrix with ground truth data
Image segmentation results with different Scale parameter

Multi-resolution image segmentation using eCognition Professional software

Subset original image
Segmentation level 1 with SP 5
Segmentation level 2 with SP 10
Segmentation level 3 with SP 15
Fallow land

Paddy fields

Grass land
Learnings:

- Object-based classification has a higher accuracy (81.76%) than pixel-based classification (72.64%) on the viewpoint of overall accuracy.

- So, it can be stated that by using an object-based approach, the mapping of the agricultural land with its small-spaced fields in Bangladesh can be carried out more reliably compared with pixel-based classification methods.

- The study area has a complex heterogeneous land use types. As it was possible to classify this complex land use types, it is expected that other parts of the country, where less complexity in land use found could also be classified using Terra/ASTER images.

- This information could be an important source for land use planners.
Satellite Image based Crop Monitoring Services
Monitoring Level - from Block to Country

**Crop health Monitoring**
- Biomass
- Leaf Area
- Chlorophyll content

**Precision Decision recommendation**
- Nitrogen Fertilization
- Pest alert for pesticide
- Irrigation

**Prediction and Intelligence**
- Yield Potential Analysis
- Yield Predictions for major crops
- Prediction evaluation and learning
**Yield Forecasting Model**

### Goal
- **Yield Prediction**
  - Average years and blocks selection
  - Extreme years (e.g., disaster/pest pressure) and blocks selection

### Spatial and temporal Scoping
- **Average years and blocks selection**

### Crop-specific, region specific Ideal curve preparation
- **Long Term Averaged Satellite data of the selected years**

### Modelling
- **Deviation from LTA curve estimation, Regressions with yield & different vegetation indices*** and extreme year factor calculation

### Yield prediction for current year
- **Yield Prediction**

### Formula

\[ **Yield** = a \times (\text{NDVI}) + b \times (\text{LAI}) + c \times (\text{Chlorophyll Index}) - d \]
Thank you
Prospects/Future Initiatives-

- Use of Remote Sensing, GIS & GPS technology
- Harmonization with BBS on area estimation and crop cutting
- Develop forecasting system using meteorological data
- Establishment of Crop zoning
- Training to extension agents and farmers on latest monitoring tools
- Building strong monitoring team and evaluation system
- Equipment for extension agents
- Solution of vehicle problem
- Provide sufficient budget
- Online reporting system from block level to central server in HQ