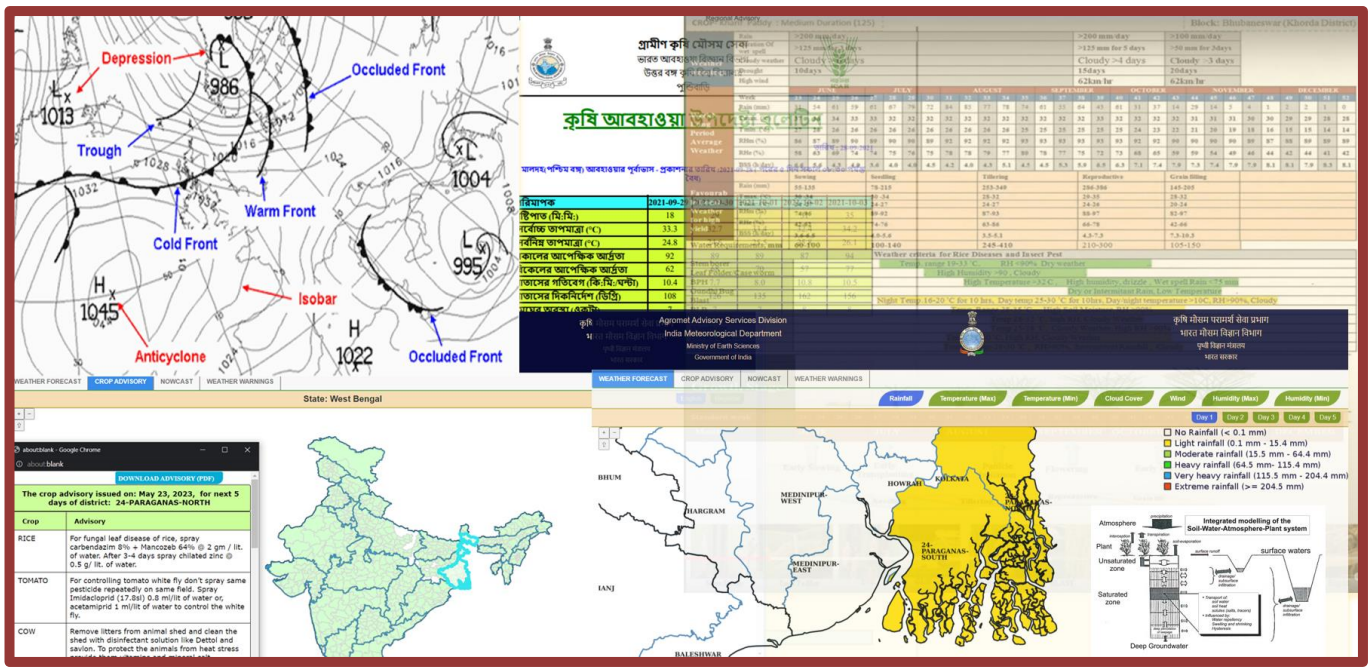
THE NEOTIA UNIVERSITY
ज्ञानम् आत्म प्रदीपाय

System Simulation and Agro-Advisory
Practical Manual
Course No - EC-SSC P 612, Credits-3(2+1)



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CONTENT

Lesson No.	Lessons	Page No.
Practical		
1	Preparation of crop weather calendars	**3**
2	Preparation of agro-advisories based on weather forecast using various approaches and synoptic charts	**5**
3	Working with statistical and simulation models for crop growth	**12**
4	Potential and achievable production	**15**
5	Yield forecasting	**17**
6	Insect & disease forecasting models	**19**
7	Simulation with limitations of water and nutrient management options	**24**
8	Sensitivity analysis of varying weather and crop management practices	**27**
9	Use of statistical approaches in data analysis and preparation of historical, past and present meteorological data for medium range weather forecast	**29**
10	Feedback from farmers about the agro-advisory	**31**

Lesson 1: Preparation of crop weather calendars

Objective: Understand the basic concept of crop, crop condition, crop growth stages, climatic Normal, weather, weather parameters, mathematical calculations for calculating the climate normal for basic skills in: weather data preparation, weather forecasting, crop condition, importing tabular data for various districts, crop condition analysis, warning of the infestation of pests and diseases, preparation of standard crop weather calendars.

Software: Software having spreadsheet and database functions like MS-Excel, Google sheets, MS-Access, MS-Word or similar type of software for report preparation.

System/Hardware Requirements: Need a desktop or a laptop with standard specifications:

Web Browser : Google Chrome

The pictorial representation of detailed information for a crop w.r.t. sowing period and duration of important phenological stages in its life cycle, the optima of climatic requirement during different stages of the crop and the actual and normal weather for that station / location is called the "**Crop Weather Calendar**".

A Crop Weather Calendar (CWC) consists of typical life history of the crop, from sowing through vegetative growth, flowering, grain growth to period of maturity. These CWC provide information on crop growth stages, normal weather for crop growth, warnings to be issued based on prevailing weather conditions, water requirement of crops during their various Phyto phases, meteorological conditions favourable for development of crop pests and diseases.

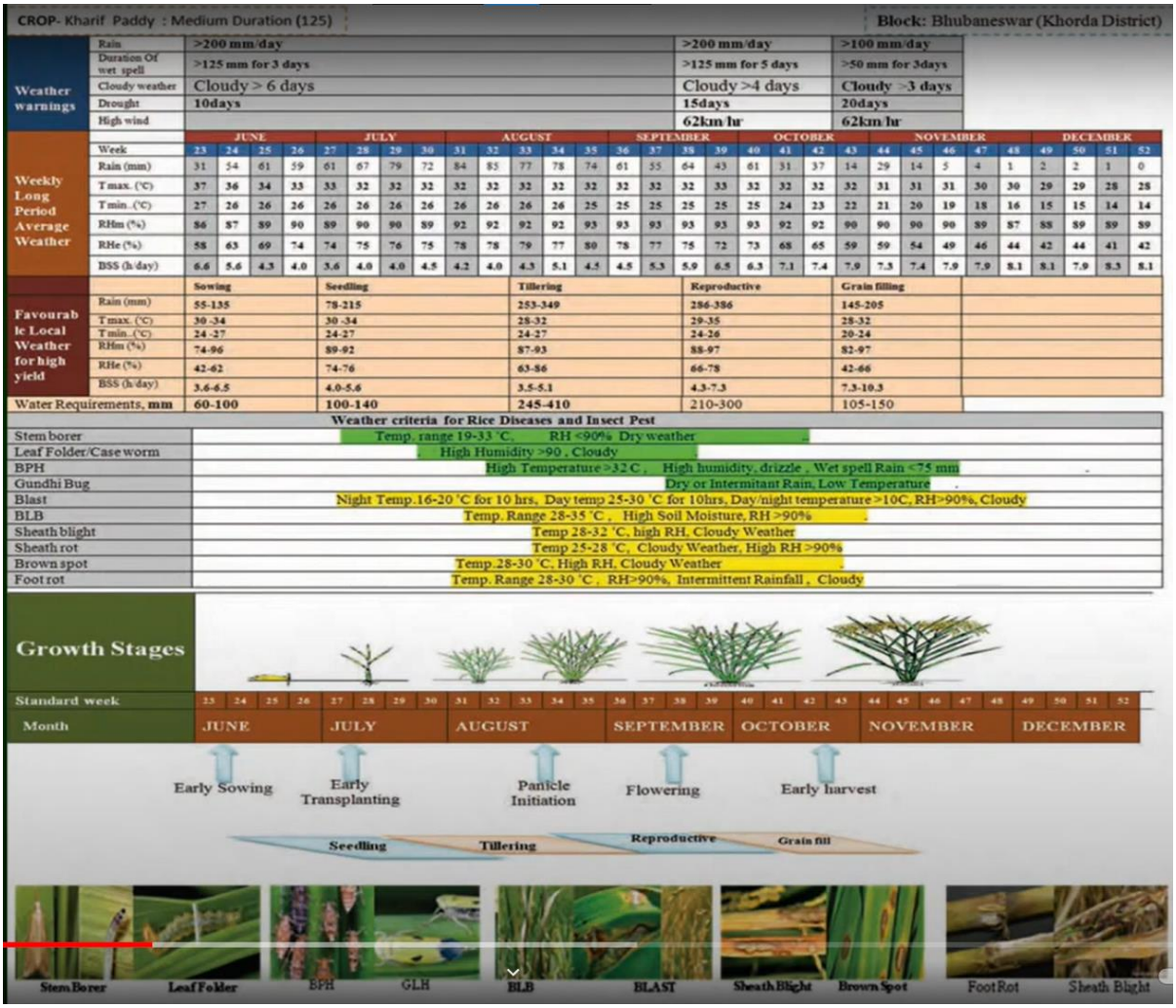
These calendars are useful for crop planning, irrigation scheduling and plant protection measures, which are of vital importance for effective crop planning and for maximizing and stabilizing food production in the country.

In a broader perspective over a period of say five years, the concise information contained in these calendars give broad indications of the direction of development which may prove useful to the planners, agricultural administrators, plant breeders and the farmers in formulating policy matters regarding plant breeding, crop adaptation, drought proofing, supplemental irrigation, maximizing the yield etc.

Methodology:

Steps:

1) Select the crop for which you want to prepare the crop weather calendar.
2) Select the area say, Block name
3) Find out the local weather stations of the districts of the state.
4) Collect the historic (for 30 years) and the daily weather data from IMD
5) Select standard weeks required for the selected crop cultivation
6) Calculate weekly long average weather for the weather parameters – rainfall, maximum and minimum temperature, relative temperature and sunshine hour.
7) Calculate climatic normal for the related standard weeks.
8) Collect standard weather warning for the area from IMD office on rainfall, duration of wet spell, cloudy weather, draught and wind speed.
9) Calculate favorable local weather for potential or high crop yield for the phenological or crop growth stages, say sowing to grain filling stages
10) Calculate water requirement for the specific crop growth stages
11) Calculate the probable pests and diseases attack on the crop growth stages based on the favorable conditions of the local weather.
12) Show the crop growth stages by pictures
13) Show the starting landmarks of crop growth stages as per the standard weeks and related months
14) Show the crop growth stages as per the standard weeks and related months
15) Give the forecasting of probable attacks of the pests and diseases on the crops by small pictures



Exercise

1) Which of the following statement is true?
   A) Crop weather calendar is a proprietary software
   B) Crop weather calendar is an open-source cross platform
   C) rop weather calendar benefits the farmers, agri-business
   D) All the above
2) CWC stands for :……
3) IMD stands for :……
4) Who can provide the weather data?
   A) Block Development office
   B) State Agricultural department
   C) Indian Meteorological department
   D) B and C
5) What is the standard week?
6) What is the software requiring for this?

Conclusion:

Video Link:

https://www.youtube.com/watch?v=xka8hJJvSHQ

Lesson–2: Preparation of agro-advisories based on weather forecast using various approaches and synoptic charts

Objective: Understand the basic concept of crop, crop condition, crop growth stages, climatic Normal, weather, weather parameters, mathematical calculations for calculating the climate normal for basic skills in: weather data preparation, weather forecasting, crop condition, importing tabular data for various districts, crop condition analysis, warning of the infestation of pests and diseases, preparation of standard crop weather calendars.

Software: Software having spreadsheet and database functions like MS-Excel, Google sheets, MS-Access, MS-Word or similar type of software for report preparation

System/Hardware Requirements: Need a desktop or a laptop with standard specifications:

Web Browser : Google Chrome

What is weather and its forecasting?

- Weather simply refers to the condition of air on the earth at a given place and time. Forecasting is the process of estimation in unknown situations from the historical data.
- Present weather conditions are obtained by ground observations, observations from ships, observation from aircraft, radio sounds, doppler radar and satellites. This information is sent to meteorological centers where the data are collected, analyzed and made into a variety of charts, maps and graphs.
- There are various techniques involved in weather forecasting, from relatively simple observation of the sky to highly complex computerized mathematical models.
- Weather prediction could be one day/one week or a few months ahead.
- Weather forecasting depends weather map elements.

Weather Map elements

Weather map elements depends on the following natural parameters:

- Pressure (high and low)
- Wind (direction and speed)
- Sky condition (cloud cover and cloud nature)
- Precipitation or rainfall (form and distribution)
- Sea condition

Following tools are required for weather forecasting

- Barometer readings
- Looking at the sky
- Nowcasting forecast
- Analog technique
- Numerical Weather Prediction (NWP) model
- Ensemble Forecasting
- Radar data
- Weather satellites data (Geostationary satellites)
- Weather maps

Types of weather forecasting

- Persistence Forecasting

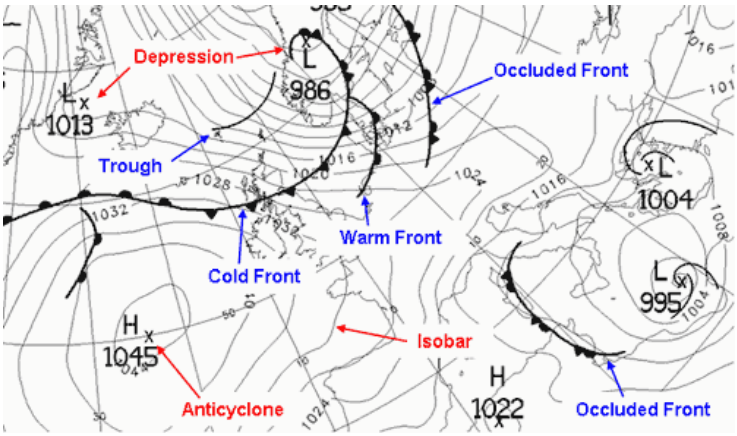
- Synoptic Forecasting
- Statistical forecasting
- Computer forecasting

Classification of weather forecasting

- Very short-range forecast
- Short range forecast
- Medium range forecast
- Long Range forecast

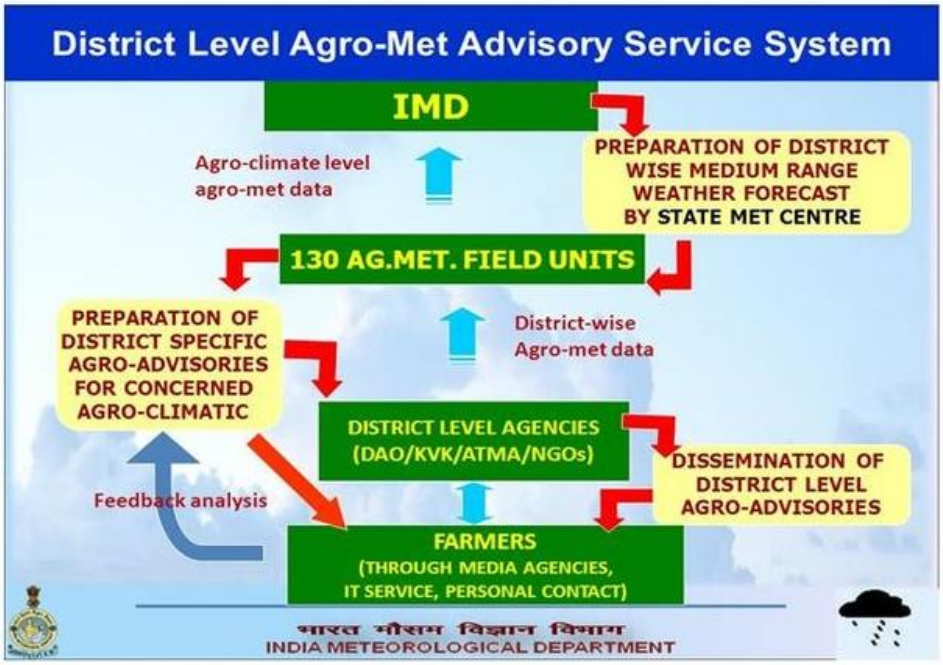
Synoptic Weather Chart

The word 'synoptic' simply means a summary of the current situation, so in weather terms, a synoptic or pressure chart is a map that summarises the atmospheric conditions over a wide area at a given time.



Weather based Agro Advisory Service (AAS)

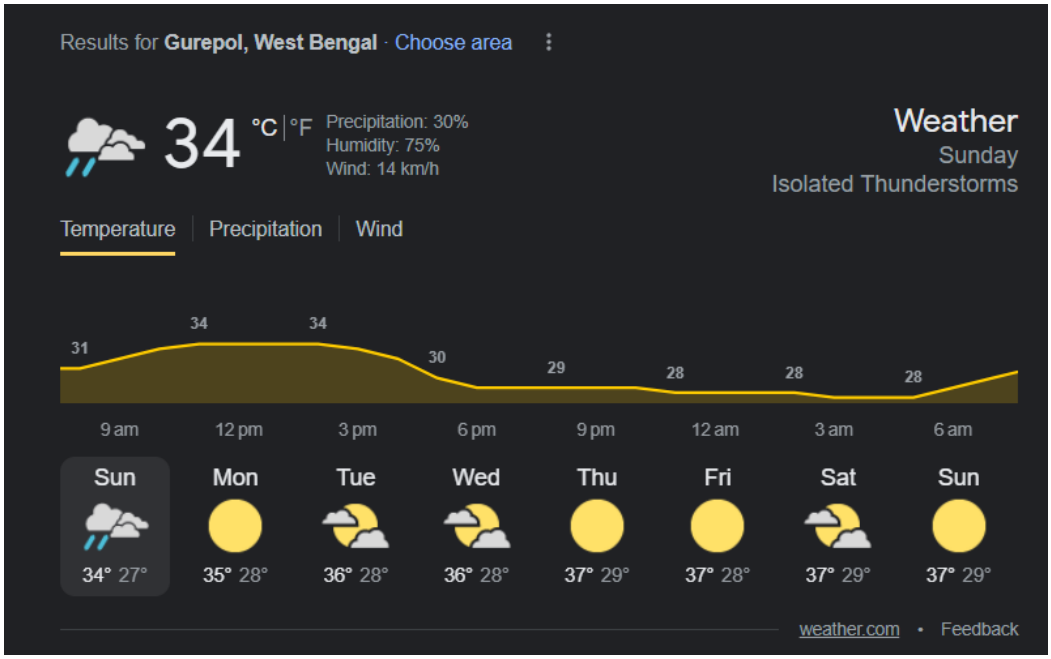
Agro advisory Service is made for the farmers, agri-business persons decision makers in the government and private sectors. The AAS is dependent on the IMD and experts in the national and district level agencies. The following picture is showing the AAS processes.



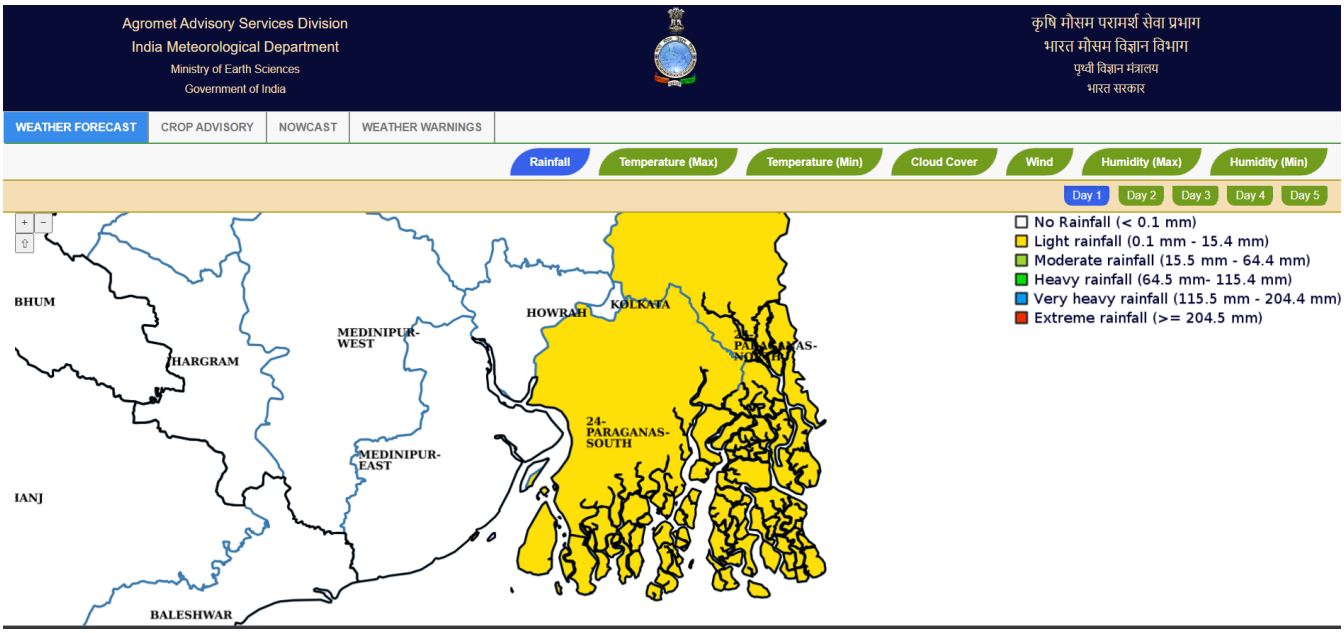
Methodology:

- Past week weather conditions from weather station through IMD
- Weather forecast of coming 5 days from IMD
- Experts on existing or future crop cultivation programs
- Agro advisory bulletin preparation
- Agro advisory bulletin would send to Expert Committee review
- Feedback from the expert farmers at district / block level.
- Comparison the forecasting decisions and update
- Distribution of agro advisory through various media
- Most important advisories sent to farmer through SMS

A Sample weather forecast from weather.com



A Sample weather forecast from IMD



Part I: Weather

Districtwise significant Past Weather in different agroclimatic zones for the period 23/05/23 to 25/05/23	District level Weather Forecast for different agroclimatic zones for the period 27/05/23 to 31/05/23

Coastal Saline Zone

EAST MIDNAPORE

Days	Rainfall (mm)	Maxi Temp (°C)	Mini Temp (°C)	Relative Humidity (%)
Tuesday	0.0	34.7-37.5	23-29.4	60-90
Wednesday	0.0			
Thursday	10.4			

EAST MIDNAPORE

Light to moderate rainfall is predicted on next 3 days and no rainfall is predicted in the remaining days.

- ð Sky will be mainly clear in next 5 days .
- ð Wind speed will be 17.0-21.0 km/hr and the predominant wind direction will be Southerly to Southwesterly .
- ð Maximum temperature is expected to be around 36.0-38.0 degree and minimum temperature is likely to be 24.0-28.0 degree.
- ð Maximum and minimum relative humidity will be in the range of 73-84% and 26-47%

SOUTH 24 PARGANAS

Days	Rainfall (mm)	Maxi Temp (°C)	Mini Temp (°C)	Relative Humidity (%)
Tuesday	0.0	33.9-39	23.4-30	45-92
Wednesday	1.9			
Thursday	0.0			

SOUTH 24 PARGANAS

Light rainfall is predicted on next 2 days and no rainfall is predicted in the remaining days.

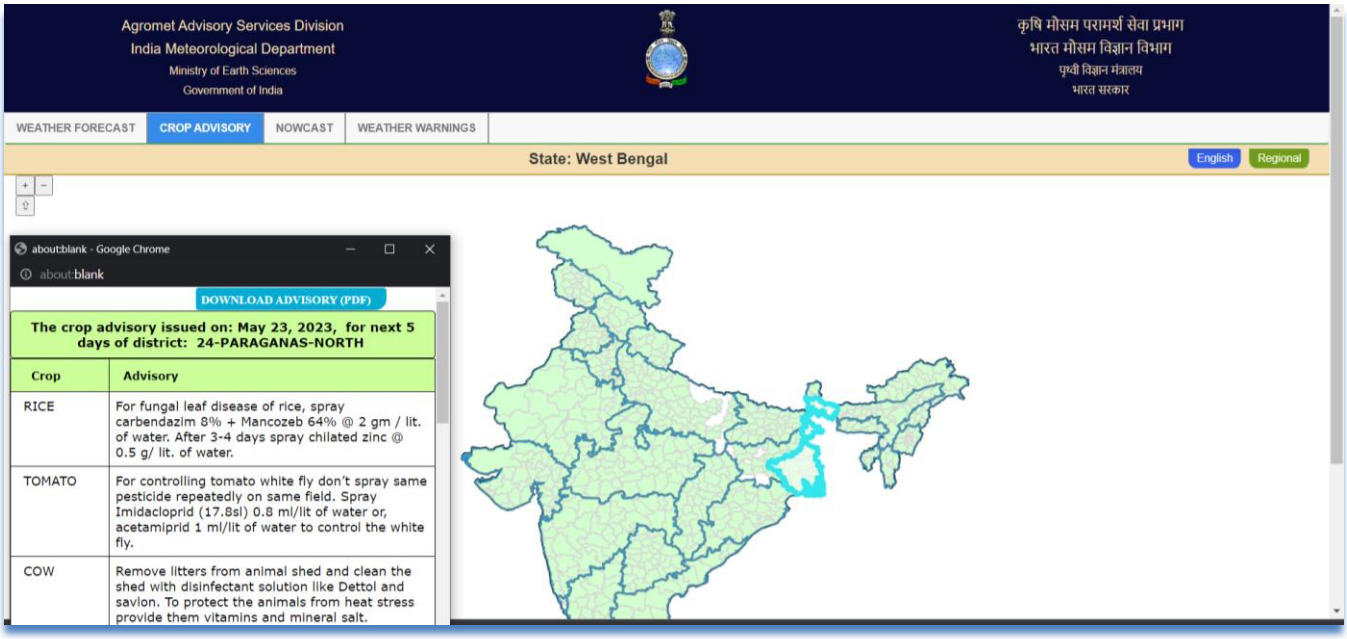
- ð Sky will be mainly clear in next 5 days .
- ð Wind speed will be 20.0-23.0 km/hr and the predominant wind direction will be Southerly to Southwesterly .
- ð Maximum temperature is expected to be around 34.0-37.0 degree and minimum temperature is likely to be 25.0-28.0 degree.
- ð Maximum and minimum relative humidity will be in the range of 82-88% and 35-53%

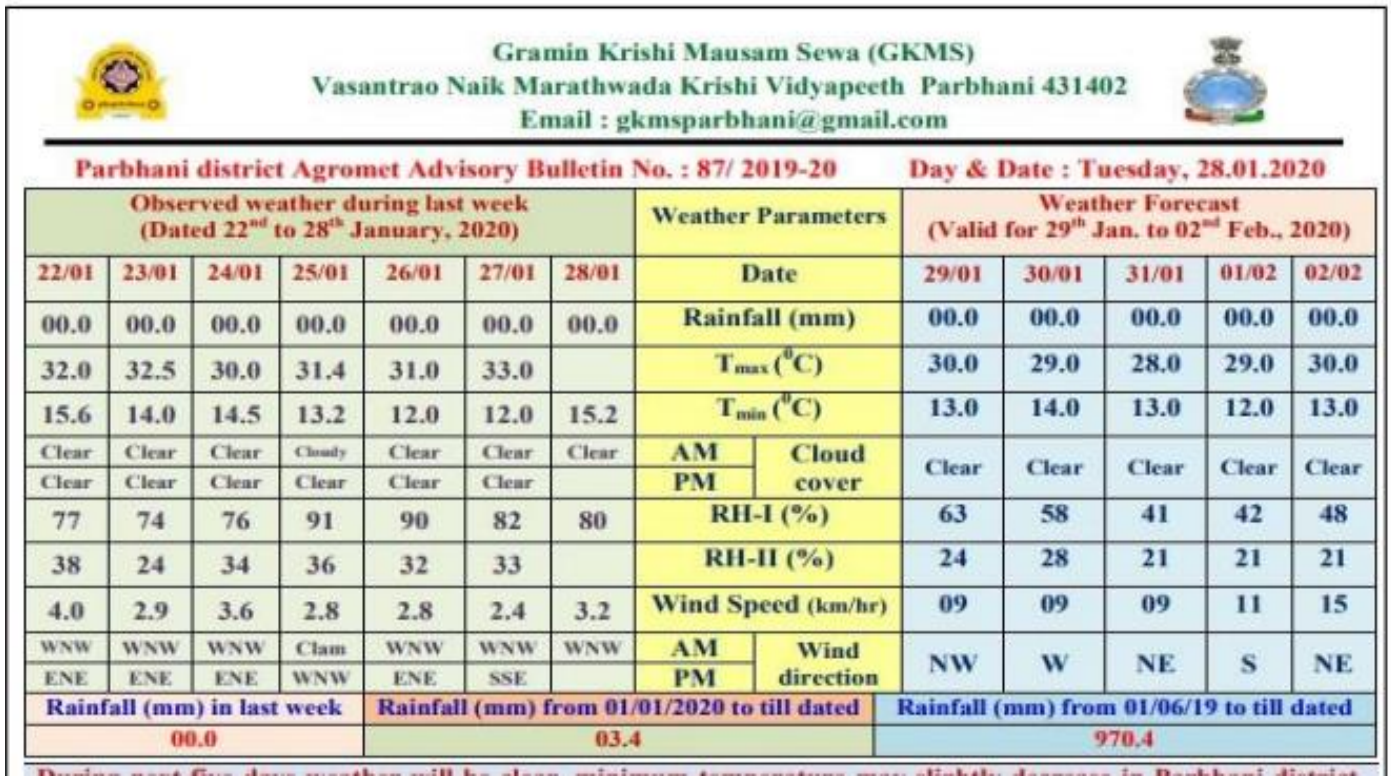
Sample Agro Advisory Services from IMD and Gramin Krishi Mausam Sewa

Part II: Agroclimatic zonewise Agricultural/Agrometeorological Advisories

GENERAL	As per extended range forecast deficit in rainfall is recorded from 4.5.23 to 17.5.23. Based on MME forecast below normal rainfall is predicted from 19.5.23 to 1.6.23. Based on MME forecast Tmax will be above normal in Week 1 and 2. and for Tmin, it will show above normal in Week 1 and week 2. To know the nowcast weather forecast for thunderstorm follow WhatsAppmesseges		
MAIN CROPS	STAGE	PEST & DISEASES	ADVISORY
Boro paddy			¿ Deep summer ploughing should be done in harvested boro paddy field to destroy eggs and pupa of insects ¿ Take care green manuring crop like cluster bean, dainchaetc after harvesting of boro paddy in order to

			fertilize the field and conserve moisture in soil ¿ Immediate take the grains of boro paddy from threshing floor for sun dry
Betel vine	Green leaf stage	Chital due to hot and humid weather	¿ Immediate repair the fencing of garden tightly ¿ Apply Bordeaux mixture and keep proper aeration inside the garden ¿ Apply sprinkler irrigation inside the garden
Coconut		Rhynochorus beetle attack due to hot and humid weather	¿ To protect the plant cut and remove the rotten portion of spindle and the adjacent 2 leaves of effected palm and spray there Hexaconazole (Cantap 5EC) @2ml in 300 ml water around the base of spindle ¿ Place 3 numbers of napthalin balls in the youngest three leaf axis and cover them with sand
Fishery	All stages	Low food intake due to hot weather	¿ Feed the fishes during morning and afternoon hours ¿ Make shadow by green pana (aquatic weed) at one side of pond ¿ Uproot the weeds from the bottom of pond water for more oxygen supply
Cattle	At all stages	¿ Worm infection due to hot and humid weather.	¿ Feed the cattle at morning and evening time ¿ Avoid mung mash and mustard cake in their food and supply arhar or black gram mash and sesame or linseed cake ¿ Keep the cattle indoor at afternoon hours also ¿ Immediate complete the vaccination before rain ¿ Feed Bolus at 4 months interval@1 Bolus per 150kg body wt for worm infection. ¿ Complete vaccination before monsoon. ¿ Keep indoor the cattle as per the warningto protect them from lightning.





Gramin Krishi Mausam Sewa (GKMS)
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Email : gkmsparbhani@gmail.com

Parbhani district Agromet Advisory Bulletin No. : 87/ 2019-20 **Day & Date : Tuesday, 28.01.2020**

Observed weather during last week (Dated 22nd to 28th January, 2020)							Weather Parameters		Weather Forecast (Valid for 29th Jan. to 02nd Feb., 2020)				
22/01	23/01	24/01	25/01	26/01	27/01	28/01	Date		29/01	30/01	31/01	01/02	02/02
00.0	00.0	00.0	00.0	00.0	00.0	00.0	Rainfall (mm)		00.0	00.0	00.0	00.0	00.0
32.0	32.5	30.0	31.4	31.0	33.0		T_{max} (°C)		30.0	29.0	28.0	29.0	30.0
15.6	14.0	14.5	13.2	12.0	12.0	15.2	T_{min} (°C)		13.0	14.0	13.0	12.0	13.0
Clear	Clear	Clear	Cloudy	Clear	Clear	Clear	AM	Cloud cover	Clear	Clear	Clear	Clear	Clear
Clear	Clear	Clear	Clear	Clear	Clear		PM						
77	74	76	91	90	82	80	RH-I (%)		63	58	41	42	48
38	24	34	36	32	33		RH-II (%)		24	28	21	21	21
4.0	2.9	3.6	2.8	2.8	2.4	3.2	Wind Speed (km/hr)		09	09	09	11	15
WNW	WNW	WNW	Clam	WNW	WNW	WNW	AM	Wind direction	NW	W	NE	S	NE
ENE	ENE	ENE	WNW	ENE	SSE		PM						
Rainfall (mm) in last week				Rainfall (mm) from 01/01/2020 to till dated					Rainfall (mm) from 01/06/19 to till dated				
00.0				03.4					970.4				

During next five days weather will be clear, minimum temperature may slightly decrease in Parbhani district. Irrigation management should be done as per availability and requirement in safflower and *Rabi* Sorghum crop.

Name of Crop	Stage	Agromet Advisory
Cotton	Harvesting	Avoid further extended growth after multiple picking. Remaining plant parts should be collected and destroy properly after final picking.
Pigeonpea	Harvesting	Harvesting and threshing of timely sown pigeonpea crop should be done.
Safflower	Growth stage	Irrigation should be applied as per availability of water through sprinkler irrigation system. Precaution should be taken that water logging situation should not be occur. For management aphids in safflower crop take a spray of *Dimethoate* 30 % EC @ 13 ml or *Acephate* 75 % SP @ 16 gm per 10 liter of water.
Rabi Sorghum	Flowering / grain filling stage	Irrigation management should be done in Rabi sorghum as per availability of water during flowering / grain filling stage. To protect the sorghum crop form birds during maturity stage use 'Agni – Rekha' (Fire red) strips around the field. For management of fall armyworm in *rabi* sorghum crop take alternate spray of *Thiamethoxam* 12 % + Lambda – *cyhalothrin* 9.5 % ZC @ 5 ml or *Spinetoram* 11.7 % SC @ 4 ml per 10 liter of water.
Banana	Growth stage	Take a spray of fungicide as per requirement in October sown banana orchard.
Mango	Flowering stage	For management of mango *hoppers* take a spray of *Deltamethrin* 2.8 % EC @ 9 ml or *Lamda cyhalothrin* 5 % EC @ 6 ml per 10 liter of water.
Grape	Fruit development stage	Due to variation in weather i.e. low temperature during early morning and bright sunshine during afternoon may affect the quality of grapes. Hence, to protect use paper bags to cover it.
Vegetable	Growth stage	Management practices should be done in seedling vegetables sown on raised bed for summer season. Apply irrigation as per requirement.
Animal husbandry	--	To maintain temperature in poultry shed during 12.00 am to 07.00 am use electric bulbs as per requirement.

This Agro Advisory Bulletin (AAB) is prepared and published with the consolation and recommendation of SMS committee of "Gramin Krishi Mausam Sewa (GKMS)", Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani 431 402 (MS).

Principal Nodal Officer
Gramin Krishi Mausam Sewa (GKMS)
VNMKV, Parbhani

Exercise

1) Which of the following statement is true?
   A) Climate Normal is the product of historical weather data.
   B) Synoptic chart shows meteorological map with specific symbols.
   C) Growth stages for all the crops is fixed.
   D) mm/sec is the unit of rainfall.
2) GKMS stands for :……
3) WS & WD stands for :……
4) SMS stands for :……
5) What does the abbreviation AAS stands for?
   A) Agro-Advisory Service
   B) Agromet-Advisory Service
   C) Alex-Advisory Service
   D) None
6) Standard week means
   A) Weeks used to monitor the crop growth
   B) Weeks used to forecast weather
   C) Indexing of weeks as per year
   D) All of the above

Conclusion:

Video Link:

https://www.youtube.com/watch?v=UfEz-ErmEvg

Lesson–3: Working with statistical and simulation models for crop growth

Objective(s):

To imparting knowledge of growth, development and yield analysis, to develop crop growth model for yield prediction using statistical techniques.

Software: Software having spreadsheet functions like MS-Excel, Google sheets, MS-Word or similar type of software for report preparation.

System/Hardware Requirements: Need a desktop or a laptop with standard specifications:

Web Browser : Google Chrome

Development of statistical model

To establish the relationship between crop yield and different weather parameters, multiple regression equation can be the easiest option. But one of the serious limitations of multiple regression analysis is that it accommodates only quantitative response as explanatory variables.

Quantitative variable can be introduced in the regression model through dummy variable. A Dummy variable is an artificial variable created to represent an attribute with two or more distinct categories or levels.

In a sample study to include the effect of date of transplanting on rice yield, the entire transplanting season has been classified into two categories. First half transplanting (early transplanting date to normal transplanting date) scored as zero (0) and second half transplanting (i.e., late transplanting) scored as one (1) to treat them as dummy variable.

The yield forecasting model has been used in this study was specified as:

$$Y = \beta 0 + \beta 1MIN + \beta 2MAX + \beta 3IR + \beta 4VP + \beta 5\ WS + \beta 6CR + \beta 7\ RD + \beta 8DMY + \epsilon \qquad (1)$$

where,

- Y= yield of Aman rice (Kg/ha);
- MIN = Minimum temperature (^{0}C);
- MAX = Maximum temperature (^{0}C);
- IR= Irradiation (MJ m^{-2} d^{-1});
- VP = Vapor pressure (hPa);
- WS = Wind speed (km h^{-1});
- CR = Cumulative rainfall for the seasons unto the week (mm);
- RD = Number of days with rain (d);
- DMY = Dummy variable (0 = First half transplanting score and 1 = Second half transplanting score);
- ϵ = Stochastic term/residual term/error term [$\epsilon \sim NID\ (0, \sigma 2)$]

Thus, the multiple effects of several weather parameters viz., maximum temperature, minimum temperature, vapor pressure, wind speed, rainfall, relative humidity, bright sun shine hour and evaporation were taken into consideration to justify the impact of them on yield.

For this multiple linear regression analysis, we require a statistical software - SPSS. Collection of data for development of statistical model the weather data need to be collected from local meteorological observatory. For development of statistical model, the yield data of wet-season rice need to be collected for ten years along with weather data. The developed model, then it would be validated with actual data set for subsequent two years.

Crop Growth Simulation model for yield prediction

In the present study, the WOFOST (World Food Studies) model may be used to simulate growth and production of rice. WOFOST was originally developed as a crop growth simulation model for the assessment of the yield potential of various annual crops in tropical countries.

The WOFOST model considers three growth levels correspond to crop production, namely, potential production, limited production and reduced production.

Crop growth is determined by irradiation, temperature, plant characteristics and crop growth management (e.g., nutrient and water management). Atmospheric CO_2- concentration is assumed to be constant. In case of estimating potential production, nutrient and water are assumed to be in ample supply.

If the supply of water or nutrients is sub-optimal during (parts of) the growing season, this leads to water- limited and/or nutrient-limited production, which is normally lower than potential production. This holds for biomass production, in some cases water limited yield may be higher than potential yield because of more favorable harvest index.

At reduced production level, the possible reduction in crop yield occurs mainly due to biotic factors like weeds, pests and diseases. In the present study the variation of rice production in the Lower Gangetic plain was determined with actual weather data, prevailing soil characteristics and common management practices followed by the farmers in the study region.

The pre-calibrated WOFOST model may be used here to determine the year-to-year variation of wet-season rice yield for different sowing dates. Validation of WOFOST Model Some common statistical parameters, namely, Coefficient of determination (R^2), Root Mean Square Error (RMSE), etc., need to be worked out to evaluate the performance of the model.

The following statistical tools were used in the present study:

(i) Bias: Bias is simply the difference of average predicted value and average observed value.
(ii) Mean Absolute error (MAE): MAE is simply the average of the absolute difference between predicted and observed value.
(iii) Mean Square error (MSE): MSE measures the average of squares of the squares of the "errors". The error is the amount by which the value implied by the estimator differs from the quantity to be estimated.
(iv) Root mean square error (RMSE): RMSE is the root of the MSE value. It is usually best to report the RMSE rather than MSE, as the RMSE would be measured in the same units as the data, rather than in squared units.

Sample results from crop simulation Models using WOFOST model.

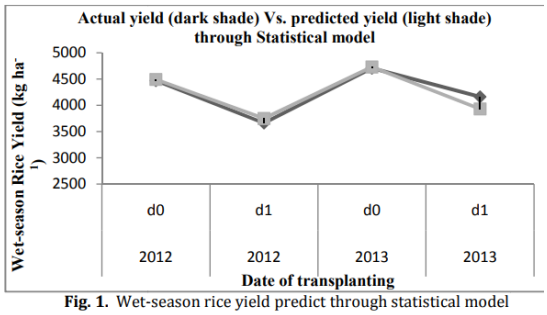


Fig. 1. Wet-season rice yield predict through statistical model

Exercise

1) Which of the following statement is true?
   A) Yield prediction using current and historical data
   B) Yield estimation using current data
   C) Both of them
   D) None

2) MAE stands for :……
3) WOFOST stands for :……
4) RMSE stands for :……
5) What does the abbreviation RD stands for?
   A) Random Digit
   B) Days of rainfall
   C) Both
   D) None of then
6) The unit of air pressure
   A) Pa
   B) hPa
   C) Both
   D) None of then

Conclusion :

Video Link:

WOFOST Model: **https://www.youtube.com/watch?v=KiUPO3SiBy4**

DSSAT Model: **https://www.youtube.com/watch?v=MIbHhcwB5Pw**

Crop Simulation Modelling: **https://www.youtube.com/watch?v=JktzLdiH860**

InfoCrop: **https://www.youtube.com/watch?v=nzGDQRNxn1s**

Lesson–4: Potential and achievable production

Objective(s):

To imparting knowledge of potential and achievable growth, yield gap analysis.

Software: Software having spreadsheet functions like MS-Excel, Google sheets, MS-Word or similar type of software for report preparation.

System/Hardware Requirements: Need a desktop or a laptop with standard specifications:

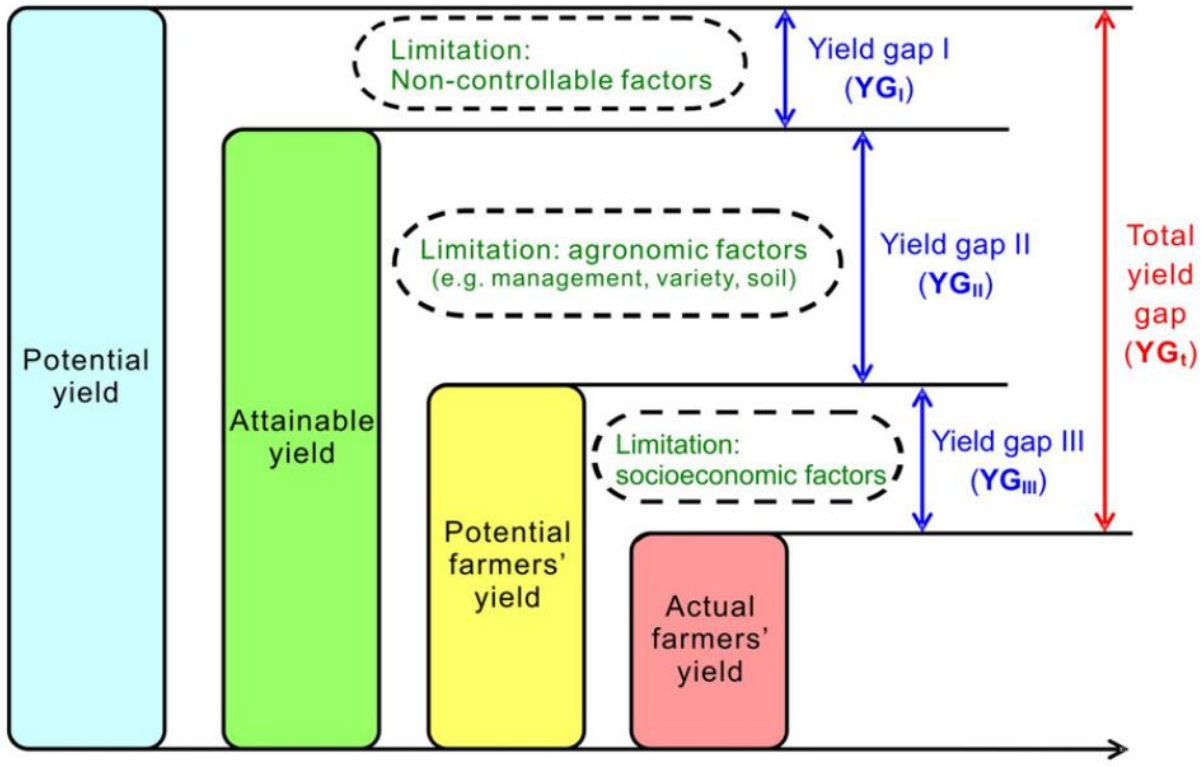
Web Browser : Google Chrome

Crop production is dependent on solar radiation, precipitation, atmospheric vapor pressure, temperature, soil fertility, and management decisions such as hybrid selection, planting date, and inputs (fertilizers and irrigation). A trend in any of these climatic variables can therefore possibly lead to a trend in crop production.

Potential yield is the yield ceiling of the crop for a given variety in a given location. Accurate estimates of crop potential yield are essential for assessing regional crop production capacity on existing farm land given best management practices.

Numerous studies successfully quantified yield gaps and gap variations in the intervening decades at different study scales.

The total yield gap was defined as the yield difference between potential and actual farmers' yield. According to the constraints, yield gaps can be broken down further into three components (Fig. 1).



Potential yield in a given location is defined as the yield of a crop cultivar when grown under non-limiting water and nutrient supply, and in the absence of pests and diseases.

Attainable yields are less than absolute biophysical 'potential yields', and represent the yield achievable using current best-known technology and management techniques at a given time and in a given ecosystem.

Attainable yield is commonly less than, or at best equal to, potential yield. The attainable yield does not take into account the cost of achieving best management practice.

Potential farmers' yield, on the other hand, is obtained by adjusting management so that crop profitability is optimized. Thus, potential farmers' yield is commonly lower than and at best equal to attainable yield.

- Actual farmers' yield is the average of farmers' yields in a given target area at a given time and in a given ecosystem. Therefore, the first component of yield gaps (YGI—Fig. 1) is mainly due to factors that are generally not controllable such as environmental conditions and some technologies unavailable in the farmers' field (Van Tran, 2001).
- The second component of yield gaps (YGII—Fig. 1) is mainly due to differences in agronomic factors. This gap exists because farmers may use suboptimal doses of inputs and cultural practices.
- The YGII can be narrowed by deploying more efforts to improve the management. The third component of yield gaps (YGIII—Fig. 1) was caused by socioeconomic factors.

Exercise

1) Which of the following statement is true?
   A) Potential yield is imaginary.
   B) Achievable yield is the actual yield
   C) Both A & B
   D) None of the above
2) YG stands for :……
3) Formula of yield is :……
4) What is the meaning of Yield Gap?
   A) Difference of the potential and achievable yield
   B) Summation of the potential and achievable yield
   C) Both of A & B
   D) None of the above
5) What are causes of the yield gap?
   A) Non-controllable factors
   B) Agronomic factors
   C) Socioeconomic factors
   D) All of the above

Conclusion :

Video Link:

https://www.youtube.com/watch?v=YqavNFROa2A

https://nutrien-ekonomics.com/news/liebigs-law-of-the-minimum/

Lesson–5: Crop Yield forecasting

Objective: Understand the basic concept of forecasting, crop yield forecasting.

Software: Software having spreadsheet functions like MS-Excel, Google sheets, MS-Word or similar type of software for report preparation.

System/Hardware Requirements: Need a desktop or a laptop with standard specifications:

Web Browser: Google Chrome

Crop Yield Forecasting

Based on crop weather studies, crop yield forecast models are prepared for estimating yield much before actual harvest of the crops. By use of empirical- statistical models using correlation and regression technique crops yield are forecast on an operational basis for the country.

Quantitative Forecast of Crop Yield Based on crop weather studies, crop yield forecast models are prepared for estimating yield much before actual harvest of the crops. By use of empirical statistical models using correlation and regression technique crops yield are forecast on an operational basis for the country. Meteorological parameters at various crop growth stages along with technological trends are used in the models.

Based on these models, monthly interim forecast is prepared for the crops and is supplied to the Planning Commission, Directorate of Economics and Statistics, Ministry of Agriculture and Co-operation, Department of Science and Technology.

FASAL: Forecasting Agricultural output using Space, Agro-Meteorology and Land based observations

Under Integrated Agromet Advisory Services scheme of IMD, a network of 130 Agromet Field Units (AMFUs) and 23 State AAS Units of IMD (Fig 1) is functioning in the country. These centers are located at different State Agricultural Universities (SAUs) / ICAR Institutes; IITs in different Agroclimatic zones of each state.

Out of these, the work of crop yield forecasting will be undertaken at 46 principal AMFUs and 23 State AAS Units of IMD located in the states. It is planned that setting up of infrastructure and the developmental works of the yield forecast models by way of generating field data from the experimental plots will be carried out simultaneously in the AMFUs in different States in consultation as well as coordination with the Agricultural Meteorology Division at Pune.

Agrimet Division will ultimately generate State and National level crop forecast based on the district level forecast received from the AMFUs.

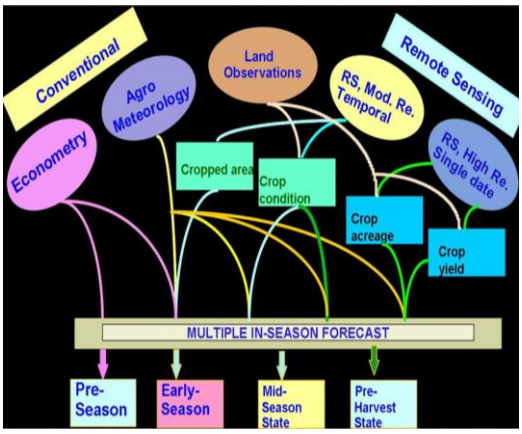


Fig.-1: Forecasting Agricultural output using Space, Agro-meteorology and Land based observations (FASAL)

Crop acreage forecast (F1) at planting stage; mid-season forecast (F2) for both acreage and crop yield and pre-harvest yield forecast (F3) will be provided by IMD using agromet models during kharif as well as Rabi season for the crops.

Forecasting of crop yield would be made for 15 crops like Kharif Rice, Wheat, Winter Potato, Cotton, Sugarcane, Mustard, Rabi Sorghum, Rabi Rice, Jute, Kharif Sorghum, Kharif Maize, Kharif Bajra, Ragi, Kharif Groundnut and Rabi Groundnut.

The objective of the project is to develop, validate and issue multiple crop yield forecast for major crops at mid-season (F2) and pre-harvest stage (F3).

The level of crop yield forecasting would be at district/ Agroclimatic zone/ state/ national level. Implementation of the project will enable Development Assistance Committee (DAC) to make more accurate forecast of production for major crops of the country at different stages of crop growth. These production estimates would facilitate various decision-making processes of the Government.

Exercise

1) Crop yield forecasting is done for how many crops?
   A) 10 crops
   B) 15 crops
   C) 20 crops
   D) All the above
2) DAC stands for :……
3) SAU stands for :……
4) AMFU stands for :……
5) How many AAS units for state level?
   A) 25
   B) 23
   C) 28
   D) None of the above
6) What is the full form of FASAL?

Conclusion:

Video Link:

https://www.youtube.com/watch?v=yQJHYLCnbx0

Lesson–6: Insect & disease forecasting models

Objective: Understand the basic concept of forecasting models based on the infestation of pests and diseases on crops.

Software: standard DTP and standard statistical software.

System/Hardware Requirements: Need a desktop or a laptop with standard specifications:

Web Browser : Google Chrome

Pest Forecasting:

Pest forecasting is the prediction of severity of pest population which can cause economic damage to the crop. The forecasting of pests guides the farmers about the timing and biology of insect incidence, and to eliminate blanket applications, reduce pesticide amounts, and achieve quality results.

Some forecasting models are described below:

(i) Quantitative Seasonal Studies: Using appropriate sampling techniques, the pest abundance must be studied over several years along with seasonal range, variability in number and distribution.

(ii) Life-History Studies: The detailed bio-ecology of pest under a range of temperature, humidity, etc. should be known.

(iii) Ecological Studies: Life-table studies of pest are important for better understanding of pest population build-up, natural mortality factors, intrinsic growth rate, etc. The migration and immigration of pests can also be used for forecasting of pests.

(iv) Field Studies: In field situations, the natural enemy abundance under a range of temperature and humidity should be studied. The other cultural practices like fertilizer application, irrigation, plant spacing, etc., affect the crop phenology which directly influences the population build-up of a pest.

Types of Pest Forecasting:

Pest forecasting may be divided into two categories, viz., short-term forecasting and long-term forecasting.

1. **Short-Term Forecasting:** The short-term forecasts are often based on current or recent past conditions that form a basis for, or an enhancement to, the forecast.

2**. Long-Term Forecasting:**

These forecasts are based on possible effect of weather on the pest population and cover a large area. The data are recorded over a number of years on wide seasonal range and from different areas.

Methods for Pest Forecasting:

Pest forecasting has generally based on environmental factors, climatic areas and empirical observations.

1. Environmental Factors: The pest attack occurs in epidemic form only when the favourable environmental conditions for multiplication of pest prevail for longer duration. Every insect requires a consistent amount of heat accumulation to reach certain life stages, which can be interpreted in terms of degree days.

There is a threshold temperature for each insect. These values can be used in predicting insect activity and appearance of symptoms during the growing season. Therefore, the degree days would be useful in pest management programme to time the scouting of insect pests. This predictive information is known as an insect model. Models have been developed for a number of insect pests.

Degree days = Maximum temperature + Minimum temperature/2 – Development threshold

2. Observations of Climatic Areas: The distribution of insects throughout the world is based on evolutionary history which includes main important factor, i.e., climate of the geographical region. There are three distinct zones of abundance of each insect species.

- Zone of Natural Abundance (Endemic): In this zone, the pest species is often in large number, regularly breeds and is a regular pest of some importance and pest is seen all the time.
- Zone of Occasional Abundance: The insect species emerge in epidemic occasionally in this zone because the climatic conditions are either less suitable or the suitable conditions exist only for a short period of time followed by unsuitable conditions.
- Zone of Possible Abundance: The pest species in this zone can be seen only after migration from zone of natural and occasional abundance outbreaks. The climatic conditions are drastic for their breeding and development.

3. Empirical Observations: This type of pest forecasting is based on estimating the number of insects available during a particular time. In other words, it is nothing but the sampling of insect or monitoring of pest population.

Pest and disease forecasting models consist of mathematical relationships which describe the progress of pest or pathogen life cycles in terms of environmental parameters such as temperature, precipitation, and humidity.

Prerequisites for developing a forecast system:

- The crop must be a cash crop (Economic value)
- The disease must have potential to cause damage (Yield losses)
- Disease assessment is essential to develop strategy for controlling a disease
- Diseases reduces the quality of the produce lower cause financial loss to the growers.
- The disease must vary each season in the timing of the first infections and its subsequent rate of progress.
- Effective and economic control known to farmers.
- Reliable means of communication with farmers.
- Farmers should be adaptive and have purchase power.
- Long-term warnings or predictions are more useful than short-term warning or predictions.

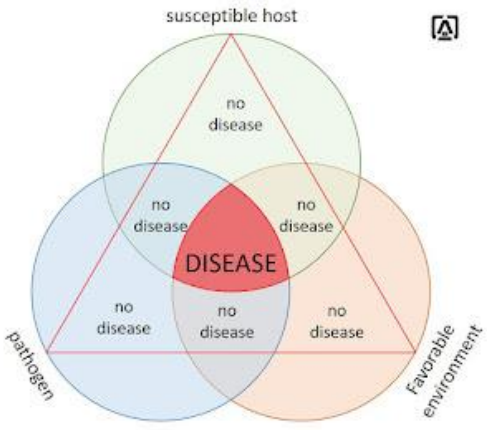
Plant disease forecasting

Plant disease forecasting is a management system for predicting the occurrence of diseases ahead of time. This management system utilizes the data of current and forecast weather conditions of a specific region to predict the outbreak and intensity of disease in near future. In this way plant disease forecasting system tells the growers in advance to or not to adapt the methods to protect a specific crop from the pests.

When timely and accurately predicted, the disease forecasting system reduces economic cost, yield loss of the farmers and reduce the adverse impact on environment. These systems should be adapted for such diseases, which are not of regular occurrence, rather comes in destructive forms, when weather conditions are favorable. Spray warning services for the downy mildew of grapevine in France, Italy and Germany during 1920s were among the first forecasting systems used for the growers.

Information needed for disease forecasting:

- Forecasting diseases is a part of applied epidemiology. Hence, knowledge of epidemiology.
- Epidemiology- development of disease under the influence of factors associated with the host, pathogen.
- The factors of epidemic and its components should be known in advance before forecasting is done.
- The information required for forecasting are:



1. Host Factors:

a. Prevalence of susceptible varieties in the given locality.

b. Response of host at different stages of the growth to the activity of host.
c. Density and distribution of the host in a given locality.

2. Pathogen factors:

a. Amount of primary initial) inoculum in the air, soil or planting material
b. Dispersal of inoculum
c. Spore germination
d. Infection
e. Incubation period
f. Sporulation on the infected host
g. Re-dispersal / Dissemination of spores
h. Perennating stages
i. Inoculum potential and density in the seed, soil and air

3. Environmental factors:

a. Temperature
b. Humidity
c. Light intensity
d. Wind velocity

Methods of disease forecasting:

1. Forecasting based on primary inoculums

In this method, presence of primary inoculum, their density and viability is tested in the planting material, soil or in the air. Planting materials are randomly tested by different testing methods and recommendations are made for the chemical treatment of seed. Diseases, like Smut of wheat, ergot of pearl millet can be tested easily. In soil, presence and density of pathogens are tested by culturing them on specific culture medium. In air, spore of the pathogens is determined through the spore trap method.

2. Forecasting based on weather conditions

In this method, different parameters of weather conditions during and between the crop seasons are considered. These parameters include, temperature, relative humidity, rainfall, wind direction, light, etc. Weather conditions above the crops and of soil is also measured.

3. Forecasting based on correlative information

In this method, data of several years on weather is collected and correlated with the occurrence and intensity of the diseases. On basis of correlation disease forecasting is done. On basis of correlative information forecasting of barley powdery mildew and fire blight of apple have been made.

4. Computer-based disease forecasting models

These models work by processing the data on above mentioned factors and warn about the outbreak and severity of a diseases in near future. Among the computer-based models, EPIDEM was developed in 1969 for early bight of potato and tomato caused by *Alternaria solani*. Since then, following models have been established to simulate the disease epidemics.

Forecast system	Diseases	Country
EPIDEM	Early blight of potato and tomato caused by Alternaria solani	NA
TOMCAST/FAST	Early blight of potato and tomato caused by Alternaria solani	NA
MYCOS	*Mycosphaerella* blight of Chrysanthemum	NA

EPIVEN	Apple scab caused by *Venturia inaequalis*	NA
PLASMO	Downy mildew of grapevine caused by *Plasmopara viticola*	NA
EPICORN	Southern corn leaf blight caused by *Helminthosporium maydis*	NA
BLIGHTCAST	Late blight of potato caused by *Phytophthora infestans*	NA
USABlight	Late blight of potato caused by *Phytophthora infestans*	USA
NDAWN	late blight and early blight	Dakota
Indo-BlightCast	Late blight of potato caused by *Phytophthora infestans*	India
Phytoprog	Late blight of potato caused by*Phytophthora infestans*	NA
CERCOS	*Cercospora* blight of celery	NA
EPIDEMIC	Designed for stripe rust of wheat, but could be modified for other diseases	NA
MARYBLIGHT	Fire blight on apple caused by *Erwinia amylovora*	NA

Examples of disease forecasting

1. Late blight of potato

Late blight of potato is forecasted after occurrence of 7 to 14 days of **blight favorable days**. Blight favorable days are when, 5 day average temperature is 25.5°C and the total rainfall for the last 10 days is more than 3.0 cm. Nowadays, computarized models, such as, BLIGHTCAST, Indo-BlightCast and Phytoprog are available in different parts of the world, which tells the farmers about the outbreak of late blight of potato in advance. Blightcast is operated by Syngenta, U.K. Indo-blightcast is operated by CPRI and AICRP, Shimla in collaboration with Agromet Division of Indian Meteorological Department, New Delhi. Phytoprog is the forecasting model used in West Germany.

2. Rice blast

Rice blast caused by *Pyrocularia oryzae* is predicted on basis of correlative information method. The disease is predicted when, minimum night temperature range between 20 to 26 °C in association with 90 % or above relative humidity.

Exercise

1) How many methods are there for pest / insect forecasting?
   A) 4
   B) 6
   C) 8
   D) None
2) CPRI stands for :……
3) AICRP stands for :……
4) ICAR stands for :……
5) What does the abbreviation Indo-BlightCast stands for?
   A) Disease forecasting software for Late Blight of Potatto
   B) Disease forecasting software for Rice Blast
   C) All the above
   D) None
6) Plant disease forecasting depends on
   A) Host, pathogen and environment

B) Human, pathogen and environment
C) All the above
D) None

Conclusion:

Video link:

https://www.youtube.com/watch?v=1l4Z1vlPV9A

https://youtu.be/2zbeGEgt-ZM

https://www.youtube.com/watch?v=xvvHUHpfQbw

https://www.youtube.com/watch?v=oiWWdBaVVKU

Lesson–7: Simulation with limitations of water and nutrient management options

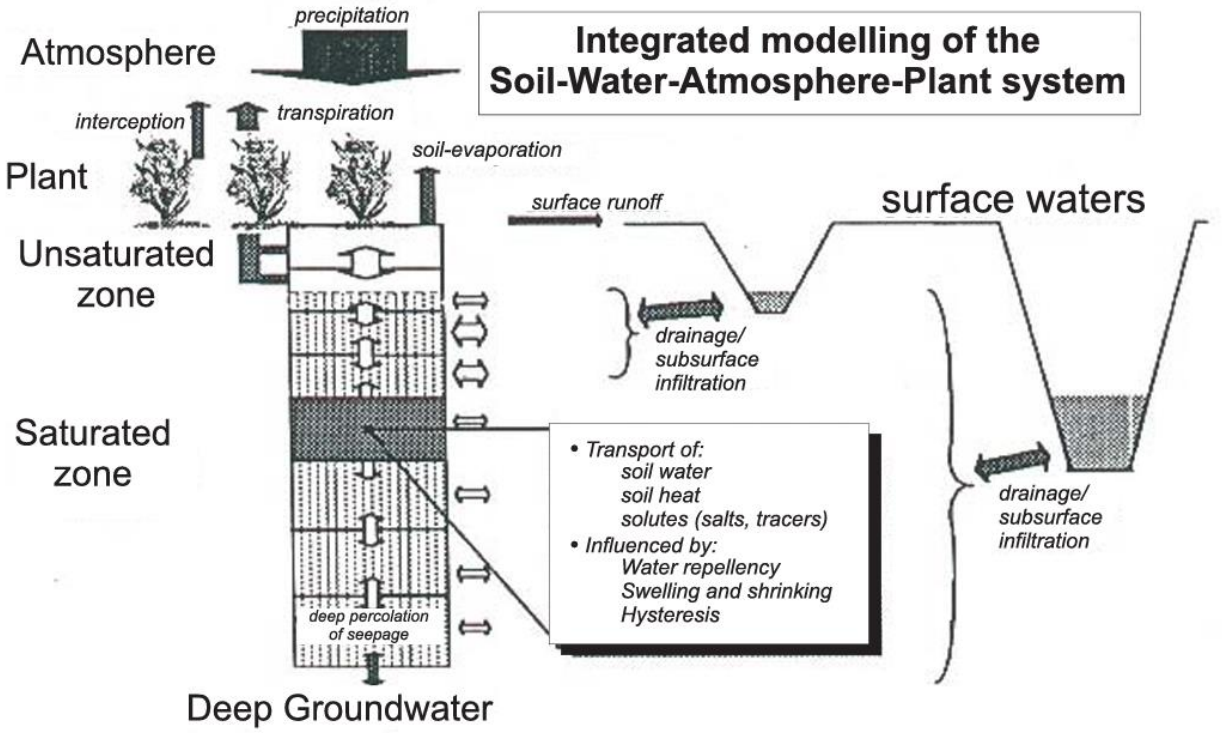
Objective: Understand the basic concept of simulation, water stress condition, nutrient management for the crops.

Software: standard software for DTP and statistical operations.

System/Hardware Requirements: Need a desktop or a laptop with standard specifications:

Web Browser : Google Chrome

The Soil-Water-Atmosphere-Plant (SWAP) model is a physically based, detailed agro-hydrological model that simulates the relationships between soil, water, weather and plants (figure 1). The core of the model is the transport of soil water is modeled by the law of continuity. SWAP models the soil water movement by considering the spatial differences of the soil water potentials in the soil profile.



SWAP simulates not only the quantity of soil water but also the quality and on the fate of solutes. The water balance is solved by considering two boundary conditions—the top and bottom boundaries. The Penman-Monteith equation is used in estimating evapotranspiration. The model uses the leaf area index (LAI) or soil cover fraction (SC) to calculate the potential transpiration and evaporation of a partly covered soil.

The surface runoff is calculated by the ratio of the difference of ponding water and the maximum height of the sill or embankments, to the resistance of soil to surface runoff. The surface detention is accounted for by the resistance term.

A simple crop model, and detailed crop model WOFOST can simulate crop growth in SWAP. The simple crop model is based on the linear production function. WOFOST (world food studies simulation model) is a general crop model, which is capable of simulating the growth and development of most crops. Several water management scenarios can be modeled in SWAP. Irrigation scheduling can be considered as fixed time or according to a number of criteria. Also, a combination of irrigation prescription and scheduling is possible. The scheduling criteria define the timing and depth of irrigation in the growth process.

Sensitivity and Limitations

- Boundary conditions (both upper and lower) are of crucial importance when applying the model.
- For all soil-crop combinations, the soil evaporation and crop transpiration are strongly dependent on the function describing LAI.
- Drainage, simulated as lateral discharge, is very sensitive to surface water levels.
- High groundwater levels are strongly related to surface water levels; low groundwater levels depend on the combination of LAI, soil physical parameters and surface water levels; 3the average groundwater level is mainly determined by the level of the primary drainage system.

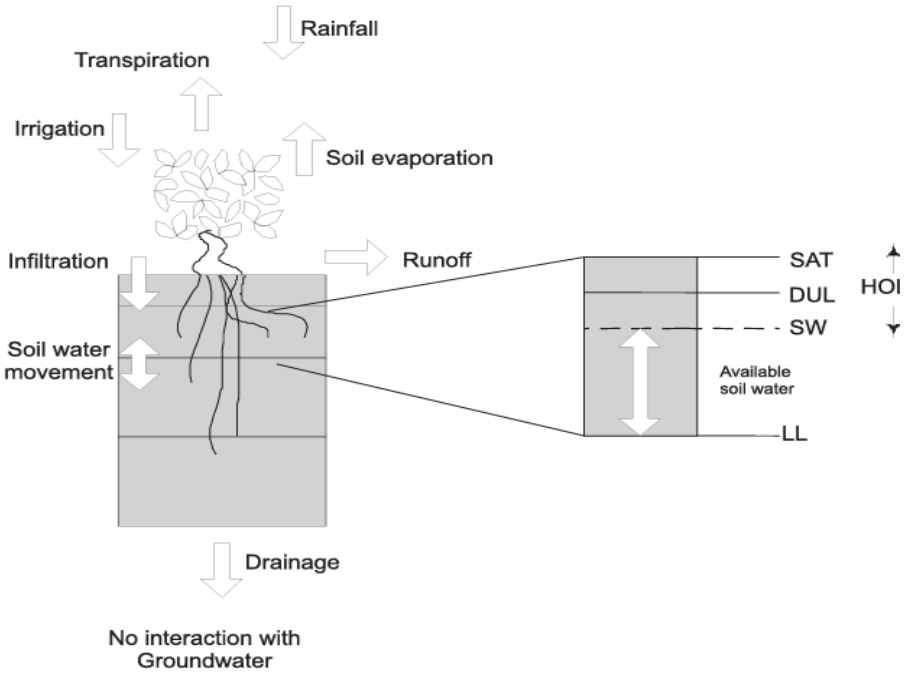
Other limitations of SWAP are as follows:

- No simulation of regional groundwater hydrology.
- No interaction between crop growth and nitrogen availability.
- No non-equilibrium sorption of pesticides and no simulation of metabolites.

DSSAT is composed of various crop models that are executed under one shell. The crop models available are: the CERES (Crop Environment Resource Synthesis) models for cereals (barley, maize, sorghum, millet, rice and wheat); the CROPGRO models for legumes (dry bean, soybean, peanut and chickpea); and models for root crops (cassava, potato) and other crops (sugarcane, tomato, sunflower and pasture).

Under this shell, simulation controls and management scenarios can be invoked in the system to simulate crop growth. The model can simulate seasonal, sequential cropping systems and a single cropping.

The soil water balance as simulated by DSSAT.



The nitrogen (N) balance in the soil is simulated using the CERES N model. The nitrogen model has two forms: for upland and lowland conditions (for rice). Basically, the nitrogen balance for other crops is derived from this model.

Limitations

The main limitations of DSSAT relate to the included crop models. Models for only a few crops are included in the system and the models do not respond to all environment and management factors. Missing are the components to predict

the effects of tillage, pests, intercropping, excess soil water and other factors on crop performance. These models are most useful in regions of the world where weather, water and nitrogen are the factors that affect crop performance.

Exercise

1) Which of the following statement is true?
   A) Crop, soil and atmosphere interactions are behind the agriculture
   B) Soil and atmosphere interactions are behind the agriculture
   C) All the above
   D) None
2) SWAP stands for :……
3) LAI stands for :……
4) CERES stands for :……
5) What does the abbreviation WOFOST stands for?
   A) world food studies simulation model
   B) world flood simulation model
   C) world famine studies simulation model
   D) None
6) DSSAT contains the functionalities of
   A) CERES
   B) CROPGRO
   C) WOFOST
   D) All the above

Conclusion:

Video Link:

https://www.youtube.com/watch?v=i0EGAYzjojQ

https://www.youtube.com/watch?v=dJnUsP36lvA

https://www.youtube.com/watch?v=rRcRXj2sKME

https://www.youtube.com/watch?v=yUiVdZ-H4sE

Lesson–8: Sensitivity analysis of varying weather and crop management practices

Objective: Understand the basic concept of Sensitivity analysis, use in crop manage practices.

Software: Software having spreadsheet functions like MS-Excel, Google sheets, MS-Word or similar type of software for report preparation and standard statistical software.

System/Hardware Requirements: Need a desktop or a laptop with standard specifications:

Web Browser : Google Chrome

Sensitivity analysis try to find out the effects of so many independent variables on or over a dependent variable. This is a kind of what-if-analysis. Sensitivity analysis of crop models such as APSIM is a valuable task which allows us to develop an intuition of the model response to changing a variety of inputs. These inputs can generally be included in the following categories:

- weather
- soil profiles
- crop/genetics
- management

The weather component can depend on different sources of data or manipulations to simulate different conditions and stresses. The soil profiles can be from different locations or specifically manipulated to understand the impact of particular soil properties. Crop properties or cultivar specific parameters can also be investigated as a source of model behavior. Finally, examples of management usually include planting date, fertilizer application, tillage or residue management and irrigation. All of these components can be sources of uncertainty and can be evaluated in a sensitivity analysis.

When multiple parameters are evaluated, performing model runs for all combinations can become prohibitive. For this reason, there are some combinations which can be more efficient and provide nearly the same amount of information. The suggestion here is to build complexity in the sensitivity analysis task gradually. For example, first choose one parameter and select 5-10 reasonable values, run the model and evaluate the model output. This is a one parameter at a time approach and it can be of great value in developing an intuition for the model behavior.

The study of how uncertainty in the output of a model (numerical or otherwise) can be apportioned to different sources of uncertainty in the model input is defined as sensitivity analysis. This acts as local type with small sample and global type with large size of samples.

A preliminary step in sensitivity analysis often involves uncertainty analysis and, as an example, it can involve computing the output from a model based on various samples from the relevant inputs. Usually, this involves identifying parameters, choosing appropriate distributions which we sample from and creating candidate values which are then used in the model.

Crop simulation models can play an important role in assessing the costs and benefits of limited irrigation and the interactions of timing and amount of irrigation water applications. The Decision Support System for Agrotechnology Transfer (DSSAT) Cropping System Model (CSM) includes several sub-models specific to individual crops.

Exercise

1) Which of the following statement is true?
    A) Sensitivity analysis are three types.
    B) Sensitivity analysis are two types.
    C) Sensitivity analysis are four types.
    D) None of the above
2) DSSAT stands for :……
3) CSM stands for :……
4) APSIM stands for :……
5) What does the abbreviation SPSS stands for?

A) Statistical package for social sciences
B) Statistical package for physical sciences
C) Statistical package for Agricultural sciences
D) None of the above

6) The variables in statistical analysis are of
A) 4 types
B) 2 types
C) 3 types
D) none

Conclusion:

Video Link:

https://www.youtube.com/watch?v=G8FX3XUJjbk

Lesson–9: Use of statistical approaches in data analysis and preparation of historical, past and present meteorological data for medium range weather forecast

Objective: Understand the background of the basic data to be used, preparation of the standard formats of historical, past and present data, statistical analysis.

Software: Software having spreadsheet functions like MS-Excel, Google sheets, MS-Word or similar type of software for report preparation.

System/Hardware Requirements: Need a desktop or a laptop with standard specifications:

Web Browser : Google Chrome

No need for fortune tellers to predict the weather, we've got the power of statistics. In fact, meteorologists rely on one thing statisticians know a lot about—applying rigorous scientific techniques to extract information and knowledge from data.

Today, weather-related data and the scientific discipline of statistics are much more sophisticated. The data, for example, are now collected through satellites, barometers, radars, weather balloons and many other instruments that are located on land, in water and the atmosphere. The data these instruments are collecting includes atmospheric pressure, temperature, speed, rain, humidity, and many other components of current weather conditions.

Statistical weather forecasting, in its broad sense, has undoubtedly been practiced for thousands of years. All that is necessary is for someone to collect data, someone to process it and someone to use the results to make a forecast.

Statistical forecasting is a branch of objective weather forecasting, the other branch being numerical weather prediction. There are three general methods of application of statistical models and describe the statistical techniques that have been applied to weather prediction.

Before using the collected data, the user must go for data cleaning and see the homogeneity of data based on the variables.

Methods of application

1. classical method – before the days of numerical models, statistical techniques necessarily incorporated the time lag. That is if one wanted to develop a scheme for forecasting the max. temperature for tomorrow, the input would consist only of observational data available at the time that the forecast was to be made.
2. Perfect programming method – as numerical models were implemented and improved, it was recognized that their output must be exploited to the possible extent. However, these models did not predict many of the weather variables with which the users are concerned.
3. Model output statistical method – the perfect prog technique makes use of numerical model output, it is not necessarily true that the statistical relationship between Y and X at time 0 is the best relation for time t when $X_{t\ is}$ estimated by numerical models. To overcome this problem, the Model Output Statistics (MOS) technique is developed.

Comparison of classical, perfect prog and MOS techniques

- Since the classical technique does not depend on numerical models, it is useful for very short-range forecasting.
- The strength of most numerical models lies in predicting events several hours to few days in advance.
- For medium range of forecasting, MOS is the best technique if
    - A sufficient sample of model output can be obtained for development
    - The model does not undergo major changes
- Major disadvantage is that a relationship developed for one model may not hold for another model.

India Meteorological Department (IMD) routinely provides forecasts in medium range scale using deterministic model Global forecast system (GFS) and ensemble model Global ensemble Forecast system (GEFS) with 21 ensemble members.

Some statistical forecast methods operate without information from the fluid-dynamical numerical weather prediction (NWP) models that have become the mainstay of weather forecasting for lead times ranging from one to a few days in advance.

Such "pure" statistical forecast methods are sometimes referred to as classical, reflecting their prominence in the years before NWP information was available.

Statistical forecast models are routinely used to enhance the results of dynamical forecasts at operational weather forecasting centers throughout the world, and are essential as guidance products to aid weather forecasters.

Much of statistical weather forecasting is based on the statistical procedure known as "least-squares regression." The fundamentals of least-squares regression are reviewed. Regression is most easily understood in the case of "simple" linear regression, which describes the linear relationship between two variables, say, x and y. Conventionally the symbol x is used for the "independent," or predictor variable, and the symbol y is used for the "dependent" variable, or the predictand.

Exercise

1) Which of the following statement is true?
   A) Regression method is being used in weather forecasting
   B) Survey is being used in weather forecasting
   C) Mobile based survey is being used in weather forecasting
   D) None of the above
2) MOS stands for :……
3) NWP stands for :……
4) GFS stands for :……
5) What is data cleaning?
   A) Finding outliers in the dataset
   B) Finding data errors and remove from the dataset
   C) All the above
   D) None
6) The parameters which are beyond control is called --------- variable
   A) Dependent
   B) Independent
   C) Both A & B
   D) None

Conclusion:

Video Link:

https://www.youtube.com/watch?v=dUf_uF0iEEg

https://www.youtube.com/watch?v=Bjuc6bXnTgw

https://www.esa.int/ESA_Multimedia/Videos/2002/06/MSG_-_The_History_of_Weather_Forecasting

Lesson–10: Feedback from farmers about the agro-advisory

Objective: Understand the format of agro advisory and its feedback from the user's level.

Software: Software like pdf reader, MS-Excel, Google sheets, MS-Word or similar type of software for report preparation.

System/Hardware Requirements: Need a desktop or a laptop with standard specifications:

Web Browser : Google Chrome

All India Radio, Kolhapur has started preparing and broadcasting of their own agricultural program from 1st April, 2005. They are broadcasting different agricultural information programs such as Kisanwani at 7.30 pm. to 8.00 pm. and Krishi-Varta at 6.50 am every day from Monday to Saturday.

On the basis of the weather forecasting, a message is prepared by a team of Scientists of NARP, Kolhapur and sent to All India Radio, Kolhapur which is broadcast. at 7.30 pm. in "KISANWANI" program on every Wednesday.

The study was undertaken in Kolhapur district of Maharashtra State, the Agro-met Advisory Bulletin may be broadcasted twice in a week and may be repeated 2 to 3 times in a day for better implementation. Broadcasting of Agro-met Advisory Bulletin may be continued as it plays an important role in planning the farm operations.

Sample Agromet Advisory Services are given in the following pages.

Gramin Krishi Mausam Sewa

District Level Agromet Advisory Bulletin

ICAR Central Coastal Agricultural Research Institute, Ela

North Goa

Agromet Advisory Bulletin

Date : 17-03-2023

Weather Forecast of NORTH-GOA(Goa) Issued On : 2023-03-17(Valid Till 08:30 IST of the next 5 days)

Parameter	2023-03-18	2023-03-19	2023-03-20	2023-03-21	2023-03-22
Rainfall(mm)	2.0	1.0	1.0	0.0	0.0
Tmax(°C)	34.0	33.0	33.0	32.0	32.0
Tmin(°C)	23.0	23.0	22.0	22.0	22.0
RH-I(%)	88	91	79	80	74
RH-II(%)	34	36	37	35	35
Wind Speed(kmph)	8.0	7.0	9.0	9.0	11.0
Wind Direction(Degree)	251	270	288	288	292
Cloud cover(octa)	1	0	0	0	0

Weather Summary/Alert:

Weather Inference • The trough from south Tamil Nadu to north Konkan now seen as a trough/wind discontinuity from Interior Tamilnadu to central Madhya Pradesh across Rayalaseema, Telangana and Vidarbha at 0.9 km above mean sea level. Weather Summary/ Alert • Light rain/Thundershowers very likely at isolated places on 17th , 18th & 19 th March 2023. • Weather is very likely to be dry on 20th & 21st March 2023 • Haze/Shallow Fog likely at isolated places on 17th, 18th & 19th March 2023 • No large change in maximum temperature for 24 hours, fall by 2-3°C on day 2, no large change thereafter • Thunderstorm accompanied with lightning very likely at isolated places on 17th & 18 th March 2023 • Maximum & minimum temperatures are likely to be around 34°C & 23°C respectively Extended range forecast Week 1 (March 17th – March 23rd) • Rainfall is very likely to be large excess • Maximum temperature is likely to be 2-4°C lower than normal • Minimum temperature is likely to be 0-2°C higer than normal Week 2 (March 24th – March 30th) • Rainfall is very likely to be large excess • Maximum temperature is likely to be 0-2°C lower than normal • Minimum temperature is likely to be 0-2°C higher than normal

General Advisory:

• Take precautions against thunderstorms and lightning while moving out

SMS Advisory:

• If Outbreak of fruit flies observed fallen fruits should be collected and destroyed in order to avoid more incidence of fruit flies

Crop Specific Advisory:

Crop(Varieties)	Crop Specific Advisory
RICE	• Light rain/Thundershowers very likely at isolated places on 17th , 18th & 19 th March 2023, hence water level should be maintained upto 5cm in the paddy fields • Possibility of incidence leaf folders in paddy. Hence control measures can be taken once the dry weather prevails
GROUNDNUT	• Light rainfall on 17th , 18th & 19 th March 2023 may increase the incidence of sucking pest. Hence take suitable control measures once the dry weather prevails • To control the aphids, thrips and leaf miners spraying of spinosad @ 0.2 ml/litre of water can be done or apply NSKE 5% (neem seed kernel extract) • Yellow sticky traps can be kept in the field for better monitoring of these sucking pests

Horticulture Specific Advisory:

Horticulture(Varieties)	Horticulture Specific Advisory
COWPEA/ LOBIA	• Light rainfall on 17th , 18th & 19 th March 2023 may increase the incidence of sucking pest. Hence take suitable control measures once the dry weather prevails • To control the aphids and thrips spraying of spinosad @ 0.2 ml/litre of water can be done or apply NSKE 5% (neem seed kernel extract) • Yellow sticky traps can be kept in the field for better monitoring of these sucking pests
MANGO	• Due to forecast of light rainfall /thunderstorms on 17th , 18th & 19 th March 2023, incidence of fruit flies may increase in mango • If Outbreak of fruit flies observed fallen fruits should be collected and destroyed and in order to avoid more incidence of fruit flies • It can also be controlled by use of fruit fly traps containing Methyl Euginol (0.1%) + Malathion (0.1%) • Pre harvest bagging of marble size mango fruits in 25 X 20 cm paper bags can improve quality of fruits and also protect the fruits from fruit fly infestation and also sun scorching during bright sunshine hours • Irrigate the orchards at 7 to 10 days interval
CASHEW	• Due to forecast of light rainfall during on 17th , 18th & 19 th March 2023, collect the ripned and fallen cashew fruits to avoid losses • Separate the seeds from the apple and take precautions while drying them due to possibility of rainfall
COCONUT	• Due to forecast of light rainfall /thunderstorms on 17th , 18th & 19 th March 2023, incidence of pest may increase in coconut hence take suitable control measures during clear weather • Mulching of the tree basins should be done with the paddy straw or green/dried leaves to conserve moisture • Irrigation can be given to coconut palms in sandy soils at 4 days interval in basin method or daily through drip irrigation • To control mites, spraying of 2% neem-garlic emulsion or azadirachtin 10000 ppm @0.004% is recommended • To control white flies , application of 1% starch solution on leaflets to flake out the sooty moulds • In severe case, spray neem oil 0.5% and no insecticide is recommended • Installation of yellow sticky traps on the palm trunk to trap adult whiteflies
ARECANUT	• Mulching of the tree basins should be done with the paddy straw or green/dried leaves to conserve moisture • Irrigation can be given to arecanut palms in sandy soils at 4 days interval in basin method or daily through drip irrigation

Live Stock Specific Advisory:

Live Stock(Varieties)	Live Stock Specific Advisory
COW	• Due to forecast of light rainfall /thunderstorms and lightning on 17th & 18 th March 2023, avoid allowing of animals to open fields for grazing • Keep animals indoor

গ্রামীণ কৃষি মৌসম সেবা
ভারত আবহাওয়া বিজ্ঞান বিভাগ
উত্তর বঙ্গ কৃষি বিশ্ব বিদ্যালয়
পুন্ডিবাড়ি

কৃষি আবহাওয়া উপদেষ্টা বুলেটিন

তারিখ : 28-09-2021

মালদহ(পশ্চিম বঙ্গ) আবহাওয়ার পূর্বাভাস - প্রকাশনার তারিখ :2021-09-28 (পরের ৫ দিন সকাল ০৮:৩০ পর্যন্ত বৈধ)

পরিমাপক	2021-09-29	2021-09-30	2021-10-01	2021-10-02	2021-10-03
বৃষ্টিপাত (মি:মি:)	18	29	7	31	35
সর্বোচ্চ তাপমাত্রা (°C)	33.3	32.7	33.4	32.4	34.2
সর্বনিম্ন তাপমাত্রা (°C)	24.8	24.6	25.5	25.8	26.1
সকালের আপেক্ষিক আর্দ্রতা	92	89	89	87	94
বিকেলের আপেক্ষিক আর্দ্রতা	62	68	70	57	77
বাতাসের গতিবেগ (কি:মি:/ঘন্টা)	10.4	7.7	8.0	10.8	10.5
বাতাসের দিকনির্দেশ (ডিগ্রি)	108	126	135	162	156
মেঘের অবস্থা (ওকটা)	7	7	7	8	8

আবহাওয়ার সংক্ষিপ্তসার/সতর্কবার্তা::

আগামি ৫ দিন মূলত মেঘলা থেকে সম্পূর্ণ মেঘাছন্ন আকাশ থাকার সম্ভাবনা থাকবে। আগামি ৫ দিন বিক্ষিপ্ত জায়গায় হাল্কা থেকে মাঝারি (৭-৩৫ মিমি) বৃষ্টির সম্ভাবনা থাকছে। সর্বাধিক তাপমাত্রা ৩২-৩৪ ডিগ্রি এবং সর্বনিম্ন তাপমাত্রা ২৫-২৬ ডিগ্রির আশেপাশে থাকবে। আগামি ৫ দিন মূলত দক্ষিন পূর্ব দিক থেকে বাতাস ঘণ্টায়ে ৮-১১ কিমি. বেগে বইবার সম্ভাবনা থাকছে। বাতাসের আপেক্ষিক আদ্রতা ৬০-৯০% এর আশেপাশে থাকবে।

সাধারণ পরামর্শাবলী::

আগামি ৫ দিন মালদা জেলায়ে বৃষ্টি স্বাভাবিক থাকবে। আগামি ৫ দিন বৃষ্টির পূর্বাভাষ থাকায়ে ধানের শীষ বেরনো অবস্থায়ে জল সংরক্ষণ করুন। যেহেতু আগামিকাল ভাল বৃষ্টি হয়েছে তাই সেচ প্রয়োগের প্রয়োজন এখন নেই। নিয়মিত জমি পরিদর্শন করতে হবে। বর্তমান অবস্থায়ে খলা পচা, এবং বাদামি শোষক পোকার উপদ্রব অনেকাংশে বেড়েছে। অবিলম্বে প্রতিকার ব্যাবস্থা গ্রহন করতে হবে। কেবলমাত্র পরিষ্কার আকাশ দেখে তবেই স্প্রে করুন যেহেতু বৃষ্টির সম্ভাবনা আছে।

বার্তামূলক পরামর্শ:

আগামি ৫ দিন হাল্কা থেকে মাঝারি বৃষ্টির সম্ভাবনা আছে। বাদামি শোষকপোকার নিয়ন্ত্রনের জন্যে পাইমেট্রোজিন 50% WG @ ১২০গ্রাম/ একর হারে প্রয়োগ করুন।

ফসল বিশেষ পরামর্শাবলী::

ফসল	ফসল বিশেষ পরামর্শাবলী:

9/28/21, 12:25 PM Regional Advisory

ফসল	ফসল বিশেষ পরামর্শাবলী:
ধান	যদি বাদামি শোষকপোকার (BPH) এর সংখ্যাগুছিতে ৫-১০ অতিক্রম করে, তাহলে বিকল্পভাবে ভিজা এবং শুকানোর কৌশল দ্বারা ধানের ক্ষেত্রের মাইক্রো-জলবায়ু পরিবর্তন করার পরামর্শ দেওয়া হচ্ছে। (জমিতে দীর্ঘ সময় জলদাঁড়িয়ে থাকা উচিত নয়)। যদি সমস্যা এখনও থেকে যায়, তাহলে পাইমেট্রোজিন50% WG @ ১২০গ্রাম/ একর অথবা ডাইনেটফুরান২০% SG @ ৮০ গ্রাম অথবা ইমিডাক্লরপ্রিদ ১৭.৮%SL @ ৫০ মিলি প্রতি একরে স্প্রে করুন।শোষক পোকার সংক্রমণের সময় নাইট্রোজেনযুক্ত সার ব্যবহার থেকে বিরত থাকুন। 1-2 টিলারে খলা পচা রোগ দেখা দিলে, টেবুকনাজল ৫০% + ট্রাইফ্লক্সিস্তরবিন ২৫% ডাবলু.জি @ ৮০ গ্রাম/একর স্প্রে করুন। ৭-১০ দিনের ব্যবধানে স্প্রেটি পুনরাবৃত্তি করুন।
৯৫৫	1% urea at 30 DAS may be sprayed for attaining higher yield.

উদ্যানপালন বিশেষ পরামর্শাবলী::

উদ্যানপালন	উদ্যানপালন বিশেষ পরামর্শাবলী:
মরিচ	নুইয়ে বা ঢলে পরা রোগ থেকে গাছ বাঁচাতে ভ্যালিডামাইসিন ২০ মিলি স্ট্রেপটোসাইক্লিন ১০ লিটার জলে গুলে স্প্রে করুন। উন্নত মানের আঠা অবশ্যই ব্যাবহার করুন। বৃষ্টির পূর্বাভাস থাকলে পরিষ্কার আকাশ দেখে তবেই স্প্রে করুন।

পোল্ট্রি বিশেষ পরামর্শাবলী::

পোল্ট্রি	পোল্ট্রি বিশেষ পরামর্শাবলী:
মুরগি	এই বর্ষাকালে মুরগি বা হাঁসকে কখনই ভেজা বা স্যাঁতসেঁতে খাবার খেতে দেবেন না।এই সময়ে যে কোনো গরু, ছাগল বা হাঁস -মুরগিকে গোলাকার কৃমি এবং ফিতকৃমি উভয়ের জন্য বিশেষ পরিমাণ কৃমিনাশক সরবরাহ করা খুবই গুরুত্বপুর্ণ।

Bidhan Chandra Krishi Vishwavidyalaya, the state university of west Bengal used to publish Weekly Weather Forecast along with impact-based forecast (IBF) for Agriculture for Hooghly, Howrah, Nadia, Murshidabad, Purba Bardhaman, Paschim Bardhaman, North 24 Parganas, South 24 Parganas and Purba Medinipur districts of West Bengal (based on the IMD forecast)

Exercise

1) Which of the following statement is true?
   A) State university publish weekly weather forecast.
   B) Pdf files are not readable by Adobe software
   C) Farmers feedback yet to come
   D) All the above
2) IMD stands for :……
3) IBF stands for :……
4) Livestock means :……
5) What does the abbreviation IBF stand for?
   A) Impact based study
   B) Impact oriented survey
   C) All the above
   D) None
6) The state universities publish agro advisories based on
   A) WMF forecast
   B) IMD forecast

C) FAO forecast
D) All

Conclusion:

Video Link:

https://www.fas.scot/what-is-the-farm-advisory-service/
https://www.youtube.com/watch?v=fd6ypwdnS_w
https://www.youtube.com/watch?v=CkE7GNTZUDY