YES-TECH MANUAL 2023

YES-TECH

Yield Estimation System based on Technology

Pradhan Mantri
Fasal Bima Yojana

Department of Agriculture & Farmers Welfare
Ministry of Agriculture & Farmers Welfare
Government of India

कृषि रक्षक

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14	Abstract (with Keywords)	**Abstract:** Towards enabling large scale adoption of technology-based yield estimates in PMFBY system for crop loss assessment, DA&FW has conceptualised Yield Estimation System based on Technology (YES-TECH) under PMFBY. YES-TECH advocates the blended use of modelled and CCE yield estimates for insurance claim assessment from Kharif 2023 season onwards. The current document provides guidelines for implementing YES-TECH by identified agencies in each State. **Keywords:** YES-TECH, Crop insurance, Yield estimation, Innovative Technologies		

Preface

Pradhan Mantri Fasal Bima Yojana (PMFBY), being implemented in the country from 2016, with the aim to support agriculture production by providing crop insurance against comprehensive risks throughout the crop season. The Department of Agriculture and Farmers Welfare (DA&FW), Ministry of Agriculture and Farmers Welfare (MoA&FW), Government of India (GoI), is the nodal agency for executing PMFBY. The operational guidelines for smooth implementation of PMFBY were documented in 2016 and revised, revamped and restructured in 2018, 2020 and 2023 respectively, and made available to all the stakeholders (www.pmfby.gov.in).

Crop yield estimates of the Insurance Units (IUs) for the current and past years form the basis for crop loss assessment and indemnity payout under PMFBY. Crop yield estimation is done through Crop Cutting Experiments (CCEs), the traditional system of manual yield measurements in randomly selected field plots for each crop in each IU. Major limitations of CCE based crop yield estimation includes (a) limited number of measurements tends to produce higher standard error, (b) time-consuming process, (c) manpower intensive and (d) vulnerable to human errors.

DA&FW has taken up many initiatives to improve crop yield estimation procedures ever since the launch of PMFBY. Technology development agencies from both Government and Private sectors have been engaged for developing new yield estimation methods using various datasets and models through pilot studies.

The objective of these pilot studies was to generate reliable yield estimates through scalable models for paddy and wheat crops at IU level. These studies were conducted during 2019 and 2020 for both the kharif and the rabi seasons for selected crops and districts across different agro-climatic zones of India. The Expert Committee, comprising of experts from Remote Sensing & GIS, Agriculture and Data Science domains, carried out detailed evaluation of pilot studies and recommended five approaches for yield estimation for nation-wide rollout covering paddy and wheat crops from the 2023 crop season onwards.

Towards enabling large scale adoption of technology-based yield estimates in PMFBY system for crop loss assessment, DA&FW has conceptualised a special initiative i.e., "Yield Estimation System based on Technology (YES-TECH)" under PMFBY. YES-TECH advocates the blended use of modelled and CCE yield estimates for insurance claim assessment from Kharif 2023 season onwards. In this connection, this document shall act as a guide and manual for the concerned 'Stakeholders', i.e., the Centre, the States/UTs, the insurance companies (ICs), Mentor Institutions for Technology Rollout (MITR) and the Technology Implementation Partners (TIP), for the national level rollout of YES-TECH. DA&FW has constituted the YES-TECH committee with the following mandate:

- Preparation of SOP for each technology model(s)/approach(es) approved by GoI for various crops.
- Creating a panel of Technology Implementation Partners (TIP) from which States/UTs can select a TIP for implementation.
- Suggesting Mentor Institutions for Technology Rollout (MITRs ~ friend) to help the States/UTs in rolling out YES-TECH.
- Preparation of Model Tender document for on-boarding of TIPs by States/UTs.
- Proposing amendments in the relevant guidelines, if required.
- Support to States/UTs for preparing tender documents.
- Monitoring and evaluation of YES-TECH implementation progress.
- Any other issues related to comprehensive roll out of YES-TECH

The YES-TECH committee consists of the following Members;

S. No	Name of Expert	Designation
1	Dr. C. S. Murthy, Director, MNCFC	Chair
2	Dr. Rajendra Prasad, Director, IASRI (ICAR)	Member
3	Dr. Bimal Bhattacharya, Group Director, SAC (ISRO)	Member
4	Dr. Karun Kumar Choudhary, Head, Crop Monitoring Division, NRSC (ISRO)	Member
5	Dr. Paresh Shirsath, Scientist BISA-CIMMYT	Member
6	Dr. Maheswaran, R. Assistant Prof. IIT Hyderabad	Member
7	Shri. Sunil Kumar, Assistant Commissioner, DA&FW	Member
8	Commissioner of Agriculture, Maharashtra	Member
9	Director of Agriculture, Odisha	Member
10	Dr. Sunil Kumar Dubey, Deputy Director, MNCFC	Member Secretary

The committee has organised several consultations to develop the current YES-Tech document. The purpose of this document is to provide comprehensive guidelines and support to the States/UTs, the MITRs and the TIPs, for implementing technology-based yield estimation procedures under the YES-TECH initiative of PMFBY. The important elements of the manual are brief description of recommended procedures/models of yield estimation, Standard Operating Procedure (SOP) for implementing the models, mentor agencies to support States/UTs, empanelment guidelines for selecting implementing agency, model tender document and Tripartite Agreement. This manual shall act as a guideline for the States/UTs and other implementing agencies for adopting YES-TECH from the Kharif 2023 crop season onwards.

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List of Abbreviations

AI/ML	Artificial Intelligence/Machine Learning
ANGRAU	Acharya N. G. Ranga Agricultural University
ANN	Artificial neural network
APSIM	Agricultural Production Systems sIMulator
ARG	Automatic Rain Gauge
AWS	Automatic Weather Station
AY	Actual Yield
BISA	Borlaug Institute for South Asia
CART	Classification and Decision Tree
CCEs	Crop Cutting Experiments
CCM/CHM	Crop Condition Monitoring/Crop Health Monitoring
CHF	Crop Health Factor
CIMMYT	International Maize and Wheat Improvement Center
CRIDA	Central Research Institute for Dryland Agriculture
CROPIC	Collection of Real Time Observations and Photo of Crops
CSM	Crop Simulation Model
CV	Coefficient of Variation
DA&FW	Department of Agriculture and Farmers Welfare
DEM	Digital Elevation Model
DNN	Deep Neural Network
DSSAT	Decision Support System for Agro-technology Transfer
EMD	Earnest Money Deposit
FAPAR	Fraction of Absorbed Photosynthetically Active Radiation
GP	Gram Panchayat
GT	Ground Truth
HARSAC	Haryana Space Applications Centre
HI	Harvest Index
IASRI	Indian Agricultural Statistics Research Institute
ICAR	Indian Council of Agricultural Research
IIT	Indian Institute of Technology
IMD	India Meteorological Department
IP&GIS	Image Processing and Geographical Information System
ISRO	Indian Space Research Organization
IT	Information Technology
IUs	Insurance Units
LSWI	Land Surface Water Index
MAPE	Mean absolute percentage error
MITR	Mentor Institutions for Technology Rollout
MNCFC	Mahalanobis National Crop Forecast Centre
MoA&FW	Ministry of Agriculture and Farmers Welfare
MODIS	Moderate Resolution Imaging Spectro-radiometer
MOSDAC	Meteorological and Oceanographic Satellite Data Archival Centre
MSA	Mid-Season Adversity
NAS	Network Attached Storage

NASA	National Aeronautics and Space Administration
NBSSLUP	National Bureau of Soil Survey & Land Use Planning
NCIP	National Crop Insurance Portal
NDA	Non-Disclosure Agreement
NDVI	Normalized Difference Vegetation Index
NESAC	North Eastern Space Applications Centre
NIR	Near Infrared
NN	neural network
NRMSE	Normalized Root Mean Square Error
NRSC	National Remote Sensing Centre
NSIC	National Small Industries Corporation
NSO	National Statistical Office
OUAT	Orissa University of Agriculture and Technology
PAR	Photosynthetically Active Radiation
PBG	Performance Bank Guarantee
PJTSAU	Prof. Jayashankar Telangana State Agril University
PMFBY	Pradhan Mantri Fasal Bima Yojana
PROBA	Project for On-Board Autonomy
RF	Random Forest
RFP	Request for Proposal
RMSE	Root Mean Square Error
RS&GIS	Remote Sensing and Geographical Information System
RUE	Radiation Use Efficiency
RVI	Radar vegetation index
SAC	Space Application Centre
SAN	Storage Area Network
SAUs	State Agricultural Universities
SLA	Service Level Agreement
SMAP	Soil Moisture Active Passive
SOP	Standard Operating Procedure
SPOC	single point of contact
SRSACs	State Remote Sensing Application Centers
SRTM	Shuttle Radar Topography Mission
SVM	Support Vector Machine
SWIR	Shortwave Infrared
T Scalar	Temperature Scalar
TA	Tripartite Agreement
TIP	Technology Implementation Partners
TNAU	Tamil Nadu Agricultural University
TY	Threshold Yield
UAV	Unmanned Aerial Vehicle
VCI	Vegetation Index
W scalar	Water Scalar
WINDS	Weather Information Network Data System
WOFOST	World Food Studies Simulation Model
WRF	Weather Research & Forecasting

Executive Summary

Pradhan Mantri Fasal Bima Yojana (PMFBY), is a yield-guarantee scheme over an insured area. Hence, the data on crop yield estimates over Insurance Units for the current and past years are crucial for crop loss assessment and indemnity payout. Current system of crop yield estimation using the yield measurements of Crop Cutting Experiments (CCEs) is often reported to be prone to different errors. Therefore, DA&FW initiated pilot studies on technology-based crop yield estimation for paddy and wheat, in the recent years. The results of these pilot studies have been evaluated and the Expert Committee has recommended for upscaling these methods.

Accordingly, DA&FW has initiated nation-wide rollout of Yield Estimation System based on Technology (YES-TECH), from kharif 2023, towards enabling large scale adoption of technology-based yield estimates for yield loss and insurance claim assessments under PMFBY. The Department has constituted an Expert Committee for YES-TECH which has undertaken several rounds of consultations with various stakeholders and prepared the current document to enable implementation of YES-TECH by States. The purpose of YES-TECH is to blend the technology-based yield estimates with manual yield estimates and reduce the dependence on manual system gradually. It is recommended that the modelled yield should be given at least 30% in the blending approach.

Crops and choice of yield models to be covered under YES-TECH are notified from time to time based on the maturity level of technology models. The crop-model matrix, currently identified for roll out and referred in this document covers paddy and wheat with five models for yield estimation. SOPs for all the five notified models are provided. States are expected to select a model of their choice in consultation with experts and stake holders.

Structured system for YES-TECH implementation has been proposed to make the entire process more systematic, timely, objective and transparent. Technology Implementation Partner (TIP) agency selected by State will implement the selected yield model under the guidance and supervision of an expert agency called Mentor Institute for Technology Roll-out (MITR) which is nominated by GoI. Guidelines for selection of TIP either through nomination or tendering route are furnished. Similarly, the list of MITR agencies which are Government entities like ISRO, ICAR etc has also been furnished. Financial support for states for implementing YES-TECH is also indicated.

Roles and responsibilities of States, Insurance Companies, TIP and MITR agencies are well documented. Towards ensuring discipline in the implementation, timelines for submission of reports on work progress during the season and end-of-season have been stipulated. A system for payments to TIP linked with work progress is developed. Penalty system for violation of timelines and grievance redressal and disputes resolution framework have also been represented. Model documents on (a) tender process for selection of TIP and (b) Tripartite Agreement between State, TIP and MITR are also provided.

The Government of India (GoI) has the authority to clarify, amend, withdraw, or review any provisions of the YES-TECH manual. The YES-TECH Committee is responsible for the overall execution and monitoring of YES-TECH, including the empanelment of MITRs, TIPs, and the selection of districts for implementation.

Thus, the current document covers all aspects of YES-TECH implementation and acts as a reference guide for smooth roll-out of such a major technology intervention under PMFBY. Further, the document will be updated with additional crops and suitable technology models from time to time, thus supporting all future initiatives too on improving crop yield data under insurance.

SECTION 1
YES-TECH Manual

1. Introduction

Globally, agriculture is exposed to multiple hazards leading to frequent crop losses. As a result, crop insurance has become an indispensable risk management tool in the agriculture sector. Better management of agricultural risks is one of the important strategies to address the current challenges of food security, income security, and climate resilience in Indian agriculture. Increasing crop risks coupled with low growth and outreach of crop insurance signifies the huge potential for crop insurance in India. Therefore, a robust system of crop insurance is the need of the hour to reduce the impact of covariate risks in agriculture and promote innovations and investments in the farming sector.

Pradhan Mantri Fasal Bima Yojana (PMFBY) being implemented in the country from Kharif 2016, is an area yield index insurance that has many improved features to compensate for multiple risks during the entire life cycle of the crop season. The use of technologies viz. remote sensing, mobile and data analytics is mandatory for the effective implementation of the scheme. The Department of Agriculture and Farmers Welfare (DA&FW), Ministry of Agriculture and Farmers Welfare (MoA&FW), Government of India (GoI), is the nodal agency for executing PMFBY in the country.

Area-yield insurance is a yield guarantee scheme over the specified area. It adopts an area approach defining the Unit Area of Insurance known as an Insurance Unit (IU), generally coinciding with a group of villages called Gram Panchayat (GP). Crop yield estimates of the IU for the current and past years form the basis for crop loss assessment and indemnity pay-out. A certain per cent, 70%, 80%, or 90% of the average yield of the past five best out of seven years of an IU called Threshold Yield (TY) is guaranteed for the current year. Actuarial premium rates are determined at the district level for each crop based on the IU's past risk profiles in the district. The current year's yield shortfall from the TY of the crop in the IU is applied to the sum insured for calculating the pay-out (www.pmfby.gov.in).

Currently, Crop yield estimation is done by carrying out Crop Cutting Experiments (CCEs), i.e., manual yield measurements at a randomly selected limited number of field plots for each crop in each IU. The limited number of measurements leading to higher standard errors of estimates and their proneness to subjectivity have become major constraints in generating reliable yield estimates. As a result, the estimated yield of an IU tends to be biased leading to disputes and delays in claims settlements. Thus, the challenge in the area-yield crop insurance in India continues to be improving the crop yield estimation system.

Technology interventions, in the form of using satellite data, long-term weather datasets, and usage of mobile apps for CCEs and collecting crop pictures, to improve crop yield estimation and crop damage assessment, are largely recognized and promoted. Technology based estimation is largely based on documenting the edaphic factors, weather and its changes as it occurs in the entire period the crop is on ground (from seed to harvest) and how the health of crop was impacted by it, and is reflective of the potential of the crop yield that has materialized in the season, cutting across all varieties and farming practices. These technology-based estimations are unbiased and when used in conjunction with CCE estimates results in betterment of final yield estimates. DA&FW has taken up many initiatives to improve crop yield estimation procedures ever since the launch of PMFBY in 2016 (www.pmfby.gov.in). Technology development agencies of both Government and Private sectors are currently developing tools and methodologies for crop yield estimation and crop damage assessment methods, using various datasets, models, and analysis techniques for improving crop loss assessment in crop insurance.

1.1. YES-TECH, CROPIC & WINDS

Towards introducing and catalysing nationwide, large scale adoption of technology-based solutions under PMFBY, DA&FW has conceptualised to amalgamate the system for technology-based yield-estimation and crop damage assessment under the umbrella of YES-

TECH i.e., Yield Estimation System based on Technology. YES-TECH advocates the blended use of modelled and CCE yield-estimates for insurance claim assessment from Kharif 2023 season onwards. Under YES-TECH, it has been envisaged to develop a database system for aggregating crop health photographs taken at periodic intervals, i.e., Collection of Real Time Observations & Photographs of Crops (CROPIC), to ascertain the temporal health of the crops and use the picture analytics results as an input into crop yield estimation and to build a two-step mechanism to handle issues related to add-on claims.

In the context of the crop insurance schemes in India, weather data is extremely important to mitigate the hardships of the insured farmers against likelihood of anticipated crop losses. Weather datasets are relevant to multiple perils under PMFBY, such as inundation due to flood or rainfall, cyclones, cloudbursts, landslides, drought etc. Restructured Weather Based Crop Insurance Scheme (RWBCIS), which represents a major chunk of Crop Insurance business in India is totally dependent on accurate and reliable weather data sets for quantifying crop losses suffered by the farmers. Historical weather datasets are also required for working out the actuarial premium rates and for designing of the term sheet. The Operational Guidelines of RWBCIS mandates to ensure 100% of weather data must be from Automatic Weather Station (AWS) & Automatic Rain Gauge (ARG) only and the same must be installed and notified at the lowest possible level of administrative hierarchy. In view of the above, DA&FW has envisaged to set up a wider national level network of AWS & ARGs and creating a strong and resilient platform i.e., Weather Information and Network Data System (WINDS), which will consist of the existing AWS/ARG network established by Indian Meteorological Department (IMD) and various States/UTs. This huge weather dataset, integrated on a single platform, can be used by the respective State/UT Governments for crop insurance, sowing, cropping, harvesting and market planning, and consultation and advisories to the farmers. This nationally important data, thus generated may also be promoted and nurtured for wider applications, research and strategic utilization, for bringing in efficiencies and transparency in service delivery to the consumers, in different sectors.

The weather and pictorial datasets and information products generated under WINDS and CROPIC initiatives will be of immense value to strengthen YES-TECH implementation.

1.2. YES-TECH Pilot Studies

During the past seasons (2016-2022) of Kharif and Rabi, DA&FW engaged various technical agencies/experts/research bodies (Government/ private; national/international) and rigorously started conducting pilot studies for GP level yield estimation, for Cereal & Non-Cereal crops, through several innovative technologies/data like high spatial and temporal resolution remote sensing data, long-term soil & weather data, crop yield data, Advanced intelligent crop simulation models, Artificial intelligence/machine learning, Internet of Things (IoT), Crop Photo analytics, Advanced Statistics, etc. These pilot studies were conducted to assess the outcome and findings for taking decisions which will help in deciding the best available methodology/strategy for technology-based yield estimation at GP level, while minimizing the errors.

The objective of these pilot studies was to generate reliable & scalable technology-based yield estimates and crop damage assessment procedures for all crops notified under PMFBY, at the smallest administrative unit, i.e., Gram Panchayat (GP). These studies were conducted during 2019 and 2020 for both the Kharif and the Rabi seasons for selected crops and districts across different agro climatic zones of India. After detailed analysis, five approaches were recommended by the Expert Committee for the national-level rollout of technology-based yield estimation for the Paddy and Wheat crops from the 2023 crop season onwards. Pilot studies for other major crops, have already been initiated in kharif 2022 and rabi 2022-23 seasons, as per the recommendation of the competent authority of the Central Government and the recommended approaches for the same will be notified separately from time to time within the tender duration, as a corrigendum/amendment to this Manual.

1.3. Rationale for Implementing YES-TECH

1.3.1. Results of pilot studies on technology-based yield estimation carried-out by different agencies with the support of DA&FW, are promising as per the observations of the Expert Committee constituted by DA&FW.

1.3.2. All the approaches which have been recommended by the expert committee under YES-TECH, use well established models for which peer reviewed research is available, and these models are in open source and thoroughly tested under Indian conditions.

1.3.3. Increasing acceptance to technology-based yield estimation by States/UTs and other stakeholders and proactive steps already taken by some of the States like Maharashtra and Madhya Pradesh to adopt technology-based yield estimation under PMFBY.

1.3.4. Technology-based yield estimation shall be implemented on graded scale i.e., minimum 30 % weightage of Technology driven yield in the first year and 70% to traditional Crop Cutting Experiments approach subject to fulfilment of conditions, especially generation of crop maps with desired level of statistical accuracy, as stipulated in YES–TECH manual.

1.3.5. The concept of assigning the weightage to model derived yield estimates is meant for improving the accuracy of final yield estimates and reducing moral hazards and manual interventions, however the conventional CCEs (to be captured through CCE Agri app) will be continued as usual.

1.3.6. YES–TECH proposal has been widely discussed with all the stakeholders implementing PMFBY, at different forums and inputs and feedbacks received thereof have been incorporated into this document.

1.4. Scope of this document

1.4.1. Documentation of technical procedures, guidelines and protocols for implementing technology-based yield estimation models of YES-TECH under PMFBY.

1.4.2. To define the roles and responsibilities of the Stakeholders implementing YES-TECH, and their empanelment/selection criteria.

1.5. Crop - Model Matrix (CMM)

1.5.1. CMM represent the combination of crops and technology models approved for yield estimation under PMFBY. Crops and technology models notified under this manual shall only be eligible for calculating Crop Insurance claims under PMFBY.

1.5.2. CMM-1 covering wheat and paddy is being rolled out through the current document itself. Under CMM-1, five approaches are recommended covering 9 States are mentioned in Appendix 1.

1.5.3. GoI will notify subsequent CMMs from time to time based on the recommendations of YES-TECH Committee.

1.5.4. Upon such notifications on subsequent CMMs relevant details will be added as appendices to this manual.

1.5.5. YES-TECH shall be implemented in the districts where satellite-based crop mapping, of the target crop is technically feasible, as specified in the subsequent chapters of this document.

1.5.6. Special Exemption from CMM-1 Framework: Since the states of Madhya Pradesh and Maharashtra had implemented technology-based yield estimation from Kharif 2022 as per approval given by GoI vide letter dated 17th June 2022 , as a special dispensation for them, nothing in this clause will apply to the states of Madhya Pradesh and Maharashtra for Crops

other than those mentioned in CMM-1, provided that technology based yield estimation for these crops is implemented within the purview and administrative framework defined in this Manual.

1.5.7. Extending the coverage of CMM-1 to other states will be done from 2024 Kharif season onwards.

2. YES-TECH Implementation Framework

2.1. With the support of the current manual, States/UTs shall select a TIP and a MITR from the list of agencies empanelled by GoI.

2.2. MITR mentors, monitors and evaluates the results of models. That means MITR is associated with the total process end to end.

2.3. Disputes, if any, related to the technology-based yield estimation will be handled by MITR at State/UT level. However, YES-Tech Committee will act as appellate authority in case the state level decisions are challenged. Its decisions shall be final and binding on all concerned.

2.4. States/UTs shall implement the selected model for yield estimation through TIP with the mentorship of MITR following the guidelines furnished in the Appendix 1 of this document.

The framework for the implementation of YES-TECH models is depicted in Figure 1 below.

Figure 1: YES-TECH Implementation Framework
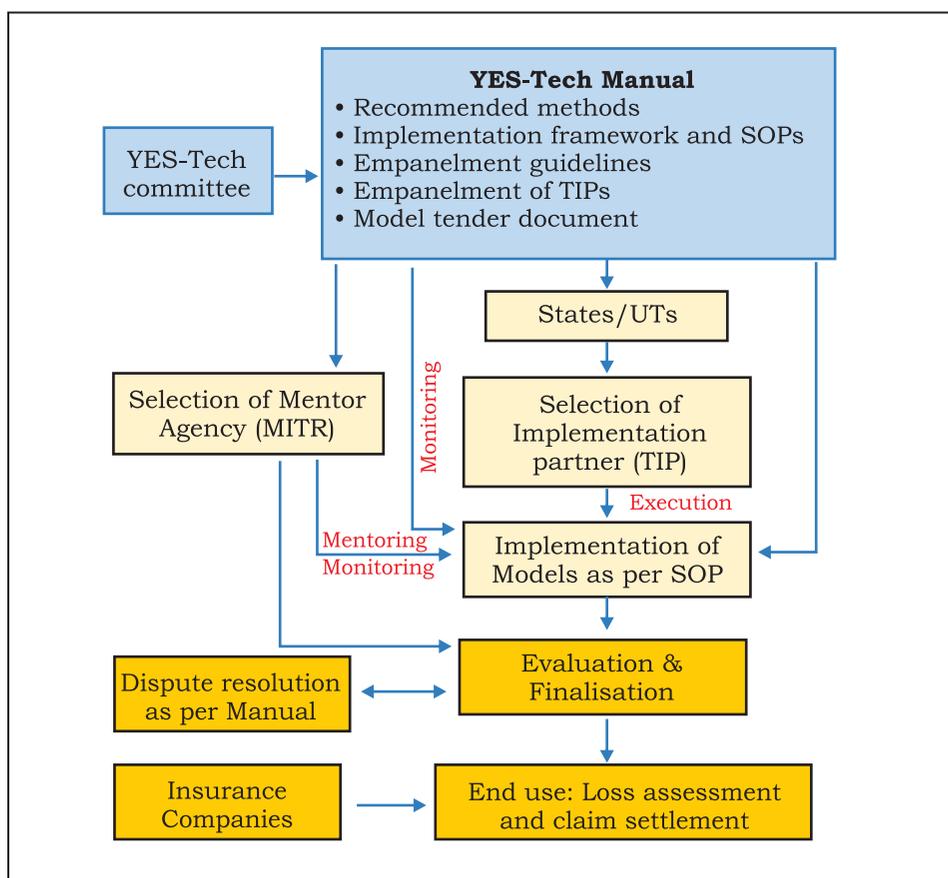
3. Roles and Responsibilities of stakeholders in implementing YES-TECH

3.1. Government of India (GoI)

3.1.1. GoI shall notify the YES-TECH Committee.

3.1.2. The GoI, through YES-TECH Committee, shall nominate and select MITR who shall act as nominee of the GOI in implementation of the YES-TECH.

3.1.3. The GoI shall have the sole power to clarify, amend, withdraw, review etc. any of the provisions of the YES-TECH Manual and issue notification in this regard.

3.1.4. The GoI shall make necessary provisions for the integration of YES-TECH with National Crop insurance Portal (NCIP) for seamless flow of data and information.

3.2. YES-TECH Committee

3.2.1. Overall execution and monitoring of YES-TECH.

3.2.2. Empanelment of the Mentor Institutes for Technology Rollout (MITR) for providing mentorship to the States/UTs and TIP(s) for the overall implementation of YES-TECH in the state.

3.2.3. Empanelment of the Technical Implementation Partners (TIP), both Private and Government bodies, and notify the list from time to time.

3.2.4. List of States/UT wise districts for YES-TECH implementation shall be decided based on the YES-TECH readiness checklist given in Annexure I and the list of potential districts in Table 13 (Appendix 1). State/UT in consultation with MITR and YES-TECH Committee will notify the districts.

3.2.5. The YES-TECH Committee shall, from time to time, amend the crop wise list of districts under CMMs and the state shall include these districts in YES-TECH implementation framework based on feasibility of its applicability in such districts.

3.2.6. Periodical training and awareness program of Stakeholders under the PMFBY capacity building framework, through MITR /National Agencies/ TIPs in every season will be organised under the guidance of YES-TECH Committee.

3.2.7. Harvest index (HI) required as input in the models will be published by YES-TECH Committee in consultation with MITR organisations. Basic data for computation of HI shall be provided by State Department of Agriculture in consultation with MITR preferably District/Season wise. HI values shall be updated every year, before the start of season.

3.2.8. The YES-TECH committee shall devise a detailed Monitoring and Evaluation (M&E) framework, containing key performance indicators, for the ranking of MITRs & TIPs.

3.2.9. Mahalanobis National Crop Forecast Centre (MNCFC) functions as the secretariat of the YES-TECH committee for taking care and disposing off the day-to-day matters for all YES-TECH related activities, on its behalf.

3.2.10. The matters for which the full house of the YES-TECH committee shall mandatorily convene are as follows:

1. Changes/Revisions in the selected CMM.
2. Inclusion of new models/approaches
3. Implementing any Pilots for Inclusion of new Crops
4. De-empanelment of Technology Implementation Partners (TIPs)
5. Notification of Harvest Index (HI)

6. For resolution of appeals against the orders of MITR on the End of Season Reports (ESR) by the State/UT or the Insurance Company.

7. Fixing norms for paying cost to MITR.

8. Finalisation of data and information sharing protocols.

9. Any other matter referred by Government of India.

3.3. States/UTs

3.3.1. YES-TECH tender shall be for three years, preferably co-terminus with the PMFBY tender cycle.

3.3.2. The State/UT shall refer to the YES-TECH model tender document for selection of TIP for implementing YES-TECH and in case required, they shall add additional scope that they wish to incorporate with the existing services as per their respective financial rules.

3.3.3. The State/UT shall identify a MITR institute and a TIP for implementing YES-TECH and there should be no conflict of interest in the roles and responsibilities of the MITR and the TIP.

3.3.4. The State/UT shall select a Private agency as TIP through financial bidding process or a Government Organization as TIP as per their respective financial rules, from the list of agencies empanelled by MNCFC.

3.3.5. The State/UT shall select a MITR organization from the list of mentor organizations, identified by YES-TECH committee **(Table 1)**, for their respective States/UTs. MITR selection shall be done from the provided list only and same may also be mentioned in the PMFBY tender floated by the state. MITR agency is a nominee of GoI for YES-TECH implementation.

3.3.6. Selection of models as per CMM is at the discretion of States. Before implementing any model under YES-TECH, the State needs to ensure the preparedness in terms of prerequisites i.e., infrastructure/information/ inputs/data etc., as mentioned in Annexure I.

3.3.7. It is mandatory for the State/UT implementing YES-TECH, to declare the selected model in the beginning of crop season in order to maintain transparency in the system.

3.3.8. The Season and crop wise model adopted by the State/UT must be notified in the PMFBY Tender notification itself.

3.3.9. Model to be adopted should be same for a given crop season and for a given year all over the State/UT. Change in model after one year (at least two crop seasons) is permitted but should be notified well in advance before the start of the next season.

3.3.10. The State/UT shall assign at least 30% weightage to modelled yield and 70% weightage to CCE derived yield for calculation of final yield estimates. The State/UT may decide to assign higher weightages to modelled yield/CHF. The season-wise, and crop-wise weightage bifurcation should be finalized in consultation with MITR and informed to all stakeholders before the commencement of the season.

3.3.11. The states may examine the list of districts as suggested under the relevant CMM and take a decision for inclusion under YES-TECH in consultation with MITR. If the MITR agrees, the state can even add districts to the suggested list (Table 14) but will only be able to exclude any district with specific consent of the MITR with clearcut reasons for doing so. However, it is desirable that the selected districts should have a minimum of 5000 Ha of area under the target crop.

3.3.12. Satellite based crop mapping is a prerequisite for YES-TECH- implementation. If crop mapping is not possible for any Insurance Unit due to small and isolated fields or very low coverage, it is recommended to exclude such IUs from YES-TECH and follow only conventional CCE System. State can take a decision to merge such IUs with contiguous IUs and implement the models.

3.3.13. Hilly States/Districts may also be exempted from YES-TECH implementation in consultation with MITR, if required.

3.3.14. Before taking any decision regarding selection of districts, the accuracy of the crop maps must be ascertained by the concerned state in consultation with the MITR.

3.3.15. The States/UTs must indicate crop wise specific dates for the submission of all the reports by the TIP in their respective TA, as per the seasonality discipline and crop calendar.

3.3.16. The States/UTs will mandatorily utilize the Special Report (SR) as one of the inputs for determining the invocation of Prevented / Failed Sowing and Prevented Planting / Germination Claims or Mid-Season Adversity Claims as per the relevant provisions of PMFBY Guidelines.

3.3.17. The State/UT shall ensure a smooth field data collection activity, and provide necessary administrative support to the selected TIP for YES-TECH implementation. They shall also provide the latest administrative boundaries (GP/IU wise), historical yield data, crop data or any other datasets required by the TIP for implementing YES-TECH.

3.3.18. State/UT will evaluate the result along with the MITR and if the results are satisfactory then payment will be released as per the payment terms.

3.3.19. State/UT shall follow the procedure as defined in dispute resolution mechanism, if the TIP has not delivered the results or the State/UT is not satisfied with the deliverable/methodology.

3.3.20. The State/UT shall sign a mandatory Tripartite Agreement (TA) with the MITR and TIP.

3.4. **Mentor Institutions for Technology Rollout (MITR)**

3.4.1. MITR is a nominee of GoI for YES-TECH implementation.

3.4.2. The MITR in consultation with the State/UT shall provide consent to act as mentor for that State/UT and same shall be mentioned in the PMFBY tender notification of the State/UT.

3.4.3. The agencies identified as MITR can act as MITR in not more than three State/UTs however this shall not apply for Himalayan and North-Eastern Region (NER) states.

3.4.4. In the event that MITR agency has a direct or indirect financial /administrative/other interest in any transaction with the TIP, directly or on behalf of the State/UT, the agency shall promptly disclose such interest in writing to the YES-TECH Committee, before accepting the role as MITR.

3.4.5. The agencies identified as MITR may act as TIP, but not in the same state where they are supporting as MITR.

3.4.6. The state level organizations cannot act as MITR for their parent State/UT, under whose administrative and financial jurisdiction they fall, to avoid any conflict of interest.

3.4.7. Further, if any organization, listed as MITR, is engaged or is already providing support as Technical Partner for technology-based yield estimation, or related works, to the State/UT, they can continue as MITR under YES-TECH framework.

3.4.8. Phase wise review of YES-TECH implementation will be done by MITRs and State/UTs, which must conform with the seasonality discipline of PMFBY. All the implementing stakeholders will be part of these reviews.

3.4.9. MITR shall review the various reports submitted by TIP comprehensively, and will recommend to accept/reject/review the report as per the dispute resolution mechanism under this manual.

3.4.10. MITR shall identify and notify a Single Point of Contact for each State/UT where they are acting as MITR.

3.4.11. MITR shall continuously monitor and provide technical guidance to the selected TIPs in YES-TECH implementation and suggest changes/modifications in the results, if any, before final submission of yield estimates. MITR will also ensure the improvement in the deliverables to the State/UT by the TIP, within stipulated timelines.

3.4.12. MITR shall constitute a committee under the chairmanship of the Head of the Institution/Head of Department or equivalent officer for disposal of review petitions under the dispute resolution mechanism defined in this manual.

3.4.13. MITR may access the required data from TIP for verification and quality check.

3.4.14. MITR should not use the data of YES-TECH for any other purpose. However, after obtaining permission from YES-TECH Committee and signing a non-disclosure agreement, MITR can use the data for research and development purposes only. There shall be moratorium period of 3 years for publishing the results of such studies. It shall be ensured by MITR that the results of such studies shall not conflict with the interests of crop insurance system.

3.4.15. The MITR shall sign a mandatory Tripartite Agreement (TA) with the State/UT and TIP. MITR will sign Agreement as a nominee of GoI for YES-TECH implementation.

3.4.16. The mentor organizations, MITRs, to support the YES-Tech activities of States/UTs are listed in Table 1 below:

Table 1: List of MITRs to support YES-TECH Initiative

S. No	Institute	Address	Contact Details
01	Space Applications Centre (SAC)	Director, SAC, Ahmedabad	director@sac.isro.gov.in
02	National Remote Sensing Centre (NRSC)	Director, NRSC, Hyderabad	director@nrsc.gov.in
03	NRSC	General Manager NRSC Regional Centre BENGALURU	sksrivastav@nrsc.gov.in hebbar_kr@nrsc.gov.in gmrcsouth@nrsc.gov.in
04	NRSC	General Manager NRSC Regional Centre KOLKATA	director@nrsc.gov.in sksrivastav@nrsc.gov.in gmrc_e@nrsc.gov.in
05	North Eastern Space Application Centre (NESAC)	Director, NESAC, ISRO, Shillong	director@nesac.gov.in
06	CRIDA-ICAR	Central Research Institute for Dryland Agriculture, ICAR, Hyderabad	director.crida@icar.gov.in

S. No	Institute	Address	Contact Details
07	IARI-ICAR	Director ICAR-IARI Pusa, New Delhi	director@iari.res.in
08	TNAU	Vice Chancellor, Tamil Nadu Agriculture University	directorwtc@tnau.ac.in
09	OUAT	Vice Chancellor, Odisha University of Agriculture & Technology, Bhubaneswar	registrarouat@gmail.com
10	PJTSAU	Vice Chancellor, Professor Jayashankar Telangana State Agricultural University (PJTSAU), Telangana	regrpjtsau@gmail.com
11	ANGRAU	Acharya NG Ranga Agricultural University	vicechancellor@angrau.ac.in
12	HARSAC	Haryana Space Applications Centre, Hisar	ps.harsac.ggm@gmail.com contact@harsac.org

3.5.   Technology Implementation Partners (TIP)

3.5.1. The empanelment of TIPs and their participation in YES-TECH implementation will imply their acceptance of all provisions, modalities and guidelines of YES-TECH.

3.5.2. The empanelled TIPs may participate in the financial bidding process of the States/UT Governments for implementing YES-TECH.

3.5.3. The empanelled TIPs have to deploy requisite infrastructure and resources for implementation of YES-TECH.

3.5.4. Implement the selected model in an effective and transparent manner to meet YES-TECH objectives.

3.5.5. Follow the seasonality discipline of PMFBY and the timelines, for data analysis and report submission, as prescribed in YES-TECH guidelines.

3.5.6. The TIP shall act upon the suggestions/instructions of the MITR, in a timely manner.

3.5.7. The TIP shall mandatorily establish a functional physical office in the State/UT, either in the capital city of the State/UT or in a city mandated by the State/UT Government, to implement YES-TECH.

3.5.8. The TIP shall conduct a preparatory meeting within 7 working days of submission of the inception report, with State/UT representative, MITR organization, and other stakeholders implementing YES-TECH. The TIP will briefly explain the selected methodology, planning for the milestone deliverables, inputs required, etc., and request for necessary administrative approvals from the State/UT for implementing YES_TECH.

3.5.9. The TIP shall collect requisite number of Ground Truth (GT) data points, conduct CCEs (as per Annexure VIII) and collect other relevant field information for implementing YES-TECH crop models.

3.5.10. The TIP shall sign a mandatory Tripartite Agreement (TA) with the State/UT and MITR. MITR will sign MoU as a nominee of GoI for YES-TECH implementation.

3.5.11. The TIP shall submit the phase wise reports/results as per the defined timeline and through the desired channels. The TIP will participate in the review meeting with the State, MITR Organization, Insurance companies and other stakeholders at regular intervals.

3.5.12. The TIP shall carryout any work related to WINDS, CROPIC etc., as directed by YES-TECH committee.

3.5.13. The TIP shall hand over the data collected from the field at the end of the project as per the data and information sharing protocols notified by YES-TECH committee and shall not use the data and models for any purpose without prior approvals from the State/UT.

3.6.   Insurance Companies (ICs)

3.6.1. The IC shall take part in regular meetings/workshop/training related to YES-TECH pertaining to their area of implementation.

3.6.2. The IC will support the TIP in collection of ground information, to the extent possible, and provide relevant data as per data sharing protocols.

3.6.3. The IC shall not indulge in any unethical practices to influence the TIPs or MITRs.

3.6.4. The IC shall take part in all monitoring and evaluation activities carried-out by MITRs.

3.6.5. The IC shall disclose any conflict of interest with the TIPs or MITRs in the implementing state.

3.7.   Tripartite Agreement (TA) between State/UT, TIP and MITR

3.7.1. The State/UT, TIP and MITR shall enter into a Tripartite Agreement, before the commencement of the first season of implementation of YES-TECH in the prescribed format.

3.7.2. MITR will sign the Agreement as a nominee of GoI for YES-TECH implementation.

3.7.3. The roles and responsibilities of the States/UTs, TIPs, MITRs as defined above and the provisions of performance evaluation matrix and applicable penalties will be a part of the Agreement necessarily.

3.7.4. A template of the Tripartite Agreement (TA) will be shared separately by GoI with recommendation of YES-TECH committee.

4.   Models under YES-TECH framework

4.1.   Models under CMM-1

1. Semi-physical model

2. AI/ML models

3. Crop simulation models

4. Ensemble models (AI/ Crop Simulation/ Semi-physical etc.,)

5. Parametric index of crop performance (Indirect approach)

4.1.1.   Semi-physical model

4.1.1.1. This method is based on Radiation Use Efficiency (RUE) model proposed by Monteith, 1977. This model is based on the bio-chemical process of plant–light absorption for photosynthesis, radiation use efficiency, stress factors, accumulated biomass, and grain yield. Its strength lies in adopting a process-based framework with limited parameterization. It is recognized as a better approach than simple empirical modelling. Critical elements of the RUE model include (a) reliable information on crop planting and harvest dates and (b) derivation of water stress and temperature stress factors.

4.1.1.2. Temperature and water stress are the two important limiting factors and quantifying these two parameters at local scales like IUs remains a big challenge. This model would result in potential yield rather than actual yield if the stress factors are not accounted using right data and technique. The model cannot be applied for part of the season because constant RUE is applicable only when the entire crop-growing season is considered. Moderate resolution (10-30m) NDVI and LSWI datasets throughout the crop season are to be used. In the event of non-availability of 10-30m data, MODIS 250m data may be used. Use of FAPAR data of MODIS and Sentinels are suggested. Harvest index (HI) can be derived from the historical CCE datasets (biomass and grain yield).

4.1.2. AI/ML Models (Machine Learning / Deep Learning)

4.1.2.1. Crop yield has high variability across space and time owing to variations in weather, edaphic, management factors, and genotypes. Spectral data of a crop is the integrated manifestation of the effect of all the above factors, and hence, satellite data has a significant role in regional crop yield assessment. Remote sensing based spectral data has been incorporated into different statistical, agro-meteorological, and simulation models for crop yield assessment.

4.1.2.2. Artificial Intelligence (AI) has gained importance in solving the non-linear relationships between variables. AI includes Machine Learning and Deep Learning models, such as the random forest (RF), support vector machine (SVM), and different variants of neural network models (NN). In recent years, AI models have gained momentum in crop yield estimation due to certain inherent advantages with these models. Satellite-derived vegetation indices, meteorological data, hydrological variables, and edaphic factors are being used in these models.

4.1.3. Crop simulation models

4.1.3.1. Crop growth models simulate the plant processes to estimate various bio-physical parameters and final crop yield. These models need intensive parameterization starting from genetic coefficients of crop variety under cultivation, crop sowing time, crop management practices – fertilizer applications, irrigation supplies, pest/disease occurrence, etc. These are highly reliable point-based or location-specific models due to the availability of input parameters in experimental plots.

4.1.3.2. Input data in the model includes daily max & min temperature, daily solar radiation, daily rainfall, soil data - depth wise texture, bulk density, pH, organic carbon, water holding capacity, etc., Start of the sowing and irrigation information can be derived from satellite images and other management factors can be taken from the standard local practices.

4.1.3.3. Model calibration and validation approaches are required for each selected model for the selected crop. The simulation models are sensitive to the genetic coefficients of the crop. A proper varietal-based approximation of genetic coefficients is required at the disaggregated level before simulating the crop yield. The modelling approach often remains lumped in absence of spatial input parameters unless space-based inputs are assimilated or externally incorporated. The insurance units or agro ecologies with highly varying biophysical conditions need careful consideration on using simulation models and their yield extrapolation.

4.1.4. Ensemble models (Machine Learning/Crop Simulation/Semi-physical)

4.1.4.1. An ensemble approach to yield estimation involves combining the predictions of multiple models to make a final estimation. This can be done through various techniques such as model averaging, model voting, or more sophisticated methods such as stacking.

4.1.4.2. One advantage of using an ensembled approach is that it can potentially improve the accuracy of the final prediction by reducing the variance of the individual models. This is because the individual models may make different errors, and by combining their predictions, the errors may cancel out to some extent.

4.1.4.3. To use an ensembled approach for yield estimation, one has to train multiple models on the same dataset. Different types of models can be used such as decision trees, support vector machines, or neural networks, or we could use the same type of model with different hyper parameter settings. These models can be clubbed with mechanistic approaches too.

4.1.4.4. There are several benefits of using an ensembled approach for yield estimation:

1. **Increased accuracy:** By combining the predictions of multiple models, the ensembled approach can often provide more accurate predictions than any single model. This is because the individual models may have different strengths and weaknesses, and the ensembled approach can take advantage of the strengths of each model while minimizing the impact of their weaknesses.

2. **Reduced variance:** Using an ensembled approach can also reduce the variance of the predictions, which can be especially useful when the individual models are prone to overfitting or have high variance in their predictions.

3. **Improved generalization:** An ensembled approach can also improve the generalization of the model, meaning it can make more accurate predictions on unseen data.

4.1.5. Parametric Index - Crop Health Factor (CHF)

4.1.5.1. CHF is a composite index of crop performance incorporating multiple physical and biophysical parameters related to crop health. It is a quantitative measure of crop health and its overall performance.

4.1.5.2. The research findings that can establish the rationale for adopting CHF are (a) objectively measured yield-proxy-index is a better choice than subjectivity-prone manual yield estimates to design crop insurance contracts, (b) currently satellite and weather datasets permit more objective assessment of crop health at moderate spatial and temporal scales, (c) composite indicators are effective to simplify the complex processes into easily understood simple comparisons.

4.2. Accounting for end-of-season crop risks (applicable to all models)

4.2.1. There are certain crop risks that need to be accounted separately in modelled yield, because they are not parameterized in the model. Therefore, a Correction Factor approach is developed here to correct the modelled yield for such risks which include:

i. Unseasonal rains/Floods/Cyclones (submergence, lodging, panic harvest etc.)

ii. Weather aberrations such as hot and dry winds, rise in temperatures (poor grain setting and grain development)

iii. Weather induced pest/disease incidence, etc.

4.2.2. Mostly, these risks occur during reproductive stage of crops – flowering to harvest period, during the last 30-40 days of crop's life cycle i.e., before crop harvest.

4.2.3. The methodology framework for generating Correction Factor for accounting the impact of such crop risks occurring the terminal part of season, has two components namely:

a) detecting the affected/exposed area in each Insurance Unit and

b) crop loss fraction in such area.

4.2.4. Triggers for initiating the analysis for accounting such risks shall be decided by the states in consultation with MITR and will inter alia include:

a) Excess/Unseasonal rainfall

b) Wind speed

c) Relative Humidity

d) Temperature

e) Any additional weather parameter.

4.2.5. Affected area is derived using, (a) satellite-based harvest area maps, (b) satellite indices before and after the risk events in the current year and (c) satellite indices of past year(s) with no risk events.

4.2.6. Yield loss fractions are to be generated based on anomalies detected by satellite indices. The indices of current season are compared with that of recent past two to three normal years (which is decided by States in advance). It is to be ensured that crop stage is more or less same between the years of comparison for meaningful outcomes.

4.2.7. A look-Up-Table (LUT) is prepared based on previous studies and experiences to arrive at crop losses. While it is not practical to set these limits truly representing the real loss, a liberal approach with a reasonable trade-off is formulated here for the benefit of farmers as well as for ICs for easy settlement of claims.

4.2.8. LUTs for computing Correction Factors for accounting for certain crop risks are given below in **Table 2**. The values mentioned in the LUTs are indicative in nature. The % reduction in yield due to various risks mentioned in the **Table 2** can be improved using other sources of objective data such as CCE yield, in consultation with MITR and State/UT Governments.

Table 2 : Look-Up-Tables showing possible yield reduction

(a) Reduction in NDVI / Backscatter due to flood inundation		
S.no	**% reduction in satellite index**	**Associated % crop yield reduction**
1	20-30	20
2	30-50	40
3	50-70	60
4	>70	100
(b) Increase in LSWI / Backscatter due to crop lodging		
S.no	**% increase in satellite index**	**Associated % crop yield reduction**
1	20-30	20
2	30-50	40
3	50-70	60
4	>70	100

(c) Increase in Backscatter due to excess wetness caused by rainfall		
S.no	% increase in back scatter	Associated % crop yield reduction
1	20-30	20
2	30-50	40
3	50-70	60
4	>70	100
(d) Increase in LSWI/Backscatter due to high temperature		
S.no	% increase in satellite index	Associated % crop yield reduction
1	20-30	20
2	30-50	40
3	50-70	60
4	>70	100
(e) Reduction in LSWI/NDVI due to pest incidence		
S.no	% reduction in satellite index	Associated % crop yield reduction
1	20-30	20
2	30-50	40
3	50-70	60
4	>70	100

4.2.9. Computation of final estimate

Area weighted approach is followed to arrive at final estimate of modelled-yield or CHF for each IU, using percent area affected and percent of yield/CHF loss in the affected area.

5. Conditions in YES-TECH implementation

5.1. Model implementation for past years

5.1.1. It is mandatory to implement these models as per the manual for the current and past years from 2017 onwards. Model implementation for past years ensures consistency in the model performance as well as outputs and builds confidence among the implementing stakeholders.

5.1.2. These approaches have been recommended by the expert committee after analysing results obtained from multiple pilot studies. The models have been validated against independent CCEs conducted by the implementing agencies and the CCE data collected under PMFBY.

5.1.3. Running the Yield Models on the historical datasets, including remote sensing Images, Weather & Soil parameters, and CCE Yield datasets will help to better fine tune the models, resulting in robust modelling framework and will set a baseline for future improvements.

5.1.4. The model outputs of past years shall not be used for (a) making comparisons with other datasets, (b) revising the loss assessments of past years, and (c) challenging the estimates of current/past years.

5.1.5. No challenges or appeals against the past years' yield estimates shall be entertained in any court of law or appellate authority. Past estimates will fall within the category of "intellectual property" under section 8(1)(d) of the Right to Information Act, 2005, and not be made public. These datasets are used to understand the model consistency and security, and can be shared with relevant stakeholders for technical usage as per the data and information sharing protocols notified by the YES-TECH Committee.

5.2.   Recommended end use of model outputs

Blending of modelled crop yields or CHF with CCE-yield estimates is suggested for arriving at yield-based crop loss estimates and claim assessments from Kharif 2023 crop season onwards.

5.2.1.   Direct and Indirect Approach for Yield estimation

5.2.1.1. At least 30% weightage is to be assigned to modelled yield. Composite yield estimate will be generated by assigning 70% weightage to CCE yield and 30% weightage to modelled yield, and this blended yield estimate will be used for arriving at yield loss assessments.

5.2.1.2. In case of Crop Health Factor (CHF), 70% weightage is to be assigned to CCE-yield deviation from its threshold and 30% weightage to CHF deviation from its threshold.

5.2.1.3. States can increase the weightage for modelled yield at their discretion and there is no upper cap on weightage to be given to modelled yield. It is to be noted that the weight to be assigned to modelled yield needs to be declared in the beginning of crop season in the PMFBY tender documents for Kharif 2023 season and subsequently by way of a specific notification by the concerned State/UT before the start of every season.

5.2.2.   Implications of blended approach

5.2.2.1. The blending approach would lead to improved loss assessment mechanism under PMFBY, by minimizing the limitations that are inadvertently present in the sole dependence on manual CCE estimates.

5.2.2.2. The basis for assigning 30% weightage to technology can be drawn from the facts that the benefit of technology adoption can be realised only when significant weightage is assigned to the outcome. Such minimum weightage is needed to result in a meaningful impact on the final yield estimates.

5.2.2.3. Here it may be noted that the aim of YES-TECH rollout is not to replace the CCEs entirely, but to improve upon the yield estimates and to reduce the dependency on CCEs in a graduated manner.

5.2.2.4. It is to be noted that the purpose of implementing YES-TECH is to improve the accuracy of yield estimation and loss assessment in the current year. The modelled outputs are not meant for changing AY and TY values for the current year.

5.2.2.5. The Threshold Yield (TY) for 1st season of YES-TECH rollout will be calculated from the previous season's Actual Yield (CCE based). For subsequent seasons, YES-TECH derived Yield estimates will be incorporated for TY calculation.

5.3.   Financial implications

Implementation of any model under YES-TECH involves cost considerations for field data collection, crop mapping, procurement of satellite & weather datasets, model training, and validation, setting up of infrastructural facilities, computational facilities, model training, and validation, data analysis, expert knowledge, etc. All these inputs and factors will contribute towards the overall implementation of YES-TECH.

5.3.1. Cost of implementing the YES-TECH shall be shared between Central and State Government on sunset basis as mentioned in **Table 3** below:

Table 3: Financial arrangement for implementing YES-TECH

S. No	Particulars	Sharing Ratio/Pattern between Central and State Governments for YES-TECH		
		2023-24 (1st year)	2024-25 (2nd year)	2025-26 (3rd year)
1	North-eastern and Himalayan States	90:10	90:10	90:10
2.	Other States	90:10	80:20	60:40

5.3.2. Reference Cost for TIP for Implementing YES-TECH

5.3.2.1. On the basis of the pilot studies conducted by different agencies under PMFBY, the district wise notional cost of implementing YES-TECH for a crop for a season works out to be approximately Rs. 6-8 Lakhs, per district, for districts having approximately 5000 Ha under target crop. This is only indicative cost incurred for collection of all the requisite input/information and analysis of data in the limited districts of pilot studies. This shall be taken as reference only.

5.3.2.2. However, the cluster wise actual cost of implementing YES-TECH for a crop in a season will be discovered through the financial bidding process for the selection of private agencies as TIPs.

5.3.2.3. The size and the grouping of the cluster shall conform with the PMFBY district clustering as notified by the respective States/UTs.

5.3.2.4. For the State/UT Government agencies, which will be selected as TIP on nomination basis, the cluster wise cost of implementing YES-TECH for a crop in a season will be the lowest of:

1. The national average of the cluster wise notional price discovered through the tendering process for the selection of private agencies; OR

2. The cluster wise actual expenditure incurred by the State/UT Government agency nominated as TIP for implementing YES-TECH for a crop in a season.

5.3.3. Payment to MITR

5.3.3.1. Up to 20% of YES-TECH implementation cost in a given State/UT can be paid to respective MITR, for meeting the following requirement while discharging their responsibilities in YES-TECH:

1. Computer systems and software,

2. Hiring of contractual manpower (preferably in Remote Sensing & GIS and Data Science domain),

3. Travel Expenses for YES-TECH related activities,

4. Other miscellaneous expenses,

5. Institutional overheads, if any.

5.3.3.2. The MITR will submit a detailed State wise Three-Year financial plan for the above with the YES-TECH committee.

5.3.3.3. MNCFC/YES TECH Committee will examine the proposal submitted by MITR and the admissible cost of infrastructure, manpower and other expenses, will be considered and sanctioned for the tender cycle.

5.3.3.4. Infrastructure and Set-up Cost: YES-Tech committee shall recommend the quantum of payment to be paid upfront as first instalment/ mobilization advance to MITRs, for meeting of requisite infrastructure and set-up cost.

5.3.3.5. The balance payment shall be paid on actual cost basis on submission of Bills/Invoice/Expenditure Statement etc. by the MITR at regular intervals.

5.4. **Usage of CCE-Agri App**

5.4.1. The purpose of YES-TECH rollout is not to replace the CCEs entirely, but to reduce the dependency on CCEs in a graduated manner.

5.4.2. CCEs will continue to be conducted by the respective State/UT departments in the same way as earlier, following the relevant clauses of the Operational Guidelines of PMFBY.

5.4.3. In order to encourage the usage of CCE Agri app for capturing the Crop Cutting Experiments (CCEs) by the States and to reduce moral hazards, it has also been decided to give additional weightage to YES-TECH derived yield estimates in case a certain number of CCEs are not conducted through CCE Agri app in a District for a particular crop in a season.

5.4.4. The additional weightage to be given to YES-TECH yield estimates in such case is provided in **Table 4** below:

Table 4: Additional weightage to YES-TECH yield estimates

% of CCEs recorded by CCE-Agri App	Additional weightage to YES-TECH yield	Total weightage to YES-TECH yield
>= 75 %	0 %	30 %
>= 50 % & < 75 %	5 %	35 %
>= 25 % & < 50 %	10 %	40 %
>= 10 % & <25 %	15 %	45 %
< 10 %	20 %	50 %

5.5. **Other Conditions**

5.5.1. The Threshold Yield (TY) for 1st season of YES-TECH rollout will be calculated from the previous year's Actual Yield (CCE based). For subsequent seasons, the blended yield estimates that were used for claim settlements will be incorporated for TY calculation.

5.5.2. Time line/Seasonality discipline for Tender, award of work order, shall be as per the relevant PMFBY guidelines.

5.5.3. The final estimates of YES-Tech models shall be made available within 30 days of crop harvesting.

5.5.4. Yield estimation would be carried out at Insurance Unit level as specified by the state.

5.5.5. MITRs & TIPs will assist and provide the requisite input data for calculation of the generic parameters like RUE, Harvest index, etc. to MNCFC, if required.

5.5.6. **Data Sharing:** A National level, access-controlled web-based data repository will be created for sharing and dissemination of past, current and future datasets and results with the

stakeholders implementing YES-TECH. The same repository will be integrated into the National Crop Insurance Portal (NCIP), providing seamless access to all datasets.

5.5.7. The data and information sharing protocols will be prepared and published separately by the YES-TECH Committee.

6. Reports under YES-TECH

The selected TIPs shall submit the following technical reports (cluster-wise, crop-wise) at pre-defined intervals, conforming with the Seasonality Discipline, for review by the State, MITRs and Insurance Companies:

1. Inception Report (IR)

2. Mid-Season Report (MSR)

3. End of Season Report (ESR)

4. Special Reports (SR)

Though the above reports are to be produced at Cluster-Crop level, the State/UT or the MITR may ask for granular reports as and when required. All the reports under YES-TECH shall have the Document Control Sheet (DCS) provided in Annexure VII.

6.1. Inception Report (IR)

6.1.1. On selection, the selected TIP will submit a cluster-wise detailed work plan and preparatory report within a month of the Award of work order/Start of Season.

6.1.2. Start of the season will be construed as the opening of Farmer Enrolment on the National Crop Insurance Portal (NCIP) for that particular season.

6.1.3. A template for Inception Report is provided as Annexure II.

6.2. Mid-Season Report (MSR)

6.2.1. The MSR brings more clarity on work progress and permits need-based corrections/changes in the planned activities.

6.2.2. The TIP will submit a cluster-wise MSR, as per the timelines, terms and conditions as mentioned in the Award of work order/Tripartite Agreement (TA) Document and conforming with the Crop Calendar notified by the respective state.

6.2.3. The Mid-Season report should be submitted tentatively during the first fortnight of September for Kharif and during the 2nd Fortnight of January for Rabi season. The States/UTs must indicate crop wise specific dates for the same in their respective Award of work order/Tripartite Agreement (TA) Documents, as per the seasonality discipline and crop calendar.

6.2.4. The MSR must include:

i. Detailed description of the study area

ii. Data collection, Ground Truth, crop monitoring - Methodology and Sources

iii. Ground data collection status, including results of target crop classification and acreage estimation with help of mobile applications and remote sensing data analysis.

iv. Crop health monitoring status (indices like NDVI, VCI, LSWI, Soil Moisture condition, etc.) as per established methodology with interpretations. The spectral indices profiles of current and past years of the study area should be presented.

v. Comparison of different weather indices of different years should also be furnished in the report.

6.2.5. A template for Mid-Season Report is provided as Annexure III.

6.3. **End of Season Report (ESR)**

6.3.1. ESR documents the detailed results, deviations from the proposed methodology with justifications and IU-wise final yield estimates.

6.3.2. The report must comply with timelines and terms and conditions as mentioned in the Award of work order/Tripartite Agreement (TA) and conforming with the Crop Calendar and Seasonality Discipline notified by the respective State/UT Government. The States/UTs must indicate crop wise specific dates for the same in their respective Award of work order /Tripartite Agreement (TA) documents.

6.3.3. The ESR must include:

 i. Description of field data (summary tables with statistical analysis and any interpretation)

 ii. Crop area estimations (statistics, maps, and accuracy)

 iii. CCE data analysis and description if used in models

 iv. GP/IU level yield estimates / CHF values for current and past years preferably from 2017 onwards, its comparison, and evaluation based on set statistical parameters,

 v. Interpretation and discussion for GP level yield estimates, explaining the variance and losses, if any.

6.3.4. A template for ESR is provided as Annexure IV.

6.4. **Special Reports (SR)**

6.4.1. Special Reports related to Prevented/Failed sowing & Mid-Season adversity will be provided by TIP on the request of the State Agriculture Department. The Operational Guidelines of PMFBY mandates the usage of advanced & innovative technologies such as, Satellite/UAV Remote Sensing, AWS/ARG data for validation of on Account Payment of Claims due to Mid-Season Adversity (MSA) and Prevented / Failed sowing and Prevented planting / germination.

6.4.2. As the TIPs will start Remote Sensing & GIS based Crop Condition Monitoring (CCM) on near real time basis and crop area estimation in their respective districts right from the award of work order, this extra information will be mandatorily utilized by the states as one of the inputs for determining the invocation of Prevented / Failed sowing and Prevented planting / germination Claims or Mid-Season Adversity Claims.

6.4.3. **Prevented Sowing (SR-PS)**

6.4.3.1. For assessment of Prevented / Failed sowing and Prevented planting / germination claims, remote sensing and weather products as may be produced and referred to as One of the Inputs before invoking Prevented Sowing claims in a district.

6.4.3.2. A template for SR-PS is provided as Annexure V.

6.4.4. **Mid-Season Adversity (SR-MSA)**

6.4.4.1. For assessment of On-Account Payment of Claims due to Mid-Season Adversity Claims, remote sensing and weather products as described in the relevant clause of Operational Guidelines of PMFBY may be produced and referred to as One of the Inputs before invoking Mid-Season adversity claims in a district.

6.4.4.2. A template for SR-MSA is provided as Annexure VI.

6.5.   Mode of Delivery

6.5.1.   TIPs will submit the yield estimation reports for evaluation by MITR, States/UTs and ICs at pre-defined intervals, both in Offline and Online modes. Email will be accepted as mode of delivery of the phase-wise reports and the date and time of the email will be construed as the date and time of the submission of the report.

6.5.2.   A web interface may also be developed for online hosting of datasets and reports which may be made available to all the stakeholders implementing YES-TECH for scrutiny.

6.5.3.   These reports and datasets will not be shared publicly by any of the concerned stakeholders., without prior approval/consent from MNCFC, till the finalization and publishing of data and information sharing protocols and guidelines.

7.   Dispute resolution in YES-TECH – Timelines and Mechanisms

Since YES-TECH is being rolled out for the first time, therefor not all disputes/issues can be envisaged at the time of framing of this manual. Accordingly, provision is being made to handle disputes of both types, viz. those which are anticipated and otherwise.

7.1.   Specific Disputes related to implementation of YES-TECH

7.1.1.   Inception Report (IR)

7.1.1.1. The TIP shall submit a District-Wise IR within a month of the Award of work order/ Start of the season and communicate with all the stakeholders implementing YES-TECH.

7.1.1.2. The IR shall be discussed with all stakeholders and suggestions/modifications, if any, shall be finalized by MITR within 7 working days of such discussion.

7.1.1.3. There shall be no Review/Appeal against the recommendations of MITR on Inception Report by the IC or the State.

7.1.2.   Mid-Season Report (MSR):

7.1.2.1. The MSR shall be deemed to be accepted by all the Stakeholders, if no application of Review is received within 7 working days of the submission of the report by the TIPs.

7.1.2.2. The State/UT or IC can file for a review of the MSR with the MITR, within 7 working days of the submission of the MSR by the TIPs.

7.1.2.3. The MITR shall review the petition through a separate internal committee under the chairmanship of the Head of the Institution/Head of Department or equivalent officer, which will pass a speaking order on the matter within 7 working days of the filing of review application, after hearing all the stakeholders implementing YES-TECH.

7.1.2.4. There shall be no Appeal against the order of MITR on MSR.

7.1.3.   End of Season Report (ESR)

7.1.3.1. The ESR shall be deemed to be accepted by all the Stakeholders, if no application of Review is received by MITR within 10 working days of the submission of the report by the TIPs.

7.1.3.2. The State/UT or the IC can file for a review of the ESR with the MITR, within 10 working days of the submission of the ESR by the TIPs.

7.1.3.3. The MITR shall review the petition through a separate internal committee under the chairmanship of the Head of the Institution/Head of Department or equivalent officer, which will pass a speaking order on the matter within 7 working days of the filing of review application, after hearing all the stakeholders implementing YES-TECH.

7.1.3.4. The report shall be deemed to be accepted by all the stakeholders, if no Appeal is received by YES-TECH committee within 7 working days from the date of passing of order by the MITR.

7.1.3.5. In case one of the Stakeholders, States/UT or IC, is not satisfied with the order of the MITR, they can appeal against the order with the YES-TECH Committee, within 7 working days from the date of passing of order by the MITR or within 7 working days of submission of the revised report by the TIPs.

7.1.3.6. Any member of the YES-TECH Committee who is involved as MITR will recuse themselves from the committee to avoid any conflict of interest.

7.1.3.7. The YES-TECH Committee will hear the appeal and pass a speaking order within 15 days of the date of receipt of appeal, after hearing all the stakeholders implementing YES-TECH, including MITR. For this, the YES-TECH Committee will call for a meeting of all the stakeholders within 7 working days of the date of receipt of appeal in which views of all the stakeholders will be recorded.

7.2. **Other Disputes related to implementation of YES-TECH**

Any dispute/grievance not listed in this manual shall be referred to the State Level Grievance Redressal Committee (SGRC) under PMFBY, who shall resolve the dispute within 15 days from the date of application. An appeal to the YES-TECH Committee may be filed against the order of the SGRC within 30 days from the date of passing of the order, whose decision shall be final and binding.

7.3. **General Provisions related to dispute resolution**

7.3.1. Any dispute or appeal by the State/UT or IC, raised under the Dispute resolution mechanism of YES-TECH must be related to the technical aspects, such as model parameters, methodology deviations or map accuracies etc., of YES-TECH implementation.

7.3.2. The regular Crop Cutting Experiment (CCE) datasets cannot be challenged at this forum by comparing them against the technology-based yield estimates or Vice-Versa.

7.3.3. The timelines mentioned for dispute resolutions are sacrosanct in nature and must be strictly adhered to, as they conform with the Seasonality Discipline of PMFBY and if not followed, the complete schedule for timely payout to farmers is disturbed and defeats the overall objective of PMFBY.

7.3.4. An application for the Review of MSR or ESR must be filed by the State/UT or IC only when sufficient ground exists for the same. The stakeholder filing for review must include the bases and facts to support their review application.

7.3.5. The decision of the YES-TECH committee will be final and binding on all the stakeholders implementing YES-TECH.

8. **Empanelment of Technical Implementation Partners (TIP)**

8.1. **Empanelment of TIP by YES-TECH Committee**

8.1.1. The Private Sector and Central/State/UT technical organizations who have already implemented Pilot Studies on technology-based Yield Estimation under PMFBY will be empanelled by default by the YES-TECH Committee as TIP.

8.1.2. The Private Sector and Central/State/UT technical organizations empanelled by YES-TECH Committee as TIP and selected by State/UT Government through bidding process/nomination shall implement YES-TECH.

8.1.3. Any other Private Sector Company or Central/State/UT organization may submit their proposal to the YES-TECH committee in the prescribed format, for empanelment as TIP.

8.1.4. The list of TIPs to support the YES-Tech activities in the States/UTs is provided in **Table 5** below:

Table 5: List of Empanelled TIPs to support the YES-Tech activities

S. No	Institute	Address	Contact Details
01	Space Application Centre (SAC)	Director, SAC, Ahmedabad	director@sac.isro.gov.in
02	National Remote Sensing Centre (NRSC)	Director, NRSC, ISRO, Hyderabad	director@nrsc.gov.in
03	NRSC	General Manager, NRSC Regional Centre, Bengaluru	sksrivastav@nrsc.gov.in hebbar_kr@nrsc.gov.in gmrcsouth@nrsc.gov.in
04	NRSC	General Manager, NRSC Regional Centre Kolkata	director@nrsc.gov.in sksrivastav@nrsc.gov.in gmrc_e@nrsc.gov.in
05	North East Space Application Centre (NESAC)	Director, NESAC, ISRO, Shillong	director@nesac.gov.in
06	CRIDA-ICAR	Director, Central Research Institute for Dryland Agriculture, ICAR, Hyderabad	director.crida@icar.gov.in
07	IARI-ICAR	Director ICAR-IARI Pusa, New Delhi	director@iari.res.in
08	TNAU	Vice Chancellor, Tamil Nadu State Agriculture University	directorwtc@tnau.ac.in
09	OUAT	Vice Chancellor, Odisha University of Agriculture & Technology, Bhubaneswar	registrarouat@gmail.com
10	PJTSAU	Vice Chancellor, Professor Jayashankar Telangana State Agricultural University (PJTSAU), Telangana	regrpjtsau@gmail.com
11	ANGRAU	Acharya NG Ranga Agricultural University, Hyderabad	vicechancellor@angrau.ac.in
12	HARSAC	Haryana Space Applications Centre, Hisar	ps.harsac.ggm@gmail.com contact@harsac.org
13	MRSAC	Maharashtra Remote Sensing Application Centre, Nagpur	director@ mrsac.maharashtra.gov.in
14	MPCST	Madhya Pradesh Council of Science and Technology, Bhopal	dg@mpcost.nic.in

S. No	Institute	Address	Contact Details
15	APSAC	Vice Chancellor, Andhra Pradesh Space Application Centre, Vijayvada	vc.apsac@ac.gov.in
16	ICRISAT	ICRISAT, Hyderabad	MuraliKrishna.Gumma@icrisat.org
17	AgroTech Risk	CEO, Agrotech Risk Private Limited Noida, Uttar Pradesh	akhilesh@agrotechindia.co.in
18	Niruthi	CEO, Niruthi Climate & Eco Systems Pvt Ltd Hyderabad, Telangana	mkukunuri@niruthi.com
19	CropIn	CEO, Cropin Technology Solutions Pvt. Ltd, Gurgaon, Haryana	kunal@cropin.com
20	WRMS	MD & CEO, WRMS Pvt. Ltd., Gurugram, Haryana	anuj.khumbat@wrmsglobal.com
21	AMNEX	MD & Founder, Amnex Infotechnologies Pvt. Ltd., Gandhinagar, Ahmedabad, Gujarat	aditya@amnex.com
22	RMSI	Senior Vice President, RMSI Private Limited, Noida, Uttar Pradesh	pushpendra.johari@rmsi.com

8.2. Criteria for Empanelment of TIP (Eligibility & Procedure)

8.2.1. Eligibility Criteria

8.2.1.1. This work is open to all technical Agencies, which include government, private, international, and autonomous organizations. However, International Agencies should have technical units in India with adequate capacity to work in field level.

8.2.1.2. The agencies must be having proper Manpower Resources i.e., Lead Experts, Remote Sensing Experts, GIS Experts, Statistics Experts, Agriculture Experts, Data Science & Modellers, and Software Developers on their pay rolls, minimum of 10-15 experts, for which documentary proof needs to be submitted. They must have adequate ground staff/ resources to capture the ground level observations Ground truth, Crop Photographs, and Crop Cutting Experiments, crop loss surveys etc., within the stipulated time periods. Any false information may lead to immediate de-empanelment forfeiting of the remaining dues if any.

8.2.1.3. The Agency should have experience in implementing the technology-based yield estimation for at least 2-3 crops in considerably large areas, across the country.

8.2.1.4. Agency should have experience in yield estimation at sub district level or below using Remote Sensing and other datasets with proven accuracy and results.

8.2.1.5. Agency should have adequate experience in using modern tools like Artificial Intelligence, Machine Learning, Deep learning, Crop simulation Modelling, Decision Support Systems, moderate to high-resolution data from satellites & UAVs, etc.

8.2.1.6. The Agency must not have been blacklisted/debarred by any Government or its bodies, nor should they have been debarred from dealing with any public entity.

8.2.1.7. The Agency must be registered with all Government/statutory authorities such as the Sales Tax Department, Income Tax Department, etc. as required in the normal course of business for providing similar services.

8.2.1.8. Agency should have the experience to carry out the crop mapping, crop health monitoring, crop yield estimation and crop risk assessment using geospatial data for the crops notified in the scheme by the states like Paddy, Wheat, Cotton, Soybean and Mustard etc. in at least 20 districts cumulatively, distributed across different agro-climatic zones in the previous five years.

8.2.1.9. Preference shall be given to agencies which are well-versed in implementing innovative technologies in agricultural applications i.e., Remote Sensing, AI/ML, IoT, and Crop Simulation tools and their approach has been tested/used by the State/insurance companies/central government agencies/PSUs etc.

8.2.1.10. They must have in-house remote sensing and data processing capability (well-equipped lab).

8.2.1.11. The agency must have the in-house capability of Crop Yield Estimation using Technology as specified in this manual.

8.2.1.12. The agency should have a minimum annual turnover of 5 Crores in the last three years specifically related to similar activities.

8.2.2. **Technical Criteria for Empanelment of TIPs**

8.2.2.1. The empanelment of the new/additional TIPs will be done through the short-term Expression of Interest. The minimum qualifying mark will be 60 out of a maximum of 100 (hundred marks) as a benchmark for the quality of the technical proposal. The various criteria based on which the technical proposal will be evaluated are given in **Table 6**.

Table 6: Marking Criteria for Technical Evaluation

S.No.	Parameters	Explanation/Details
1	**Experience of the Company in similar work (Max. 30 marks)** *(Documentary proofs to be submitted)*	Experience can be in the form of a) crop yield estimation using at least one of the models suggested under YES-Tech, (**10 marks**) b) crop loss assessment, using satellite/ UAV data, (**10 marks**) and c) use of Advanced Data Analytics (AI/ML) (**10 marks**) covering at least 10 districts. Marks shall be distributed based on the stratified information given by the agencies on aforesaid desirable technical parameters.
2	**The capabilities to handle innovative technologies (Max. 20 Marks)** *(Detailed methodology should be given showing the specific technology to be used)* Scientific documentary proof needs to be submitted.	• Use of moderate to resolution (10m to 30 meter or better) optical satellite data: **2 Marks** • Use of SAR data: **2 Marks** • Smart Sampling for CCEs, using satellite and other data: **2 Marks** • Use of Statistical Models: **2 Marks** • Crop mapping with satellite data: **2 Marks** • Use of CHF models: **2 Mark** • Use of Crop Simulation Models (with RS inputs): **2 Mark** • Use of Semi Physical Models: **2 Mark** • Use of Semi AI& ML: **2 Mark** • Use of Ensembled Models: **2 Mark**

S.No.	Parameters	Explanation/Details
3	**Technical facility available with the Agency to handle the analysis for at least 100 districts in a season (Max. 15 Marks)** *(Complete details with specifications and documentary proof may be provided)*	• Computer Lab facilities (in-house): capable of handling moderate to high resolution satellite images **maximum 3 marks**. • Software (02) for IP&GIS for satellite & UAV data processing: **maximum 2 marks** • Storage Facilities (NAS/SAN/Cloud): maximum **2 Marks** • Portal/Dashboard development capabilities: **2 Marks** • AI/ML Software Tools: **2 Marks** • Crop Modelling Tools: **2 Marks** • Mobile App for Field Data Collection, with pictures & geo coordinates: **2 Marks**
4	**Qualification of Technical personnel available with the Agency (Max.15 marks)** *(Details to be given with name, designation, qualification and mobile number)*	3 marks each for theme experts in RS&GIS/ Agriculture/Data Analytics/IT/ Statistics/ Mathematics (having experience in relevant field for more than 3 years) • Geospatial technology in Agriculture: **Max. Marks 03** • Data Science Expert: **Max Marks 03** • IT Expert: **Max Marks 03** • Agriculture Expert: **Max 03 marks** • GIS Developer: **Max 03 Marks**
5	**Technical presentation (Max.15 Marks)**	Review of agencies technical and scientific achievements
6	**Scientific achievements (Max marks 05)**	• Patents: Max 2 marks • Peer reviewed Scientific papers/ technical reports submitted to Government: 1 mark each (max. 03 marks)
	Total = 100	

8.2.3. The Agencies who are qualifying as per the technical evaluation criteria will be considered technically competent and would be considered for the empanelment.

8.2.4. **Documents to be Submitted by the Agencies**

The agencies shall submit the following documents along with their proposal for empanelment as TIP:

a) An Undertaking on the agency's letterhead along with requisite documentary proofs. The format of the undertaking is provided in <u>Annexure IX</u>.

b) Any other document required as per the GOI EOI/tender notification.

9. **General Conditions for Selection of TIP by the State**

9.1. The State/UT shall select the TIP in case of implementation of YES-TECH either through nomination from empanelled Central/State/UT Government's technical institutes, as per the prevailing financial rules, or by inviting financial bids from the empanelled agencies only through Least Cost System (LCS).

9.2. There shall be compulsory tender of three years, preferably co-terminus with PMFBY tender cycle, to ensure assured business to the TIPs for a longer duration leading to increased commitment towards infrastructure and manpower deployment. This will also facilitate the TIP to build its capacity and credibility among the stakeholders and will enable a supportive and collaborative interaction and service effectiveness.

9.3. Only one TIP will be selected by the State/UT for implementing YES-TECH in their State/UT, subject to one TIP taking up a maximum of two states excluding Himalayan and North Eastern Region (NER) states.

9.4. Before the commencement of the crop season and preferably well before the publication of PMFBY tender, the State/UT shall invite the empanelled TIPs as mentioned in the preceding para, through tender for submission of season-wise, cluster-wise, crop-wise financial bid.

9.5. Detailed Model Tender Document for YES-TECH financial bidding process is provided in Section 2 of this document.

9.6. The model tender document shall consist of a basic scope of work, payment terms, milestone delivery timelines, infrastructure and resource requirements etc. and other terms which may be incorporated by the implementing State/UT as per the prevailing financial rules.

9.7. In order to have transparency, all the details mentioned in the YES-TECH Model Tender Document shall be made a part of the tendering process. No modification in the terms and conditions enumerated in the tender document shall be allowed post tendering.

9.8. Bidding shall be done through the mode as prescribed in the Financial Rules prevailing in the State/UT and work order may be released within 2 weeks of the opening of the Tender.

9.9. All conditions proposed to be stipulated by State Government should be incorporated in the bid document itself and no new condition materially amending the terms should be included in the Tripartite Agreement (TA). In case empanelled TIPs have any objection to any Tender condition which is in conflict with the guidelines in YES-TECH Manual, they can make a reference to the State Government within 3 days of issuance of Tender.

9.10. State shall follow its due process including financial rules, general rules etc., while floating the tender.

9.11. The State/UT will validate the necessary documents before opening the financial bid.

9.12. Based on the season-wise, cluster-wise and crop-wise rates quoted by the participating empanelled TIPs, the total price of implementing YES-TECH in the State/UT for the tender cycle and the average season-wise, district-wise price will be calculated for L1 bidder.

9.13. Once the process is over, State/UT will issue a notification of award/ work order to the L1 Bidder followed by a Tripartite Agreement (TA) and the same shall be informed to YES-TECH Secretariat.

9.14. Model Tripartite Agreement (TA) for YES-TECH financial bidding process is provided in Section 3 of this document.

10. **Payment to TIP – Terms and Conditions**

10.1. Payment to the TIPs shall be calculated and disbursed season-wise, cluster-wise for each implementing season. The Payment schedule for one season is also designed in such a way so as to conform with the seasonality discipline in the relevant clauses of operational guidelines of PMFBY.

10.2. The payment to TIPs shall be made as per the SOP to be notified by DA&FW, GoI.

10.3. **1st Instalment - Advance – 20%**

10.3.1. Advance/Mobilization charges, 20% of total project cost of corresponding season (Kharif and Rabi separately), shall be paid within 15 working days after the award of the work order/ start of the season (Start of the season will be construed as the opening of Farmer

Enrolment on the NCIP for that particular season) subject to the relevant provisions of the financial rules of the State/UT.

10.3.2. TIPs will be liable to start the work only after the receipt of the 1st instalment or advance payment. Even if there are pending payments for the previous seasons, the same TIP will start the work for the current season only after receiving the 1st Instalment (20 % Advance) for the current season.

10.4.   2nd Instalment – 10%

10.4.1. 10% of total project cost of corresponding season (Kharif and Rabi separately) shall be released within 15 working days after the submission of cluster wise/crop-wise IR by the TIP.

10.5.   3rd Instalment – 20%

10.5.1. 20% of total project cost of corresponding season (Kharif and Rabi separately) shall be released within 15 working days after the submission of cluster wise/crop-wise MSR by the TIP.

10.6.   4th Instalment – 30%

10.6.1. 30% of total project cost of corresponding season (Kharif and Rabi separately) shall be released within 15 working days after the submission of the cluster wise/crop-wise ESR by the TIP.

10.7.   5th Instalment - 20%

10.7.1. If there is no review/ appeal petition filed against the ESR within the designated timelines and there are no further Modifications/changes suggested by MITR in the final report, i.e., the report is deemed to be accepted, full remaining 20% of total project cost of corresponding season (Kharif and Rabi separately) shall be disbursed to the implementing TIP within 15 days of the last date for filing of review or appeal petition.

10.7.2. If there is a review/appeal petition filed against the ESR within the designated timelines, or there are modifications/changes suggested by MITR in the final report, then the remaining 20% of total project cost of corresponding season (Kharif and Rabi separately) shall be withheld till such petition attains finality and shall be disbursed accordingly.

10.7.3. Detailed payment schedule and payment illustrations have been provided in the model tender document.

11.   Performance Evaluation of Technical Implementation Partner (TIP)

11.1. The performance of the empanelled TIPs will be closely monitored by the concerned department of the State/UT Government, at the end of completion of each One Year interval comprising at least two crop seasons i.e., Kharif & Rabi, through ascertaining the TIP's skills, commitment and efficiencies for providing cost effective and efficient technological services.

11.2. For this purpose, a detailed Monitoring and Evaluation (M&E) framework for the ranking of MITRs & TIPs, containing key performance indicators with assigned weightage, will be devised and shared separately by YES-TECH Committee.

11.3. The State/UT government at the end of two complete seasons of a year shall initiate performance evaluation of the TIP working in their state on the specific parameters as prescribed in the TIP Performance Evaluation Matrix and complete the activity as per timelines defined in the Seasonality Discipline of PMFBY, i.e., within 1 month each year.

11.4. Each TIP should be given enough opportunity to present their views and substantiate their observations on such evaluation with valid data/proofs. State/UT Government shall

evaluate such additional data/proofs submitted by TIPs and accordingly review their evaluation report and submit to YES-TECH Committee as per the timelines given in M&E framework.

11.5.   Penalty Provisions

11.5.1.   Selected TIPs shall have to follow the seasonality discipline of PMFBY and provision of YES-TECH Guidelines and instructions issued by the Government from time to time to ensure that the benefit of the Scheme is reached within stipulated timelines. Non adherence of the guidelines and cut-off dates shall attract penalty.

11.5.2.   Penalty will be imposed on the TIPs based upon the Service Level Agreement (SLA) indicators of Timeliness and Quality while evaluating the performance of the TIP at all stages of YES-TECH implementation.

11.5.3.   A maximum penalty under the SLA will be 10% of the total work order value for Timeliness and 10% of the total work order value for quality, separately. However, the aggregate penalty shall not be more than 10% of the total work order value.

11.5.4.   The penalty will be calculated season-wise cluster wise and for subsequent phases of the YES-TECH implementation and if imposed, the same will be deducted from the final payment to the TIP.

11.6.   Service Level Agreements (SLA) - Timeliness and Quality

11.6.1.   Quality:

Mid-Season Report (MSR): If a review petition is filed by the State or IC on the MSR, and it is sustained by the MITR, a penalty of 3% of the cluster wise cost of YES-TECH implementation, will be imposed on the TIP.

End of Season Report (ESR): If a review petition is filed by the State or IC on the ESR, and it is sustained by the MITR, a penalty of 3% of the cluster wise cost of YES-TECH implementation, will be imposed on the TIP. Further, if an appeal petition is filed by the State or the ICs on the ESR and is sustained by the YES-TECH Committee, an additional penalty of 4% of the cluster wise cost of YES-TECH implementation, will be imposed on the TIP.

11.6.2.   Timeliness

Mid-Season Report (MSR): If the report is delayed by more than 7 days from the report submission deadline, then from the 8th day, a penalty of 0.5% will be triggered for each day or part thereof, up to a maximum of 3% of the cluster wise cost of YES-TECH implementation.

End of Season Report (ESR): If the final report is delayed by more than 7 days from the report submission deadline, then from the 8th day a penalty of 1% will be triggered for each day or part thereof, up to a maximum of 7% of the cluster wise cost of YES-TECH implementation.

11.7.   Damages

Notwithstanding anything contained in this manual, the YES-TECH Committee and/or the State/UT reserves the right to recover damages, without prejudice and in addition to the right mentioned under this Manual or remedies available under law, incurred as a result of claims arising due to misuse of any information or data acquired during implementation of YES-TECH and/or the Tripartite Agreement or breach of any confidential information, wilful gross negligence, breach of indemnity clause, wilful misconduct etc. Such right to recover damages shall be without limitation of any liability.

11.8. Penalty or damages levied on the TIP, if any, will be recovered from the final instalment of the payment.

12. **Termination, De-empanelment and Blacklisting**

12.1. **Termination of Tripartite Agreement (TA)**

12.1.1. Either party shall be entitled to terminate the Tripartite Agreement (TA) under specific situations and conditions as mentioned below, with an advance notice of ninety (90) days prior to commencement of the crop season that follows. However, the TA cannot be terminated within the ongoing season. The special conditions that invite termination of TA are as follows:

1. In case, the TIP is debarred/black-listed/de-empanelled by the YES-TECH committee.

2. Failure of the State/UT and/or the MITR and/or the TIP in performing their core responsibilities as prescribed in the YES-Tech Manual.

3. Any material changes in the YES-TECH parameters as listed in the empanelment criteria of TIPs and their roles and responsibilities, by the Centre/State/UT.

12.1.2. However, termination of TA by either party due to any reason not listed above shall be taken up by the concerned State/UT govt. with the approval of competent authority, as per their financial rules.

12.2. **De-empanelment of TIP**

12.2.1. The YES-TECH committee may review the TIP for de-empanelment suo-moto or on the recommendation of the concerned State/UT or MITR if:

12.2.2. Penalty is triggered for a TIP for 3 Seasons cumulatively in a tender cycle.

12.2.3. The agreement is terminated as per the Termination of Tripartite Agreement (TA) clause.

12.2.4. before passing any order under this provision, the YES-TECH committee shall give an opportunity of being heard to the concerned TIP.

12.3. **Blacklisting**

12.3.1. The YES-TECH Committee may blacklist, if required, the de-empanelled TIP for a period of up to three years, after giving the TIP an opportunity of being heard.

13. **General Implementation Clause**

13.1.1. Henceforth, any changes in this manual, shall be notified by GoI as addendums/ amendment/appendices to this document and shall be binding on all stakeholders implementing YES-TECH, without any prejudice.

13.1.2. The power to modify, amend, withdraw, interpret any of the clauses in this manual shall solely vest in GoI. During the course of implementation, GoI may issue directives/ advisories/notifications related to effective implementation of WINDS framework. GoI at any time, may issue amendments/clarifications to any provisions in this manual or withdraw the manual, suo moto or on the reference of the YES-TECH committee.

YES-TECH Readiness conditions for States

Compulsory Component

i. Insurance Unit Shape file

- Shape file for all major and minor insurance unit

ii. Insurance Unit crop acreage

- Insurance Unit wise crop acreage required to check the variability/crop distributions with in the IUs

iii. Weather data

- In-situ observations of weather parameters like Rainfall, Temperature, Humidity, wind speed etc. at least at block level.

iv. Crop data

- Previous years, good quality Crop Cutting Experiments (at least 200) having the information's of Latitude/Longitude, grain yield, biomass Yield, crop variety etc.

- Previous years, ground truth data (at least 200) of various crops in the well spread across the district.

v. Targeted crop (YES-TECH)

- Whether Targeted crop is notified

vi. MITR Onboarding

vii. Crop Calendar

- Sowing and harvesting windows of targeted crops

Desirable Component

- At least 2 officers in the concerned department having good knowledge on the implementation of technology under PMFBY.

- Whether state has conducted any Project in past years related to satellite imaging?

- Whether CCE Agri App are being used?

- Whether Online systems for Crop survey is available?

- Whether Cadastral map is available?

Report Format – Inception Report (IR)

Executive Summary with details of Implementing TIP

    i.   Contents with Page Numbers

    ii.   List of Tables

    iii.   List of Figures

    iv.   List of Annexes

1. Introduction

2. Review of literature with references

- Other Such studies being undertaken in different parts of the world

- Should include details of any such studies undertaken by the implementing TIPs in the past and corresponding reports and publications, if any.

3. Study Area (Description with Maps and Ancillary Data)

4. Datasets to be used for the study and their specifications & sources (With details)

    - Ground Data (Crop Survey, CCE, Soil, Weather Data, any other data) – Summary Tables should be provided for each

    - Satellite Data (Descriptions with number of scenes and dates of Data)

    - Weather Datasets and their Source

    - Details of Any Other Data

5. Detailed Methodology for Implementing the selected approach with flowcharts.

6. Detailed Workplan for implementing each step of the selected approach with timelines conforming with those given in the manual.

7. Crop Mapping Report – May Include the fortnightly progression of Crop Sown area in the study area.

8. Expected Deliverables

9. Comments and Recommendations of MITR.

Report format – Mid-Season Report (MSR)

In addition to the content in the Inception Report (Annexure II), the TIPs should include additional information in the Mid-Season Report regarding:

1. Datasets: Any Additional Data Set Used

2. Methodology:

   • Protocols for Field Data Collection, Satellite Data Processing for generation of crop maps and Acreage Estimation

   • Yield Modelling Protocols – Preparatory work

3. Crop Maps: The Mid-Season Report Should also include district-wise Crop Mapping report with accuracy assessment.

4. Comments and Recommendations of MITR on MSR

Report format – End of Season Report (ESR)

i.   Executive Summary

ii.   Contents with Page Numbers

iii.   List of Tables

iv.   List of Figures

v.   List of Annexes

vi.   List of Contributors

1.   Introduction (This should have review of literature, with references)

2.   Study Area (Description with maps)

3.   Data Used

- Ground Data (Crop Survey, CCE, Soil, Weather Data, any other data) – Summary Tables should be provided for each
- Satellite Data (Descriptions with number of scenes and dates)
- Details of Any Other Data

4.   Methodology

- Field Data Collection
- Satellite Data Processing for crop map and areas
- Smart Sampling and CCE data collection
- Yield Modelling
- Accuracy Evaluation (RMSE, NRMSE, t-test, MAPE, correlation coefficient, Index of Agreement, etc.)

5.   Results and Discussion

- Description of field data (summary tables with statistical analysis and any interpretation)
- Crop Area Estimations (Statistics, Maps and accuracy)
- Suitability of Smart Sampling (Stratification Efficiency)
- CCE data description
- Yield Estimation and its evaluation

6.   Summary and Conclusions (including way forward)

7.   Comments and Recommendations of MITRs, State or the ICs

8.   References

9.   Corresponding Annexures

Report format – Special Report – Prevented Sowing (SR-PS)

In addition to the Content in the Inception Report (Annexure II), the TIPs should include additional information in the SR-PS regarding:

1. Data Used: Any Additional Data Set, Reports

2. Methodology
   - Field Data Collection
   - Satellite Data Processing for crop map and areas
   - Accuracy Evaluation (RMSE, NRMSE, t-test, MAPE, correlation coefficient, Index of Agreement, etc.)

3. Results and Discussion
   - Description of field data (summary tables with statistical analysis and any interpretation)
   - Crop Area Estimations (Statistics, Maps and accuracy)

4. Summary and Conclusions

5. Comments and Recommendations of MITRs, State or the ICs

6. Annexes (Tables of all data details, which are being transferred to < issuing Organization /authority name>.

Report format – Special Report – Mid Season Adversity (SR-MSA)

In addition to the Content in the Inception Report (Annexure II), the TIPs should include additional information in the SR-PS regarding:

1. Datasets: Any Additional Data Set Used

2. Methodology:
   - Protocols for Field Data Collection, Satellite Data Processing for generation of crop maps and Acreage Estimation
   - Yield Modelling Protocols – Preparatory work

3. Crop Maps: The Mid-Season Report Should also include district-wise Crop Mapping report with accuracy assessment.

4. Expected Results – Yield Projections

5. Comments and Recommendations of MITR on SR-MSA

Template of Document Control Sheet for YES-TECH implementation reports (IR/ESR/MSR/SR)

1	Security Classification	Restricted.		
2	Distribution	DA&FW, Ministry of Agriculture /State Departments/Insurance Company/ MITR organisation		
3	Report / Document version	(a) Issue no.: 01		(b) Revision & Date: :........................
4	Report / Document Type	Inception Report (IR)/Mid-Season Report (MSR)/ End of Season Report (ESR)/ Special Reports (SR)		
5	Document Control Number	YES-TECH/PMFBY/DAFW GoI/State/Crop/Season/Report Type (IR, MSR, ESR, SR_V1.0		
6	Title	YESTECH implementation document (IR/ESR/MSR/SR) in ....State		
7	Particulars of collation	Pages:.... main text	Figures:	Tables:
		Annexures:	**Appendics:**	
8	Author(s)	Name of TIP: .... Address: .... Name of MITR:... Address:...		
9	Affiliation	State Department of Agriculture....................		
10	Scrutiny mechanism	Compiled/ Controlled by TIP	Reviewed by MITR (NAME)	Approved by MITR (NAME)
11	Originating unit	State Department of Agriculture.....................................		
12	Date of Initiation	DATE/MONTH/YEAR		
13	Date of Publication	DATE/MONTH/YEAR		
14	Abstract (with Keywords)	Abstract: .... Keywords: YES-TECH, Crop insurance, Yield estimation, Innovative Technology		

Guidelines for conducting CCE for model development/calibration

a) In the event of requirement, at least 10 CCEs per IUs covering 5-10% of IUs are to be conducted in each season for a crop in each district.

b) The CCE sites should be located using smart sampling. A reliable yield proxy (preferably more than one parameter or a composite indicator), having good correlation with crop yield should be used for CCE planning.

c) The CCE's shall be conducted as per the CCE User manual a notified under relevant clauses of Operational Guidelines of PMFBY or as defined by the Revenue Department of the concerned state.

- The CCE data shall be collected using the CCE Agri app in the presence of the concerned stakeholders and farmers.

- The CCE plot within the field should be representative of the whole field, not affected by site specific external factors.

- The selected field should be sole-cropped (no mixed cropping) with the concerned crop.

- The CCE should be conducted in the field, which is ready for harvest.

- The smartphone should have Navigation App, for showing GPS reading and North Direction.

- The accuracy of Biomass weighing should be 2 decimal levels in kg and grain yield in 3 decimal levels.

- The Biomass and Grain yield should be weighed using high precision digital balance. Different digital balances should be used for weighing different items (Biomass, Grain Weight, 1000 Seed Weight)

- The moisture percentage of Biomass should be obtained, at least in 5% cases, through drying method.

- The Grain moisture percentage should be obtained using portable grain moisture meter.

- A few CCE sites may be randomly selected for supervision b MITR and the Agency will facilitate (local logistics) for this supervision.

- Agency should ensure compliance with prescribed procedure (for each crop) in each district.

Undertaking Letter for empanelment of an agency as Technical Implementation partner (TIP)

[On the letter head of the Agency]

UNDERTAKING LETTER

Date: <DD/MM/YYYY>

To,
The Director,
Mahalanobis National Crop Forecast Centre,
Sahyadri Ave, Near Krishi Vistar Sadan,
Pusa, Pusa, New Delhi - 110012

Dear Sir,

Sub: Undertaking for Empanelment as Technical Implementation Partner (TIP) under YES-TECH

Having examined the Expression of Interest (EOI) documents including all annexure the receipt of which is hereby duly acknowledged, we, the undersigned, offer to provide the services as mentioned in EOI document in conformity with the said EOI document and the YES-TECH Manual 2023, as amended from time to time, and in accordance with the financial bid.

A. We understand that the EOI document provides generic specifications about all the items, and it has not been prepared by keeping in view any specific agency. We have ensured ourselves about the eligibility criteria before submitting the tender.

B. We have read, understood and accepted the terms/ conditions/ rules mentioned in the EOI document and the YES-TECH Manual 2023.

C. We undertake that in competing for and if the award is made to us, in executing the subject EOI, we will strictly observe the laws against fraud and corruption in force in India namely "Prevention of Corruption Act 1988".

D. We are not blacklisted currently by any Government or its bodies, nor debarred currently from dealing with any company or public entity.

E. We undertake to carry out the Study and the work, if selected, as per YES-TECH Manual 2023, as amended from time to time.

F. We hereby certify that we have submitted the following documents in the requested format along with this undertaking:

1. Annexure A: Certificates of past experience in similar work.

2. Annexure B: Detailed methodology for use of specific technology.

3. Annexure C: Proof of technical facility available for handling at least 100 districts in a season.

4. Annexure D: Details of qualifications of technical personnel available.

5. Annexure E: Proof of scientific achievements.

6. Annexure F: Certificate of Incorporation/ Registration of Agency/ Memorandum and Articles of Association/Partnership Deed/ Proprietorship Deed/ Declaration of Proprietorship etc. as the case may be.

7. Annexure G: Copy of Income Tax Return for the last three Financial Years.

8. Annexure H: Solvency Certificate

9. Annexure I: Audited accounts (Balance Sheet and Profit and Loss Account etc.) for the last three years.

10. Annexure J: Copies of work contracts (of similar services) of minimum 5 Crores per annum, from Government/Autonomous bodies/PSU, Private entities for the last 3 years, including satisfactory performance certificate, if any.

11. Annexure K: Acceptance Letter on Company's letterhead which should be filled, signed, and stamped/certified properly.

12. Annexure L: Copy of PAN/TAN card.

13. Annexure N: Letter of Authority/Power of Attorney/Board Resolution/any other document indicating unequivocable authority to sign and submit the EOI.

G. We certify that we have provided all the information requested by the YES-TECH Committee in the format requested for. We also understand that the YES-TECH Committee has the exclusive right to reject this proposal in case the YES-TECH Committee is of the opinion that the required information is not provided or is provided in a different format. It is also confirmed that the information submitted is true to our knowledge and the YES-TECH Committee reserves the right to reject the offer if anything is found incorrect.

Place:

Date: <DD/MM/YYYY>   **Seal and signature of the Agency**

Crop Model Matrix -1 (CMM – 1)

A. List of States where YES-TECH will be implemented in Phase 1

Implementation of yield models under CMM-1 covering paddy and wheat crops is done in a phased manner considering the readiness of states based on technical infrastructure availability, access to expertise, data related limited limitations, level of acceptance to technology interventions etc. Therefore, it is proposed to cover the following states under CMM-1, from the ensuing kharif season (2023).

1. Andhra Pradesh – Paddy
2. Assam – Paddy
3. Haryana – Paddy and wheat
4. Karnataka - Paddy
5. Madhya Pradesh – Paddy and wheat
6. Maharashtra – Paddy and Wheat
7. Odisha – Paddy
8. Rajasthan – Wheat
9. Tamil Nadu - Paddy

B.   General SOP

The framework of model implementation is presented in Fig 2. Satellite-based crop mapping, satellite and weather data analysis for generating crop health indicators, field data collection and analysis, yield modelling, and insurance loss assessment are important tasks in this framework.

Figure 2: General framework of data analysis

Satellite derived crop mapping

Satellite based health indices, mapping risk affected crop lands

- Intensive monitoring of crops from sowing to harvesting,
- Multiple indicators of crop condition

Weather/Soil/Crop Management data and indices

Smart phone based field data collection and analysis

✓ Selection of input indicators
✓ Execution of model (internal calibration/validation)
✓ Yield estimation
✓ Claim settlement

1. Semi Physical Approach

The methodology is based on the concept that the biomass produced by a crop is a function of the amount of photo synthetically active radiation (PAR) absorbed, which in turn depends on incoming radiation and the crop's PAR interception capacity. Biomass is a function of the total photo synthetically active radiation (PAR) and the ability of the plant to absorb (fAPAR) this radiation and to convert this radiation to dry matter (RUE) and yield is a function of net dry matter and the harvest index (HI) of the crop. Water Scalar derived from satellite images will be used as a limiting factor of crop yield. Major factors of crop growth (i.e.) the radiation and the ability of the crop to convert the absorbed radiation into dry matter) are derived and used for estimating the yield. Model framework (flow chart) is furnished in Fig.3 below:

Figure 3: Semi-physical model framework
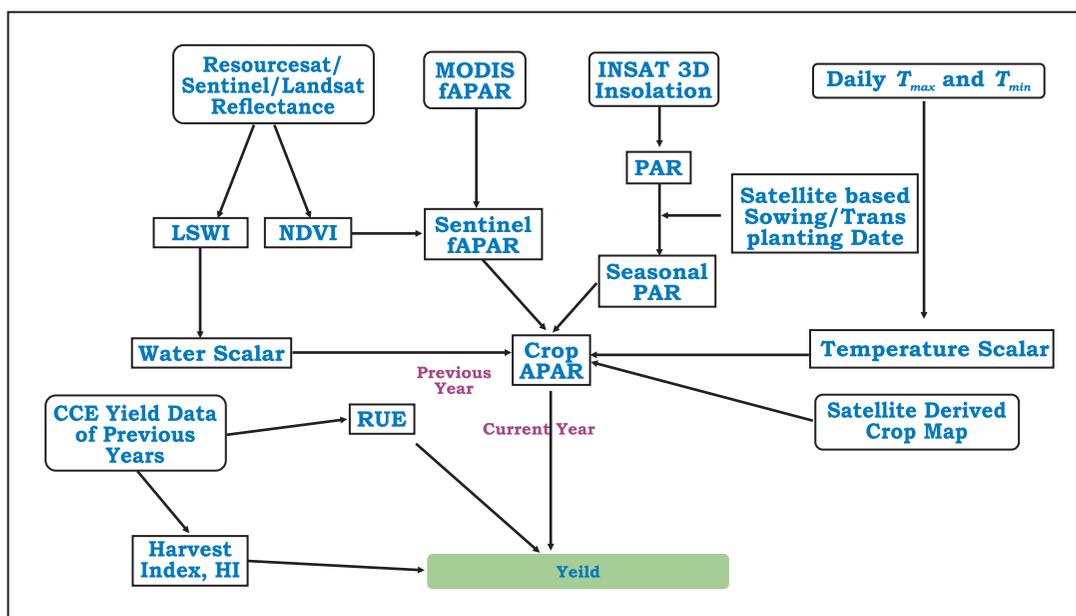
PAR-Photosynthetically Active Radiation, APAR-Absorbed PAR by the Crop, fAPAR-fraction of APAR, LSWI-Land Surface Water Index, NDVI-Normalized Difference Vegetation Index, RUE-Radiation Use Efficincy, CCE-Crop Cutting Experiments

1.1 Methodology

The generation of an accurate crop map for the current and historical years is the first important step in all the five approaches. Crop layers can be generated using SAR and Optical medium resolution (5-30 m) satellite data. The standard widely adopted methodology must be followed for crop mapping.

The classification procedure has to be performed for each district separately, and the outputs are to be verified extensively by superimposing on cloud-free optical data of appropriate months when the crop was at maximum vegetative phase. Field data points are used to check the classification performance. It is to be ensured that commission errors are <10% and omission errors can be accommodated up to 20%. By adopting this strategy on mapping error, **the IU average crop health indicators** represent the crop pixels more closely.

1.2 Input data

Basic Input Data for Model development are Fraction of absorbed photo synthetically active radiation (fAPAR), Photo synthetically active radiation (PAR), Radiation use efficiency (RUE), Water scalar, and Harvest Index (HI) data will be used for yield estimation. Details of data product, satellite, Source, and Granularity is given in **Table 7** below:

Table 7: Dataset requirement for Semi physical approach

Data /Product	Satellite/ Ground	Sensor	Resolution	Source
Daily integrated Insolation (PAR)	INSAT 3D	Imager	4 km	MOSDAC
8-days composite FAPAR	Terra Sentinel 3	MODIS OLCI	0.5 km 0.3 km	NASA-EARTHDATA ESA
8-days composite surface reflectance	Terra Sentinel 2	MODIS MSI	0.5 km 10-20m	NASA-EARTHDATA To be developed by TIP
NDVI & LSWI during entire crop season	Sentinel 2 Landsat 8	MSI OLI	10-20 m 30 m	ESA NASA-EARTHDATA
Crop mask (5-30 meter) resolutions	Sentinel 1 Sentinel 2 Landsat 8	SAR MSI OLI	20 m 10 m 30 m	To be developed by TIP
Crop Sowing Date	Sentinel 1 Sentinel 2 Landsat 8	SAR MSI OLI	20 m 10 m 30 m	To be developed by TIP
Harvest Index	Ground Data CCE	---	District Level	CCEs conducted by TIP
Daily Tmin and Tmax	Gridded Data	---	0.5° x 0.5° 5 km Grid	IMD Pune Website WRF short-range forecast of SAC

1.3 Derivatives/metric generation

Crop biomass and crop yield estimation

Crop Biomass estimation

- Biomass is a function of the total photo synthetically active radiation (PAR) and the ability of the plant to absorb (fAPAR) this radiation and convert this radiation to dry matter (RUE). Radiation Use Efficiency was the capacity of the plant to convert radiation into dry matter. The biomass had been calculated from the following equation.

$$Biomass = RUEmax \sum_{Sowing}^{Harvest} (PARxFAPARxWSxTS)$$

Crop Yield estimation

- Yield is a function of net dry matter and the harvest index (HI) of the crop. Harvest index is the ratio of crop grain yield and crop biomass. The crop yield had been calculated from the following equation.

- Yield =Biomass * Harvest Index (HI)

- HI= Economic Yield/Biological yield

Photosynthetically Active Radiation (PAR)

- Photo-synthetically active radiation (PAR) is the part of electromagnetic radiation that can be used as the source of energy for photosynthesis by green plants.

- PAR is calculated at daily basis using Insolation data and can be calculated.

PAR= Daily Surface Insulation* 0.48

Fraction of Absorbed Photosynthetically Active Radiation (fAPAR)

- The fAPAR quantifies the fraction of the solar radiation absorbed by live leaves for the photosynthesis activity and it refers only to the green and alive elements of the canopy.

- The fAPAR characterizes the energy absorption capacity of vegetation canopy. It is a basic physiological variable describing the vegetation structure and related material and energy exchange processes.

- It is an important parameter for estimating the plant biomass

Water Scalar using LSWI

- LSWI index has been used as canopy water stress in the model to incorporate the effect of moisture stress in the plant.

- LSWI index computed from the near range Infrared band and short-wave infrared (SWIR) region around 2120 nm of electromagnetic spectrum. This index is sensitive for the total amount of vegetation liquid and also for soil background.

LSWI=NIR-SWIR/NIR+SWIR

NIR=Reflectance in Near Infrared,

SWIR= Reflectance in shortwave Near Infrared

Water Scalar:

- Estimated LSWI is used further in deriving the water stress scalar.

    W Scalar= 1+LSWI/1+LSWImax

Temperature Stress:

- T stress is estimated at each time step, using the equation given below.

$$T_{stress} = \frac{(T - T_{min})(T - T_{max})}{[(T - T_{min})(T - T_{max}) - (T - T_{opt})^2]}$$

Radiation Use Efficiency (RUE)

- Plant biomass production can be modelled as a linear function of intercepted photosynthetically active radiation (PAR).

- The slope of this relationship is the RUE, which is approximately constant for forests and natural ecosystems, and particularly for crops when growth is not limited by environmental conditions.

- Radiation-use efficiency (RUE) is defined as the ratio of dry matter produced per unit of radiant energy used in its production. Because efficiency should be dimensionless, the term of "dry matter: radiation quotient" was suggested, however, RUE is used widely and considered a useful tool for simulating crop growth.

2. Machine Learning / Deep Learning approach (AI/ML models)

Machine learning models are non-parametric and captures the non-linear relationships between the yield and the features influencing the yield. Machine learning can determine pattern and correlations and develop the predictive model. The predictive model is built using several features, and as such, parameters of the models are determined using historical data during the training phase. In recent years, machine learning models have been used in various researches to improve the accuracy of crop yield by incorporating satellite derived vegetation indices, meteorological data, hydrological variables, edaphic factors etc.

Figure4 : Schematic flowchart representing Machine learning models
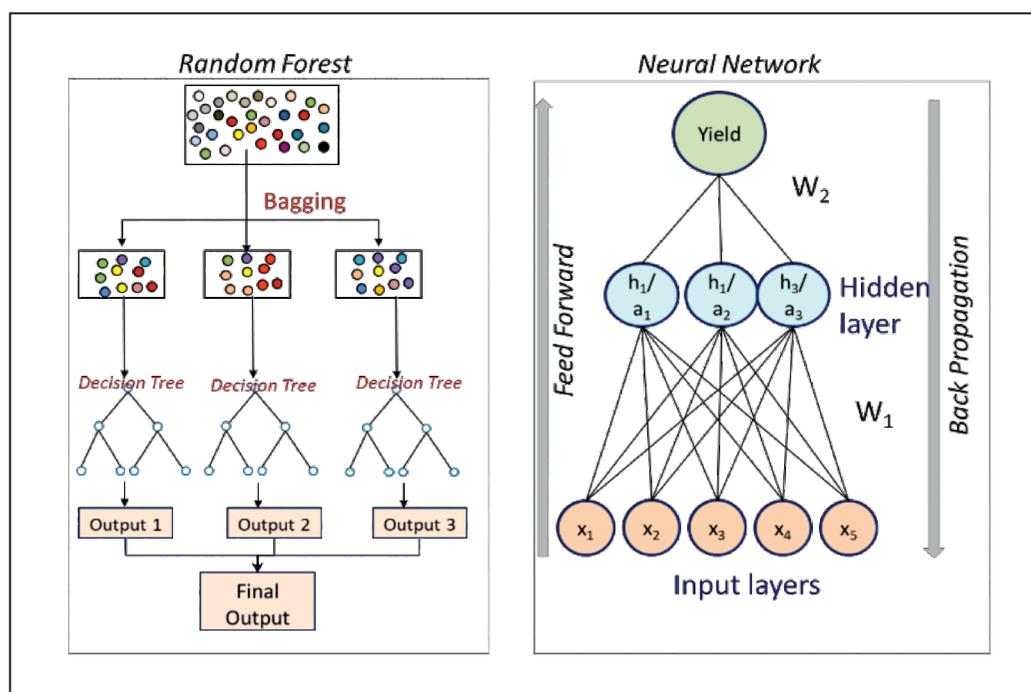
Any deep learning model requires a large volume and variety of datasets during the training process. Therefore, to achieve a stable and robust DNN model for yield prediction, a large volume of crop yield data at all yield ranges (low, medium, high) is required. The data availability at lower and higher yield ranges is to be ensured to minimise inaccuracies in model predictions. Critical issues in the operational use of AI models are feature selection, optimization of model parameters, consistency of results, the scale of model development, etc.

Two machine learning approaches are mostly followed in the literatures i.e., Decision tree based like random forest and Deep neural network based. Random forest (RF) is a supervised ensemble learning model which combines the output of multiple decision trees to make the final prediction. Each decision tree is trained in isolation and grown in random subspaces of data by using Classification and Decision Tree (CART) methodology. Deep Neural Networks (DNN) utilizes the principle of universal approximation theorem which states that a fully connected feed forward neural network with finite number of layers and neurons can approximate any kind of relationship between input and the output variables (Fig.4).

2.1. Workflow

Machine learning workflow consists of pre-processing, feature design, splitting data into training and validation sets, selecting machine learning algorithm, training, optimization, evaluations and testing. Datasets from various sources, satellite derived, weather, soil and yield need to be homogenized and aligned to the same spatial and temporal resolutions. Training, validation and testing datasets need to be mutually explicit.

2.2. Datasets

Crop yield is the result of a complex interaction between weather, edaphic, management factors and genotypes. Datasets/features must represent these factors and should have physical meaning in terms of their impact on crop growth and development. Spectral data over the crop is the integrated manifestation of the effect of all the above factors and hence, satellite data can be used as feature in the Machine learning models. **Table 8** represents various datasets commonly used in the machine learning models.

Table 8: Dataset requirement for AI/ML based approach

Category	Features	Source
Satellite based	Reflectance bands	Sentinel -2, Landsat-8, MODIS -250
	Vegetation Indices - (NDVI, EVI, Red edge index)	
	Vegetation Indices -wetness (NDWI, LSWI, etc)	
	Radar backscatter (VH, VV, RVI etc)	Sentinel -1, EOS -4
Meteorological	Rainfall, Rainy Days	IMD (Station/ gridded), satellite derived datasets
	Dry-spell/Wet -spell	
	Temperature	
	Growing degree days	
	Heat wave/cold wave	
Bio-physical	FAPAR	PROVA/Sentinel -3, MODIS, Sentinel -2
	LAI	
Edaphic	Soil (texture, depth, AWC, etc)	NBSSLUP (1: 250K, 1:50K)
	DEM	SRTM, DEM
	Soil moisture	SMAP, AMSR -E

2.3. Feature Selection, training and optimization

Feature selection should be performed such that each feature should provide unique information about crop growth. Crop growing period (start of the season, end of the season) should be considered for selecting the features. Multivariate analysis needs to be performed to check the multi-collinearity between the features. Appropriate data normalization technique needs to follow for bringing datasets to same unit. Gap-filling and outlier removal should be done through standard statistical procedure.

Regularization criteria must be followed to check the overfitting of the model. Optimization function should be reflected as an output to visualize the learning rate, batch size etc. Feature importance

should be computed to check the weightage to each feature. Statistical criteria need to be considered for accuracy, such as the mathematical expectation of mean absolute of forecast error MAE, RMSE or NRMSE.

In case of Neural network model, the following parameters need to be explicitly mentioned by the agency

- Network Architecture
- Activation function
- Learning Algorithm
- Learning rate
- Loss Function
- Regularization criteria
- Number of training epochs
- Batch size

For decision tree-based models the following configuration

- Number of trees
- No. of features randomly selected at each node
- Best feature selection criteria
- Minimum Leaf size

If any Feature engineering is adopted the its effect on the model performance need to be documented.

2.3.1. Model implementation & Deliverables

Model implementation needs to be done at IU level and the final deliverables will be the modelled yield of IU for the current and past years.

3. Crop Simulation Model Approach

(This guideline applies whether CSM is applied as a standalone or by assimilating remote sensing data, see the section on crop assimilation data)

3.1. Brief Description

Crop growth models simulate the plant processes to estimate various bio-physical parameters and final crop yield. These models need intensive parameterization starting from genetic coefficients of crop variety under cultivation, crop sowing time, crop management practices – fertilizer applications, irrigation supplies, pest/disease occurrence, etc., These are highly reliable point-based or location-specific models due to the availability of input parameters in experimental plots. Calibrated and validated crop simulation models (DSSAT, APSIM, InfoCrop, etc.,) for Indian conditions together with soils and cultivar data available locally from SAUs and NBSSLUP. These models are well-calibrated and validated for several crops such as wheat, rice, maize, sorghum, potato, soybean, chickpea, mustard, groundnut, cotton, and coconut in Indian agroecological conditions. The following processes are considered in most of these models:

- Crop growth and development: phenology, photosynthesis, partitioning, leaf area growth, storage organ numbers, source: sink balance, transpiration, uptake, allocation, and redistribution of nitrogen.
- Effects of water, nitrogen, temperature, flooding, and frost stresses on crop growth and development.
- Soil water balance: root water uptake, inter-layer movement, drainage, evaporation, runoff, ponding.

- Soil nitrogen balance: mineralization, uptake, nitrification, volatilization, interlayer movement, denitrification, leaching.
- Soil organic carbon dynamics: mineralization and immobilization.

3.2. Model framework

The crop models are process-based dynamic simulation models for simulating the growth, development, and yield of crops.

Figure 5: Modelling framework for Info Crop
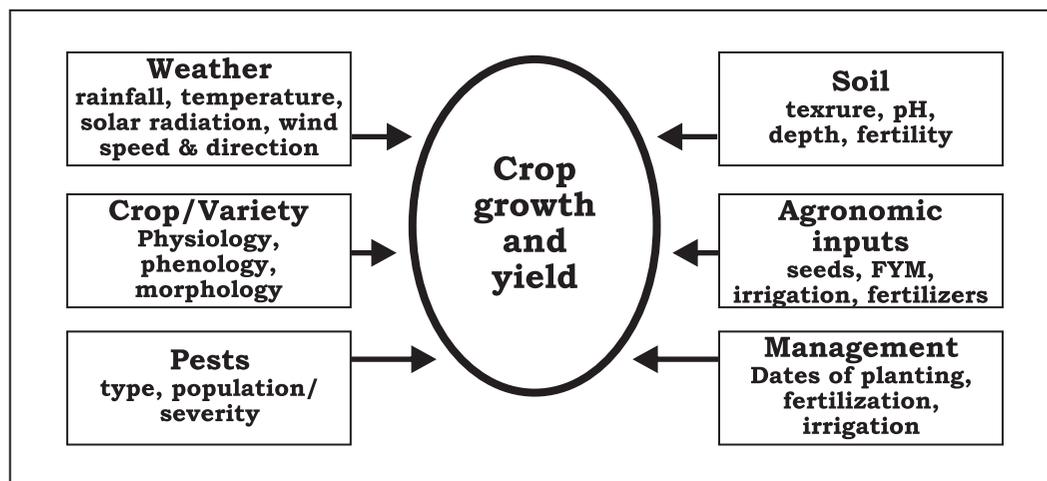
They simulate the effects of weather, soil, and crop management (sowing, seed rate, organic matter nitrogen, and irrigation), and pests (some models). It provides daily and summary outputs on various growth and yield parameters, nitrogen uptake, soil water, and nitrogen balance. Several researchers have shown the application and utility of crop simulation models in India. Below a sample modelling framework is shown for Info Crop (Fig.5)

Input data in the model includes daily max & min temperature, daily Solar Radiation (IMD AWS), Daily Rainfall (IMD AWS), Soil data - Depth wise texture, BD, pH, Organic carbon, water holding capacity, etc. The crop management information such as sowing dates and irrigation information can be derived from satellite images and used to drive simulation, and other management factors are taken as per the standard local practices. The output from the CSMs is like yield, total dry matter, crop duration, evapotranspiration, N uptake, and soil C, N, and water dynamics.

3.3. Key considerations

- There are several crop-simulation models available in the literature, however, they have varying accuracy, and only a few of them are tested thoroughly for Indian conditions. Emphasis should be given to the use of those models that have proven accuracy, and calibrated parameter values (e.g., cultivar coefficients) are available.

- The granularity of outputs derived from CSMs depends on the granularity of input datasets. To improve the granularity, spatial simulations should be done by considering variations in soil, weather, and other input parameters like sowing dates. Crop area-based aggregation must be applied to derive final yields at the IU level.

- Another approach to improving granularity is to assimilate remote sensing data (e.g., LAI, soil moisture) in crop simulation models. Such assimilation and subsequent updating of the state variables in the CSM should be done using methodologies tested and published in peer-reviewed research journals.

3.4. Methodology

Crop models distinguish varieties of a crop by their differences in phenology, growth, and source-sink balance. In most cases, thermal times of three phenological phases, the sensitivity to photoperiod, early vigor (defined in the model as relative LAI growth rate during initial stages), index of storage organs formation (slope of the relation between SO and growth during SO formation stage), and the potential weight of the storage organs were sufficient to adequately characterize the varieties.

Table 9: Dataset requirement for CSM based approach

Sr. No.	Work Component	Description and costs	Source
1	Weather data	• IMD daily weather data (station) for the current season and historical (more than 7 years) • Real-time and historical satellite/gridded weather data (daily) • Minimum weather data: Daily rainfall, temperature (maximum and minimum) • Additional weather data: Solar radiation, wind speed, humidity	IMD (Station/gridded), satellite derived datasets
2	Soil Data	• Soil physical properties by layers: Bulk density, soil texture, depth • Soil chemical properties by layers: Organic carbon, EC, pH	NBSSLUP (1: 250K, 1:50K) and Field survey data
3	Crop Management data	• Agronomic data on fertilizer, seed rate, crop duration, irrigated area, rained area, cultivars, sowing depth, etc., • Sowing dates	From various Govt Dept., Field surveys & Information from KVKs Using the above inputs and RS data (Sentinel 1, 2, and Landsat)
4	Crop specific parameters	• Crop coefficients • Phenology	Literature
5	Remote sensing data (for assimilation)	• LAI • Soil moisture	MODIS (250/500 m), Sentinel product.

3.5. Calibration and Validation

Model calibration and validation approaches are required for each selected model for the selected crop. The simulation models are sensitive to the genetic coefficients of the crop cultivar. A proper varietal-based approximation of genetic coefficients is required at disaggregated levels before simulating the crop yield. The calibration process should be done with care, and it should be ensured that the parameters do not exceed the biological range. The datasets from KVK, SAUs, or ICAR institutes should be used to check the quality of the simulation.

3.6. Deliverables

The final deliverable will be a model yield estimate for the current and at least the past five years for the given crop at the IU level. -

4. Ensemble models (Machine Learning/ Crop Simulation)

4.1. Brief description

An ensembled approach to yield estimation involves combining the predictions of multiple models to make a final prediction. This can be done through various techniques such as model averaging, model voting, or more sophisticated methods such as stacking. One advantage of using an ensembled approach is that it can improve the accuracy of the yield estimation by reducing the variance of the predictions. This is because the individual models may make different errors, and by combining their predictions, the errors can cancel out to some extent. An ensembled approach can also improve the robustness of the yield estimation, as it can be less sensitive to the specific choice of model or training data used.

In this approach, input obtained from Simulation and Machine learning approaches will be combined through scientifically designed techniques. Most accurate results are obtained by ensembling methods (weighted average, stacking). The Machine Learning approach would be Linear regression, Random Forest, ExtraTrees, gradient boosting (CatBoost), neural networks (Pytorch Tabnet), k-nearest neighbours. Simulation models (e.g. ORYZA, WOFOST, Infocrop, DSSAT, APSIM) are used, along with data assimilation technology. Brief flow diagram of approach is given if Fig. 6.

Figure 6: Schematic diagram of Ensemble technique
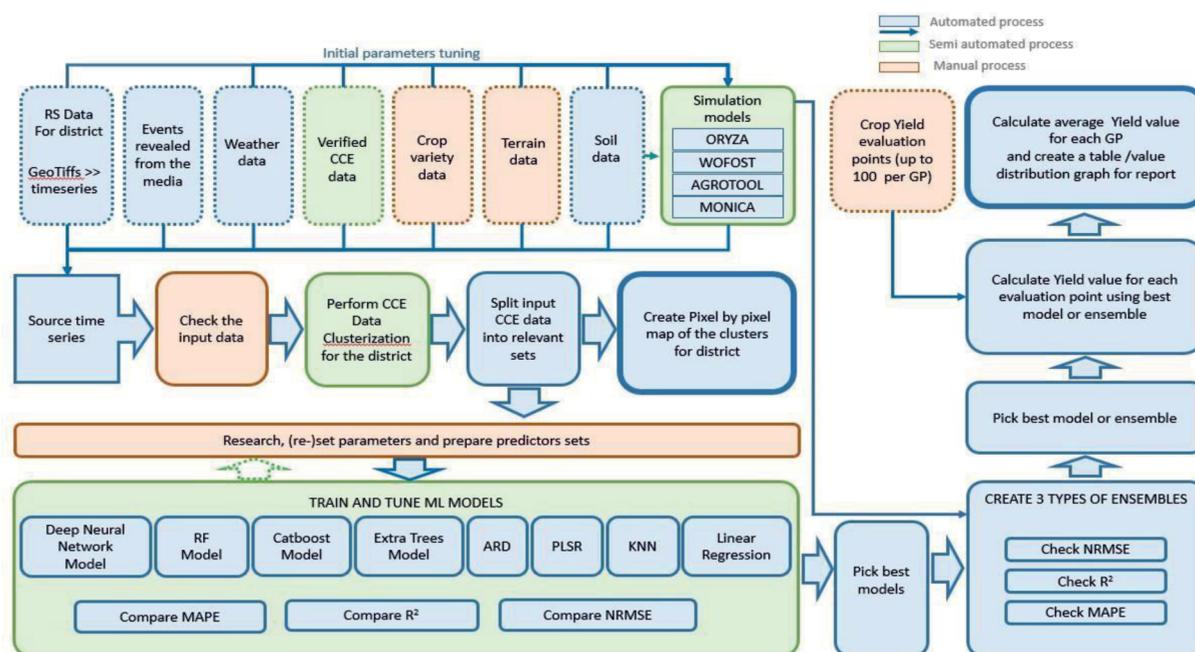
There are several methods for ensembling models, including bagging, boosting, and stacking. It is important to choose the appropriate ensembling method based on the specific characteristics of the data and the goals of the modelling process. Basic input data requirement is as given below-

4.2. Input data

As specified in Machine Learning and Simulation, model SOP.

4.3. Model deliverables

Insurance unit level yield and total biomass, crop health parameters from start to end of the season,

5. Parametric index of crop performance (Indirect approach)

Satellite-based crop mapping, satellite and weather data analysis for generating crop health indicators, field data collection and analysis, composite index generation, and insurance loss assessment are significant tasks in this framework.

A robust system of mobile-based crop surveillance is part of this approach for close and continuous monitoring of the agricultural situation. These field data points were linked to satellite indices for crop classification and crop condition assessment.

Refer the methodology section of Semi-physical approach

The following set of indices derived from satellite and weather datasets that are well reported to be related to crop condition were part of a vast repository of data in the current project.

❖ **Satellite derived**

- Normalized Difference Vegetation Index (NDVI)
- Land Surface Wetness Index (LSWI)
- RADAR backscatter
- Fraction of Photosynthetic Active Radiation (FAPAR) / Leaf area index (LAI)

❖ **Weather data**

- season's rainfall
- rainy days
- temperature,
- wind speed
- humidity

Major input datasets and their details mentioned in the Tables 2,3 &4 under Machine learning approach and crop simulation approach are also relevant for CHF generation.

5.1. CHF generation

The important elements of the CHF generation procedure include selection of input variables, data matrix preparation for all the IUs and years, grouping of IUs in each district, data normalization, weights generation, CHF development.

Fortnightly and monthly time composite NDVI and LSWI images and 12-day interval SAR VH backscatter images are to be generated covering entire crop season for the current and past years. Crop layer and shapefile of IUs are used to create the data of sub-indicators. Input parameters of the model along with their functional relationship with CHF for paddy crop are shown in Table 10.

Table 10: Input parameters of the CHF model for paddy (illustration)

S. No.	Input indicator	Functional relationship with CHF
1	Seasons' maximum NDVI	Positive
2	Season's maximum LSWI	Positive
3	Season's maximum VH backscatter	Positive
4	Integrated VH backscatter	Positive
5	Integrated FAPAR	Positive
6	Crop condition variability	Negative
7	Rainfall	Positive
8	Rainy days	Positive

From the NDVI profile of each year, the maximum NDVI value occurring at nth fortnight and the NDVI of either n+1th or n-1th fortnight, whichever is higher, are averaged. Averaging two values of NDVI reduces uncertainty and ensures a better representation of the season's maximum value. A similar approach is adopted for computing the season's maximum LSWI and Backscatter. Integrated VH backscatter represents the total Backscatter of all the data of the growing season. Integrated FAPAR (sowing to harvesting) – Monthly composite FAPAR data from September to the first fortnight of November, when the crop is actively growing and maximum vegetative phase are summed up. The period of integration varies based on crop season. Crop condition variability is represented by the maximum of the Coefficient of Variation (CV) values of NDVI and LSWI. CV was computed using mean and standard deviation of respective index in a given IU.

Justification for the above parameters can be drawn from the published research. Season's maximum NDVI and LSWI, included in the model, were reported to be effective in crop condition assessment and crop yield modelling particularly for paddy and wheat crops by many studies. SAR backscatter data was used to infer the LAI values of rice crop and used them as relative leaf growth rate parameters in the ORYZA model. Time series data of back scatter offers reliable information about the crop growth stage, such as jointing and heading in grain crops and leaf development and reproduction. FAPAR integral over the season is one of the indicators of biomass production from vegetation. FAPAR integral was already used to design index-based insurance over grasslands. FAPAR was also successfully used in grain yield estimation procedures.

Rainfall and rainy days are vital factors in crop production. Rainfall quantity shows differential effects on crop performance. Increase in rainfall up to certain level benefits the crop and beyond certain quantity of increase it harms the crop. In this model, consider the benefit-causing limit of rainfall alone, which is fixed at 150% of normal rainfall. India Meteorological Department defines normal rainfall limit as 80-120% of long-term average (www.imd.gov.in). We have considered an additional quantity of 30% assuming that it benefits the water loving paddy crop, and thus fixed the upper limit of rainfall quantity corresponding to 150% of long-term average. It is assumed that the negative effects of excess rainfall quantity beyond 150% limit, on crop performance would be captured by other parameters, i.e., NDVI, LSWI, and Backscatter. The impact of deficit rainfall on crop would anywhere be reflected in these spectral indices.

5.2. Stratification of the IUs

The IUs of each district are first segregated into homogeneous groups based on NDVI, rainfall, and soil water holding capacity datasets. It is to be ensured that each group consists of at least 4 IUs that are contiguously located. By pooling contiguous IUs into a group, the number of crop scenarios would be increased. For example, a group with four IUs and four crop years has 16 crop growing scenarios, adequate to capture the variability. The dynamic ranges of input indicators of the CHF model are more or less the same in each group because it represents a homogeneous crop growing environment. On the other hand, if each IU is treated as a discrete / standalone entity, there are only four crop growing scenarios, and such a limited database cannot represent the total variability of crop responses leading to biased weights. All the steps in CHF computation – data normalization, weights generation, and applying weights for final index generation are carried out in each stratum independently.

5.3. Data normalization

The data are first checked for redundancy by comparing inter-correlations between the variables. The input indicators of the model are in different units. Their functional relationships with CHF is either positive or negative as mentioned in the Table 5 above. To obtain these indicators unit-free, data normalization was done by following the widely recommended Min-Max approach.

In the case of the input-indicators that have a positive relationship with CHF, normalization was done using the formula;

$$x_{ij} = \frac{X_{ij} - Min\{X_{ij}\}}{Max\{X_{ij}\}_i - Min\{X_{ij}\}}$$

In the case of the input-indicators having a negative relationship with CHF, normalization was done using the formula;

$$x_{ij} = \frac{Max\{X_{ij}\} - X_{ij}}{Max\{X_{ij}\}_i - Min\{X_{ij}\}}$$

5.4. Weights generation and CHF computation

After normalization, the input indicators range from 0-1. Derivation of weights to input indicators is vital in constructing composite indices. There are many methods of weight generation in a composite data framework.

Feature extraction techniques such as Principal Component Analysis, Partial Least Squares, multi-criteria decision models are also used to aggregate different variables into a single index. But linearity assumption in data transformation is a serious limitation in most feature extraction techniques. Entropy technique based on information theory depends on the disorder degree of information. It is a more effective information measure providing balanced relationships and unbiased weights better than linear methods. The entropy-based weighting technique is recommended, considering its merits. The entropy-derived variability of a feature and its weight are directly related. This technique does not include any assumptions, cumbersome derivations, and transformations.

Consider a normalized data matrix D which consists of observation for features, where x_{ij} denotes the value of the jth feature of ith observation. The entropy of the jth feature, E_j, can be calculated as:

$$E_j = -\frac{1}{\log(n)} \sum_{i=1}^{i=n} \frac{x_{ij}}{\sum_{i=1}^{n} x_{ij}} * \log\left(\frac{x_{ij}}{\sum_{i=1}^{n} x_{ij}}\right)$$

The weight of the feature can then be calculated as:

$$w_j = \frac{1 - E_j}{m - \sum_{j=1}^{m} E_j}$$

Given the weight (w's) and the normalized feature values of ith IU. (x_{ij}'s), the Crop Health Factor (CHF) can be calculated as:

$$CHF = \sum_{j=1}^{m} w_j * x_{ij}$$

5.5. Data and outputs

Representative values of CHF for different IUs are furnished in Table 11 below.

Table 11 CHF values of different Insurance Units (illustrative example)

Table 11: CHF values of different Insurance Units (illustration)

Block_code	GP_code	Strata_code	CHF_2016	CHF_2017	CHF_2018	CHF_2019	CHF_avg 4 years	CHF_2020
9	539	51	0.32	0.6	0.63	0.68	0.56	0.56
57	540	103	0.3	0.6	0.49	0.74	0.53	0.38
168	541	53	0.4	0.45	0.41	0.4	0.42	0.37
168	542	53	0.18	0.34	0.31	0.73	0.39	0.34
168	543	53	0.39	0.46	0.36	0.42	0.41	0.42

5.6. Blending CHF with CCE Yields

70% weightage to CCE-yield deviation from its threshold and 30% weightage to CHF deviation from its threshold. However, State can increase the weightage for CHF deviation, at their discretion. Weightage to be assigned to CHF deviations needs to be declared in the beginning of crop season, and mentioned in tender documents.

Table 12: Blending Yield and CHF deviation for loss assessments

Threshold yield (kgs/ha)	2000	Threshold CHF (using the CHF values from 2017)	0.65
Current yield	1500	Current CHF	0.6
% dev	-25	% dev	-8
70% Weightage	-18	30% Weightage	-2
Net % dev. after blending	-20		
Current yield for claim settlement after blending	1600		

CHF data from 2017 are used for computation of its threshold value in the same way threshold yield data is computed.

Table 13: List of Suggestive Districts for implementing YES-TECH

Sl. No.	Crop	Season	State	District
1	Paddy	Kharif	Andhra Pradesh	Alluri Sitaramaraju
2	Paddy	Kharif	Andhra Pradesh	Anakapelli
3	Paddy	Kharif	Andhra Pradesh	Bapatla
4	Paddy	Kharif	Andhra Pradesh	East Godavari
5	Paddy	Kharif	Andhra Pradesh	Eluru
6	Paddy	Kharif	Andhra Pradesh	Guntur
7	Paddy	Kharif	Andhra Pradesh	Kakinada
8	Paddy	Kharif	Andhra Pradesh	Konaseema
9	Paddy	Kharif	Andhra Pradesh	Krishna
10	Paddy	Kharif	Andhra Pradesh	Nandyal
11	Paddy	Kharif	Andhra Pradesh	NTR
12	Paddy	Kharif	Andhra Pradesh	Palnadu
13	Paddy	Kharif	Andhra Pradesh	Parvatipuram Manyam
14	Paddy	Kharif	Andhra Pradesh	Srikakulam
15	Paddy	Kharif	Andhra Pradesh	Visakhapatnam
16	Paddy	Kharif	Andhra Pradesh	Vizianagaram
17	Paddy	Kharif	Andhra Pradesh	West Godavari

Sl. No.	Crop	Season	State	District
18	Paddy	Rabi	Andhra Pradesh	Anantapur
19	Paddy	Rabi	Andhra Pradesh	Chittoor
20	Paddy	Rabi	Andhra Pradesh	East Godavari
21	Paddy	Rabi	Andhra Pradesh	Guntur
22	Paddy	Rabi	Andhra Pradesh	Kadapa
23	Paddy	Rabi	Andhra Pradesh	Krishna
24	Paddy	Rabi	Andhra Pradesh	Kurnool
25	Paddy	Rabi	Andhra Pradesh	Nellore
26	Paddy	Rabi	Andhra Pradesh	Prakasam
27	Paddy	Rabi	Andhra Pradesh	West Godavari
28	Paddy	Kharif	Assam	Baksa
29	Paddy	Kharif	Assam	Barpeta
30	Paddy	Kharif	Assam	Bongaigaon
31	Paddy	Kharif	Assam	Cachar + DimaHasao
32	Paddy	Kharif	Assam	Chirang
33	Paddy	Kharif	Assam	Darrang
34	Paddy	Kharif	Assam	Dhemaji
35	Paddy	Kharif	Assam	Dhubri
36	Paddy	Kharif	Assam	Dibrugarh
37	Paddy	Kharif	Assam	Goalpara
38	Paddy	Kharif	Assam	Golaghat
39	Paddy	Kharif	Assam	Hailakandi
40	Paddy	Kharif	Assam	Jorhat and Majauli
41	Paddy	Kharif	Assam	Kamrup (R)
42	Paddy	Kharif	Assam	Kamrup(m)
43	Paddy	Kharif	Assam	Karbi Anglong (East+West)
44	Paddy	Kharif	Assam	Karimganj
45	Paddy	Kharif	Assam	Kokrajhar
46	Paddy	Kharif	Assam	Lakhimpur
47	Paddy	Kharif	Assam	Morigaon
48	Paddy	Kharif	Assam	Nagaon and Hojai
49	Paddy	Kharif	Assam	Nalbari
50	Paddy	Kharif	Assam	Sivasagar
51	Paddy	Kharif	Assam	Sonitpur and Biswanath

Sl. No.	Crop	Season	State	District
52	Paddy	Kharif	Assam	Tinsukia
53	Paddy	Kharif	Assam	Udalguri
54	Paddy	Kharif	Haryana	Ambala
55	Paddy	Kharif	Haryana	Bhiwani
56	Paddy	Kharif	Haryana	Charkhi dadri
57	Paddy	Kharif	Haryana	Faridabad
58	Paddy	Kharif	Haryana	Fatehabad
59	Paddy	Kharif	Haryana	Hisar
60	Paddy	Kharif	Haryana	Jhajjar
61	Paddy	Kharif	Haryana	Jind
62	Paddy	Kharif	Haryana	Kaithal
63	Paddy	Kharif	Haryana	Karnal
64	Paddy	Kharif	Haryana	Kurukshetra
65	Paddy	Kharif	Haryana	Palwal
66	Paddy	Kharif	Haryana	Panipat
67	Paddy	Kharif	Haryana	Rohtak
68	Paddy	Kharif	Haryana	Sirsa
69	Paddy	Kharif	Haryana	Sonipat
70	Paddy	Kharif	Haryana	Yamunanagar
71	Wheat	Rabi	Haryana	Ambala
72	Wheat	Rabi	Haryana	Bhiwani
73	Wheat	Rabi	Haryana	Charkhi Dadri
74	Wheat	Rabi	Haryana	Faridabad
75	Wheat	Rabi	Haryana	Fatehabad
76	Wheat	Rabi	Haryana	Gurgaon
77	Wheat	Rabi	Haryana	Hisar
78	Wheat	Rabi	Haryana	Jhajjar
79	Wheat	Rabi	Haryana	Jind
80	Wheat	Rabi	Haryana	Kaithal
81	Wheat	Rabi	Haryana	Karnal
82	Wheat	Rabi	Haryana	Kurukshetra
83	Wheat	Rabi	Haryana	Mahendragarh
84	Wheat	Rabi	Haryana	Mewat
85	Wheat	Rabi	Haryana	Palwal

Sl. No.	Crop	Season	State	District
86	Wheat	Rabi	Haryana	Panchkula
87	Wheat	Rabi	Haryana	Panipat
88	Wheat	Rabi	Haryana	Rewari
89	Wheat	Rabi	Haryana	Rohtak
90	Wheat	Rabi	Haryana	Sirsa
91	Wheat	Rabi	Haryana	Sonipat
92	Wheat	Rabi	Haryana	Yamunanagar
93	Paddy	Rabi	Karnataka	Ballari
94	Paddy	Rabi	Karnataka	Davangere
95	Paddy	Rabi	Karnataka	Koppal
96	Paddy	Rabi	Karnataka	Raichur
97	Paddy	Rabi	Karnataka	Yadgir
98	Paddy	Kharif	Karnataka	Ballari
99	Paddy	Kharif	Karnataka	Belagavi
100	Paddy	Kharif	Karnataka	Chikkamagaluru
101	Paddy	Kharif	Karnataka	Dakshina Kannada
102	Paddy	Kharif	Karnataka	Davanagere
103	Paddy	Kharif	Karnataka	Dharwad
104	Paddy	Kharif	Karnataka	Hassan
105	Paddy	Kharif	Karnataka	Haveri
106	Paddy	Kharif	Karnataka	Kodagu
107	Paddy	Kharif	Karnataka	Koppal
108	Paddy	Kharif	Karnataka	Mandya
109	Paddy	Kharif	Karnataka	Mysore
110	Paddy	Kharif	Karnataka	Raichur
111	Paddy	Kharif	Karnataka	Shivmogga
112	Paddy	Kharif	Karnataka	Udupi
113	Paddy	Kharif	Karnataka	Yadgir
114	Paddy	Kharif	Madhya Pradesh	Anuppur
115	Paddy	Kharif	Madhya Pradesh	Balaghat
116	Paddy	Kharif	Madhya Pradesh	Betul
117	Paddy	Kharif	Madhya Pradesh	Chhindwara
118	Paddy	Kharif	Madhya Pradesh	Damoh
119	Paddy	Kharif	Madhya Pradesh	Dindori

Sl. No.	Crop	Season	State	District
120	Paddy	Kharif	Madhya Pradesh	Hoshangabad
121	Paddy	Kharif	Madhya Pradesh	Jabalpur
122	Paddy	Kharif	Madhya Pradesh	Katni
123	Paddy	Kharif	Madhya Pradesh	Mandla
124	Paddy	Kharif	Madhya Pradesh	Narsinghpur
125	Paddy	Kharif	Madhya Pradesh	Panna
126	Paddy	Kharif	Madhya Pradesh	Raisen
127	Paddy	Kharif	Madhya Pradesh	Rewa
128	Paddy	Kharif	Madhya Pradesh	Satna
129	Paddy	Kharif	Madhya Pradesh	Sehore
130	Paddy	Kharif	Madhya Pradesh	Seoni
131	Paddy	Kharif	Madhya Pradesh	Shahdol
132	Paddy	Kharif	Madhya Pradesh	Sidhi
133	Paddy	Kharif	Madhya Pradesh	Umaria
134	Wheat	Rabi	Madhya Pradesh	Agar-Malwa
135	Wheat	Rabi	Madhya Pradesh	Alirajpur
136	Wheat	Rabi	Madhya Pradesh	Anuppur
137	Wheat	Rabi	Madhya Pradesh	Ashoknagar
138	Wheat	Rabi	Madhya Pradesh	Balaghat
139	Wheat	Rabi	Madhya Pradesh	Barwani
140	Wheat	Rabi	Madhya Pradesh	Betul
141	Wheat	Rabi	Madhya Pradesh	Bhind
142	Wheat	Rabi	Madhya Pradesh	Bhopal
143	Wheat	Rabi	Madhya Pradesh	Burhanpur
144	Wheat	Rabi	Madhya Pradesh	Chhatarpur
145	Wheat	Rabi	Madhya Pradesh	Chhindwara
146	Wheat	Rabi	Madhya Pradesh	Damoh
147	Wheat	Rabi	Madhya Pradesh	Datia
148	Wheat	Rabi	Madhya Pradesh	Dewas
149	Wheat	Rabi	Madhya Pradesh	Dhar
150	Wheat	Rabi	Madhya Pradesh	Dindori
151	Wheat	Rabi	Madhya Pradesh	Guna
152	Wheat	Rabi	Madhya Pradesh	Gwalior
153	Wheat	Rabi	Madhya Pradesh	Harda

Sl. No.	Crop	Season	State	District
154	Wheat	Rabi	Madhya Pradesh	Hoshangabad
155	Wheat	Rabi	Madhya Pradesh	Indore
156	Wheat	Rabi	Madhya Pradesh	Jabalpur
157	Wheat	Rabi	Madhya Pradesh	Jhabua
158	Wheat	Rabi	Madhya Pradesh	Katni
159	Wheat	Rabi	Madhya Pradesh	Khandwa
160	Wheat	Rabi	Madhya Pradesh	Khargone
161	Wheat	Rabi	Madhya Pradesh	Mandla
162	Wheat	Rabi	Madhya Pradesh	Mandsaur
163	Wheat	Rabi	Madhya Pradesh	Morena
164	Wheat	Rabi	Madhya Pradesh	Narshimapura
165	Wheat	Rabi	Madhya Pradesh	Nimach
166	Wheat	Rabi	Madhya Pradesh	Panna
167	Wheat	Rabi	Madhya Pradesh	Raisen
168	Wheat	Rabi	Madhya Pradesh	Rajgarh
169	Wheat	Rabi	Madhya Pradesh	Ratlam
170	Wheat	Rabi	Madhya Pradesh	Rewa
171	Wheat	Rabi	Madhya Pradesh	Sagar
172	Wheat	Rabi	Madhya Pradesh	Satna
173	Wheat	Rabi	Madhya Pradesh	Sehore
174	Wheat	Rabi	Madhya Pradesh	Seoni
175	Wheat	Rabi	Madhya Pradesh	Shahdol
176	Wheat	Rabi	Madhya Pradesh	Shajapur
177	Wheat	Rabi	Madhya Pradesh	Sheopur
178	Wheat	Rabi	Madhya Pradesh	Shivpuri
179	Wheat	Rabi	Madhya Pradesh	Sidhi
180	Wheat	Rabi	Madhya Pradesh	Singrauli
181	Wheat	Rabi	Madhya Pradesh	Tikamgarh
182	Wheat	Rabi	Madhya Pradesh	Ujjain
183	Wheat	Rabi	Madhya Pradesh	Umaria
184	Wheat	Rabi	Madhya Pradesh	Vidisha
185	Paddy	Kharif	Maharashtra	Ahmednagar
186	Paddy	Kharif	Maharashtra	Amravati
187	Paddy	Kharif	Maharashtra	Bhandara

Sl. No.	Crop	Season	State	District
188	Paddy	Kharif	Maharashtra	Chandrapur
189	Paddy	Kharif	Maharashtra	Gadchiroli
190	Paddy	Kharif	Maharashtra	Gondia
191	Paddy	Kharif	Maharashtra	Kolhapur
192	Paddy	Kharif	Maharashtra	Nagpur
193	Paddy	Kharif	Maharashtra	Nandurbar
194	Paddy	Kharif	Maharashtra	Nasik
195	Paddy	Kharif	Maharashtra	Palghar
196	Paddy	Kharif	Maharashtra	Pune
197	Paddy	Kharif	Maharashtra	Raigad
198	Paddy	Kharif	Maharashtra	Ratnagiri
199	Paddy	Kharif	Maharashtra	Sangli
200	Paddy	Kharif	Maharashtra	Satara
201	Paddy	Kharif	Maharashtra	Sindhudurg
202	Paddy	Kharif	Maharashtra	Thane
203	Wheat	Rabi	Maharashtra	Ahmednagar
204	Wheat	Rabi	Maharashtra	Akola
205	Wheat	Rabi	Maharashtra	Amravati
206	Wheat	Rabi	Maharashtra	Aurangabad
207	Wheat	Rabi	Maharashtra	Beed
208	Wheat	Rabi	Maharashtra	Bhandara
209	Wheat	Rabi	Maharashtra	Buldhana
210	Wheat	Rabi	Maharashtra	Chandrapur
211	Wheat	Rabi	Maharashtra	Dhule
212	Wheat	Rabi	Maharashtra	Hingoli
213	Wheat	Rabi	Maharashtra	Jalgaon
214	Wheat	Rabi	Maharashtra	Jalna
215	Wheat	Rabi	Maharashtra	Latur
216	Wheat	Rabi	Maharashtra	Nagpur
217	Wheat	Rabi	Maharashtra	Nanded
218	Wheat	Rabi	Maharashtra	Nandurbar
219	Wheat	Rabi	Maharashtra	Nasik
220	Wheat	Rabi	Maharashtra	Osmanabad
221	Wheat	Rabi	Maharashtra	Parbhani

Sl. No.	Crop	Season	State	District
222	Wheat	Rabi	Maharashtra	Pune
223	Wheat	Rabi	Maharashtra	Sangli
224	Wheat	Rabi	Maharashtra	Satara
225	Wheat	Rabi	Maharashtra	Solapur
226	Wheat	Rabi	Maharashtra	Wardha
227	Wheat	Rabi	Maharashtra	Washim
228	Wheat	Rabi	Maharashtra	Yavatmal
229	Paddy	Rabi	Odisha	Baleshwar
230	Paddy	Rabi	Odisha	Baragarh
231	Paddy	Rabi	Odisha	Kalahandi
232	Paddy	Rabi	Odisha	Koraput
233	Paddy	Rabi	Odisha	Puri
234	Paddy	Rabi	Odisha	Sambalpur
235	Paddy	Rabi	Odisha	Sonepur
236	Paddy	Kharif	Odisha	Angul
237	Paddy	Kharif	Odisha	Baleswar
238	Paddy	Kharif	Odisha	Bargarh
239	Paddy	Kharif	Odisha	Bhadrak
240	Paddy	Kharif	Odisha	Bolangir
241	Paddy	Kharif	Odisha	Boudh
242	Paddy	Kharif	Odisha	Cuttack
243	Paddy	Kharif	Odisha	Deogarh
244	Paddy	Kharif	Odisha	Dhenkanal
245	Paddy	Kharif	Odisha	Gajapati
246	Paddy	Kharif	Odisha	Ganjam
247	Paddy	Kharif	Odisha	Jagatsinghpur
248	Paddy	Kharif	Odisha	Jajpur
249	Paddy	Kharif	Odisha	Jharsuguda
250	Paddy	Kharif	Odisha	Kalahandi
251	Paddy	Kharif	Odisha	Kandhamal
252	Paddy	Kharif	Odisha	Kendrapara
253	Paddy	Kharif	Odisha	Keonjhar
254	Paddy	Kharif	Odisha	Khordha
255	Paddy	Kharif	Odisha	Koraput

Sl. No.	Crop	Season	State	District
256	Paddy	Kharif	Odisha	Malkangiri
257	Paddy	Kharif	Odisha	Mayurbhanj
258	Paddy	Kharif	Odisha	Nawarangapur
259	Paddy	Kharif	Odisha	Nayagarh
260	Paddy	Kharif	Odisha	Nuapada
261	Paddy	Kharif	Odisha	Puri
262	Paddy	Kharif	Odisha	Rayagada
263	Paddy	Kharif	Odisha	Sambalpur
264	Paddy	Kharif	Odisha	Sonepur
265	Paddy	Kharif	Odisha	Sundargarh
266	Wheat	Rabi	Rajasthan	Ajmer
267	Wheat	Rabi	Rajasthan	Alwar
268	Wheat	Rabi	Rajasthan	Banswara
269	Wheat	Rabi	Rajasthan	Baran
270	Wheat	Rabi	Rajasthan	Bharatpur
271	Wheat	Rabi	Rajasthan	Bhilwara
272	Wheat	Rabi	Rajasthan	Bundi
273	Wheat	Rabi	Rajasthan	Chittaurgarh
274	Wheat	Rabi	Rajasthan	Dausa
275	Wheat	Rabi	Rajasthan	Dhaulpur
276	Wheat	Rabi	Rajasthan	Ganganagar
277	Wheat	Rabi	Rajasthan	Hanumangarh
278	Wheat	Rabi	Rajasthan	Jaipur
279	Wheat	Rabi	Rajasthan	Jalor
280	Wheat	Rabi	Rajasthan	Jhalawar
281	Wheat	Rabi	Rajasthan	Jhunjhunun
282	Wheat	Rabi	Rajasthan	Jodhpur
283	Wheat	Rabi	Rajasthan	Karauli
284	Wheat	Rabi	Rajasthan	Kota
285	Wheat	Rabi	Rajasthan	Nagaur
286	Wheat	Rabi	Rajasthan	Pali
287	Wheat	Rabi	Rajasthan	Sawai Madhopur
288	Wheat	Rabi	Rajasthan	Sikar
289	Wheat	Rabi	Rajasthan	Sirohi

Sl. No.	Crop	Season	State	District
290	Wheat	Rabi	Rajasthan	Tonk
291	Paddy	Kharif	Tamil Nadu	Ariyalur
292	Paddy	Kharif	Tamil Nadu	Cuddalore
293	Paddy	Kharif	Tamil Nadu	Kanchipuram
294	Paddy	Kharif	Tamil Nadu	Madurai
295	Paddy	Kharif	Tamil Nadu	Nagapattinam
296	Paddy	Kharif	Tamil Nadu	Pudukkottai
297	Paddy	Kharif	Tamil Nadu	Ramanathapuram
298	Paddy	Kharif	Tamil Nadu	Salem
299	Paddy	Kharif	Tamil Nadu	Sivaganga
300	Paddy	Kharif	Tamil Nadu	Thanjavur
301	Paddy	Kharif	Tamil Nadu	Thiruvallur
302	Paddy	Kharif	Tamil Nadu	Tiruchirappalli
303	Paddy	Kharif	Tamil Nadu	Tirunelveli
304	Paddy	Kharif	Tamil Nadu	Tiruvannamalai
305	Paddy	Kharif	Tamil Nadu	Tiruvarur
306	Paddy	Kharif	Tamil Nadu	Vellore
307	Paddy	Kharif	Tamil Nadu	Villuppuram
308	Paddy	Kharif	Tamil Nadu	Virudunagar

Crop Model Matrix -2 (CMM – 2)

1.   Introduction

1.1. Yield Estimation System based on Technology (YES-TECH) is being implemented from kharif 2023, towards enabling large scale adoption of technology-based yield estimates for yield loss and insurance claim assessments under PMFBY.

1.2. The Department has constituted an Expert Committee for monitoring the implementation of YES-TECH under PMFBY. The purpose of YES-TECH is to blend the technology-based yield estimates with manual yield estimates and reduce the dependence on manual system gradually.

1.3. The CMM1 rolled out in 2023-24 season covers paddy and wheat crops with five models for yield estimation. SOPs for all the five notified models and implementation modalities are documented in YES-TECH manual 2023 (https://pmfby.gov.in/pdf/YES_TECH_Manual_2023.pdf).

2.   Coverage of additional crops under YES-TECH

2.1. Towards increasing the number of crops under YES-TECH, the Department has initiated pilot studies in 2022-23 crop seasons covering non-cereal crops.

2.2. The objective of these pilot studies was to generate reliable yield estimates through scalable models for non-cereal crops at IU level. These pilot studies were conducted in Kharif 2022-23 for 5 major non-cereal crops including maize, soybean, bajra, cotton and guar. Ten agencies were involved in these studies covering 25 districts across different agro-climatic zones of India.

2.3. The agencies have used innovative technologies/data like high spatio-temporal resolution remote sensing data, Unmanned Aerial Vehicle (UAV), advanced crop simulation models, artificial intelligence/machine learning, soil, weather & crop data, picture based analysis, advanced statistics, etc to crop mapping and yield modelling.

3.   Evaluation of pilot studies

3.1 The Department has constituted an Expert Committee to review implementations and the results of pilot studies on GP level yield estimations of cereal and non-cereal crops under PMFBY vide letter number F.No. 11019/04/2019-Cr. II dated 24th November 2022. The terms of reference of the committee includes i) selecting the agency based on defined criteria ii) recommending the cost of each study, iii) carrying out mid-terms and final review of the studies and iv) Recommendation of most optimum approach to be adopted in PMFBY.

3.2 The committee conducted the final review meeting on 15th March 2024 and evaluated the results of gram panchayat level technology-based yield estimation for non-cereal crops executed by various agencies during Kharif 2022-23. The committee has also examined the results of non-cereal crop yield estimation in MahaAgriTech, Maharashtra and MP AgriGIS, Madhya Pradesh States for soybean and cotton crops.

3.3 The expert committee found the results achieved under the above pilot studies as well as the results of MahaAgriTech and MP AgriGIS projects for soybean crop are highly encouraging and satisfactory.

3.4 Based on the review meeting, the expert committee has recommended the inclusion of soybean crop under YES-TECH program.

4.   Subsequent CMMs

4.1   Para 1.5.3 of YES-TECH Manual 2023 stipulates that "GoI will notify subsequent CMMs from time to time based on the recommendations of YES-TECH Committee."

4.2   Para 1.5.4 of YES-TECH Manual 2023 stipulates that "Upon such notifications on subsequent CMMs relevant details will be added as appendices to this manual."

4.3   According to these provisions of YES-TECH Manual 2023 and the recommendations of YES-TECH Committee, CMM2 will be implemented for tech-based yield estimation in Soybean crop from Kharif 2024 in PMFBY implementing States/UTs.

5.   CMM2

The CMM2 includes technology-based yield estimation for soybean crop under YES-TECH program.

5.1   Rationale for CMM2

Results of the pilot studies by agencies on technology-based yield estimation are promising for soybean crop. The technology-based yield estimation of soybean crop is operational in Maharashtra and Madhya Pradesh States through their MahaAgriTech and MPAgriGIS projects and results achieved thereof are highly encouraging and satisfactory.

5.2   Coverage

The following soybean cultivating States shall be covered under CMM2-

1.) Madhya Pradesh, 2.) Maharashtra, 3.) Rajasthan, 4.) Karnataka and 5.) Telangana

5.3   CMM2 Models

The following modelling approaches are recommended.

i.   Semi-physical,

ii.   Machine Learning,

iii.   Crop simulation and

iv.   Ensemble approach.

The technical details of the modelling approaches are provided in section 4 of the YES-TECH manual 2023.

5.4   Yield Data Requirements:

5.4.1 States should provide a minimum of 150 supervised CCE based yield measurements data per district in each year of implementation in order to support technology-based yield modelling system.

5.4.2 CCE derived soybean crop yield estimates at Insurance Unit level for the last 3-5 years (as per availability) shall be provided by States for model training purposes.

5.4.3 The above yield data shall be used for model development purpose only and it shall not be used to raise disputes on the modelled yield estimates since the model performance was already evaluated before including in YES-TECH program.

5.4.4 It is recommended that the modelled yield should be given at least 30% in the blending approach. Crops and choice of yield models to be covered under YES-TECH are notified from time to time based on the maturity level of technology models.

6. Specific terms and conditions

6.1 Districts growing soybean crop in at least 5000 ha of area shall only be included.

6.2 Within each selected district, Insurance Unit covering at least 100 ha of soybean crop area shall only be included.

6.3 IUs growing less than 100 ha of soybean area shall be merged with nearest neighbour IUs for yield modelling.

6.4 Satellite based crop mapping is a prerequisite for YES-TECH- implementation. If crop mapping is not possible for any Insurance Unit due to small and isolated fields or very low coverage, it is recommended to exclude such IUs from YES-TECH and adopt only conventional CCE System. State can take a decision to merge such IUs with contiguous IUs and implement the models.

7. Reference Cost for TIP for Implementing YES-TECH

7.1 The institutional mechanism for CMM2 implementation is same as that of CMM1 comprising of Mentor Institutes for Technology Rollout (MITR) for providing mentorship to the States/UTs and Technical Implementation Partners (TIPs) for the overall implementation of YES-TECH in the state.

7.2 The reference cost for implementing CMM2 is same as that of CMM1 mentioned in YES-TECH Manual 2023 which works out to be Rs. 6-8 lakhs/crop/season/district.

7.3 In the districts, where both CMM1 and CMM2 are implemented in the same season, an additional cost of Rs. 2-3 lakhs per district is applicable to over and above the standard reference cost of Rs. 6-8 lakhs. For other information related to reference cost provided in section 5.3.2 of YES-TECH manual 2023 is also applicable to CMM2.

8. Other terms and conditions

8.1 YESTECH manual 2023 shall be referred for all other terms and conditions, implementation modalities, administrative and financial matters etc.

SECTION 2
Model Tender Document

Model Tender Document

Selection of

Technology Implementing Partner (TIP)

for

Implementation of YES-TECH

under

Pradhan Mantri Fasal Bima Yojana (PMFBY) & Restructured Weather Based Crop Insurance Scheme (RWBCIS)

<DD/MM/YYYY>

Note:

The points incorporated in Model Tender Document are suggestive and respective States/UTs may kindly modify this as per applicability of related rules in the concerned States/UTs

Tender Notice

Implementation of Yield Estimation System based on Technology (YES-TECH) under Pradhan Mantri Fasal Bima Yojana (PMFBY) & Restructured Weather Based Crop Insurance Scheme (RWBCIS)

The Department of <Name of Department>, Government of <Name of State/UT> invites quotations from experienced agencies for Implementation of Yield Estimation System based on Technology (YES-TECH) in the state of <state name>, for the <season, year> under Pradhan Mantri Fasal Bima Yojana (PMFBY)/Restructured Weather Based Crop Insurance Scheme (RWBCIS)

All empanelled agencies are mandated to get enrolled on <Website> in order to download the tender documents and participate in the subsequent bidding process.

The Tender Document can be uploaded online on <website> and copies can be sent through email to <email-ID>

<Authorized signatory >
<Department name, address>

Bid Schedule

Particulars	Details
Assignment Name	Selection Of Technology Implementing Partner (TIP) for Implementation of Yield Estimation System based on Technology (YES-TECH) under Pradhan Mantri Fasal Bima Yojana (PMFBY) & Restructured Weather Based Crop Insurance Scheme (RWBCIS
Tender Reference No	[Insert tender reference no.]
Bid Submission Mode	As per the Financial Rules in the State
Date of Issue of Tender Document	DD / MM / YYYY
Date & time for Pre-Bid Meeting if required (at least one week before tender submission date)	DD / MM / YYYY at HH:MM
Pre-Bid Meeting Venue	Address: ....
Last Date for submission of queries/ clarifications	DD/MM /YYYY at HH:MM
Last Date for Submission of tender	DD / MM / YYYY at HH:MM
Date and time of tender opening	DD / MM / YYYY at HH:MM
Issue of Notification of Award (NOA) opening	Within 5 working days of financial bid
Acceptance of Notification of Award	Within 2 working days of the issue of NOA
Signing of Tripartite Agreement (TA)	With in 15 working days of acceptance of NOA
Contact Person and phone no for all queries	
Email ID for all queries	
Address for communication/submission of bids	

1. Introduction

This tender document is for obtaining services of reputed empanelled technical/research agencies for Insurance Unit (IU) level Crop Yield Estimation Using Specified Technology/models for Pradhan Mantri Fasal Bima Yojana (PMFBY) as per the YES-TECH Manual 2023 notified under PMFBY as amended from time to time. The study should be carried out for **<Crop Name> from <season> <YYYY>, to <season> <YYYY>**, and may be extended depending upon the requirement of <Issuing organization/authority name>. Presently, services are required for IU level implementation of YES-TECH in   <number of districts> in <Name of the State> state.

In case any difference is found in interpretation or reference of terms & conditions and various provisions as mentioned in the Tender document, the terms & conditions and provisions of the YES-TECH Manual 2023, as amended from time to time, shall be final and binding in all situations to all stakeholders.

2. Submission Of Bids

2.1. The Bidders should submit their Bid along with the EMD, Annexures, Certificates and other required documents as stated in the tender document, in the prescribed mode as per the Financial Rules prevailing in the State. In case the bids are submitted physically, the same shall be submitted in sealed envelopes in the following manner:

a. All signed Annexures, documents for EMD, should be submitted in an envelope superscribed as:

"All signed Annexures, documents for EMD for tender document Ref:_____(Doc Number), For Selection of TIP for YES-TECH Implementation

SUBMITTED BY   (Bidder's Name)"

b. Commercial Bid – Hardcopy for the Commercial Bid should be in a separate sealed envelope super- scribed as:

"COMMERCIAL BID for tender document Ref: _____ (Document number)" dated <DD/MM/YYYY>, For Selection of TIP for YES-TECH Implementation.

SUBMITTED BY   (Bidder's Name)"

2.2. All the envelopes should clearly indicate the name, address, telephone number, E-mail ID of the bidder.

2.3. The hardcopies of the bid (all documents and Annexures submitted as a part of bid or called for by the State) must be duly signed on each page and stamped on each page. Bid shall be signed by the Bidder, or a person duly authorized to bind the Bidder to the Tripartite Agreement (TA). Authorization by the bidder for the signatory shall be in form of a Power of Attorney or a duly certified copy of the Board resolution appointing the authorized signatory. The person signing the bid shall sign all pages of the bid, except for un-amended printed literature.

2.4. Any bid received after the due date and time for receipts of bids as prescribed in this Tender document will not be considered and returned unopened to the bidder.

2.5. The Online submission of bids along with uploading of all the documents shall be made on <name of the website/portal>. The hard copies of the documents, if required by the State along with the EMD shall be submitted to the address specified in this Tender document before the last date of submission of bids.

2.6. The Bidders may submit their queries or seek clarifications through email before the last date for submission for queries as specified in the schedule. A clarification to the queries shall be provided to the bidders and the same shall be published on the website.

3. Eligibility criteria for agencies

The agencies which are empanelled by the YES-TECH committee as TIPs shall only be eligible to participate in the Tender called by the State/UT of <Name of the State/UT> for implementation of YES-TECH.

4. Financial Proposal:

State/UT of <Name of the State/UT> has called for Season-Wise Crop-Wise rates in the financial bid from empanelled TIPs only. The TIP quoting the lowest rates shall be declared as L1 and work shall be awarded to such L1. The decision of the State shall be final and binding on all the Bidders.

5. Criteria for work

The Selected TIP (L1 Bidder) shall implement YES-TECH as per the YES-TECH Manual 2023, as amended from time to time.

6. Information/documents to be provided

6.1. The Agencies/Companies shall submit the following documents in response to this tender document:

a. Integrity pact as per Annexure I

b. An Undertaking on the agency's letterhead along with requisite documentary proofs. The format of the undertaking is provided in Annexure II.

c. Duly sealed/encrypted Financial Bid as per Annexure III

d. Non-Disclosure Agreement (NDA) as per Annexure IV

e. Any other document required as per the <Name of the State/UT> Government tender notification.

6.2. The aforementioned documents must be correctly scanned so that they are clearly readable and intelligible since otherwise, the tender document may become technically unresponsive. The documents should be organized precisely in the above order and page-numbered, with an index at the front that lists each document's page number.

7. EMD/BID security

7.1. Agencies/Bidders, except those who are registered with the Central Purchase Organization, National Small Industries Corporation (NSIC), shall have to furnish, as part of bid, an EMD/bid security from 1% to 5% of the project value in the form of either an account payee Demand Draft, Fixed Deposit receipt, Banker's Cheque, Insurance Surety Bonds or Bank Guarantee from any Indian Commercial Bank in favour of <addressing authority> <address> valid for a period of 45 days beyond the final tender validity period and shall be delivered physically to, <issuing Organization name/authority and address>, on or before the last date and time fixed for tender document submission.

7.2. The MSME and startups having valid registration certificate of the appropriate authority shall be exempted from submission of EMD, wherever applicable as per relevant rules.

7.3. The Tender Document not accompanied by EMD/Bid Security shall be rejected being non-responsive at the bid opening stage and returned to the bidder unopened.

7.4. The bid security of the unsuccessful bidder will be discharged /returned to the bidder on or before the 30th day after the award of the work order and submission of performance security by the successful bidder.

7.5. The successful bidder's bid security will be discharged upon the bidder's acceptance of the notification of award and furnishing the performance security.

7.6. The bid security may be forfeited:

    a. If a bidder withdraws his bid during the period of bid validity specified above.

    b. In the case of a successful bidder, if the bidder withdraws or amends the tender document or impairs or derogates from the tender document.

    c. In case of the successful bidder, if the bidder fails to sign the Tripartite Agreement (TA) within the stipulated timelines.

    d. In case successful bidder fails to submit the performance security, within the stipulated timelines.

8. Performance Review:

The performance evaluation of the TIP shall be done as per the Monitoring and Evaluation (M&E) framework, as described in the YES-TECH Manual 2023, as amended from time to time.

9. Performance Security

9.1. The Performance Security shall be 5% to 10% of the cost of the project for 1 year i.e., for Kharif and Rabi seasons combined and shall be submitted within 15 days of signing of the Tripartite Agreement.

9.2. The amount of performance security may be paid through Account Payee DD/Fixed Deposit Receipt (FDR)/ Bank Guarantee (PBG)/Insurance Bonds in favour of "Pay & Accounts ....".

9.3. The performance security shall be valid for at least 60 (Sixty) days beyond the completion of the period of Tripartite Agreement and shall be denominated in Indian rupees payable at _____, India issued by a scheduled bank in India through its branch in _____, India.

9.4. The performance security shall be discharged by <issuing Organization name/authority and address> and returned to the TIP within 60 days from the date of final certificate, certifying the fulfilment of the performance obligations under this Tender Document. However, it is clarified that the performance security shall be interest free.

9.5. The TIP shall furnish amendment to the performance security, if required, within 15 working days of notification.

10. Notification of Award

10.1. The notification of award shall be issued to the successful bidder (L1) within 5 working days from date of bid opening whereafter, the successful bidder shall accept the award within 2 working days.

10.2. The acceptance of the Bid based on Least Cost System (LCS), will be communicated by way of placing a notification of award in writing at the address supplied by the Bidder in the Bid document and/or on the <website>. Any change of address of the Bidder should therefore be notified promptly to the State Government at the address given in this tender document.

10.3. The Successful Bidder shall be required to enter into a Tripartite Agreement (TA) as per the draft Tripartite Agreement (TA) with the State/UT and the MITR, within 15 working days of the award of the work. This Tripartite Agreement shall be based on this tender document, YES-TECH Manual and such other terms and conditions as may be determined by <Name of State/UT> to be necessary for the due performance of the work, as envisaged herein and in accordance with the Bid.

10.4. In case L1 withdraws its bids, or fails to sign the Tripartite Agreement (TA), the State Government may take appropriate action as per the prevailing financial rules including re-tender.

11. **Financial Bid**

11.1. The financial Bid should be submitted in soft copy (signed and scanned) & in the financial bid format as per Annexure III on the E-tendering portal. In case of physical submission, the financial bid shall be submitted in a sealed enveloped superscribed as "Financial Bid for YES-TECH"

11.2. The rates quoted by the Bidder shall be inclusive of all expenses and taxes excluding GST. The bidder quoting the lowest rates shall be selected as L1 bidder for award for work order. In case of tie between the bidders, the State/UT shall follow their relevant financial rules for selection of the L1 bidder.

11.3. If there are any corrections in the Bid document, the authorized signatory should initial them all, failing which the figures for such item shall not be considered. Discrepancies in Bids will be corrected as follows:

1. Where there is a discrepancy between the amounts in figures and in words, the amount in words shall prevail.

2. If there is a discrepancy between percentage and amount, the amount calculated as per the stipulated percentage basis shall prevail.

3. Where there is a discrepancy between the unit rate and the line-item, total resulting from multiplying the unit rate by the quantity, the unit rate will govern unless, in the opinion of Government of <name of State/UT>, there is an obvious error such as rounding offer, misplacement of a decimal point etc., in which case the line-item total will prevail.

4. Where there is a discrepancy between the amount mentioned in the Bid and the line-item, total present in the schedule of prices, the amount obtained on totalling the line items in the Financial Bid will prevail.

5. In case, the bidder does not accept the correction of the errors as stated above, the Bid shall be rejected.

11.4 The financial bid shall be submitted as per the format and the same will be evaluated on Least Cost System (LCS) Basis. The formats and illustrations for preparation and submission of financial bids are provided in the tables below:

Table 1: Financial Bid Format for CMM1

S. No.	Season	Crop	Total No. of Clusters (to be filled by the State/UT)	Rate per Cluster in Rs (Excluding GST)	Total Amount
1	Kharif 2023	Paddy			
2	Rabi 2023–2024	Wheat			
		Paddy			
3	Kharif 2024	Paddy			
4	Rabi 2024–2025	Wheat			
		Paddy			
5	Kharif 2025	Paddy			
6	Rabi 2025–2026	Wheat			
		Paddy			
		Grand Total			

Table 2: Financial Bid for the Crops other than CMM-1
(Applicable to MP & MH only as per YES-TECH Manual)

S. No.	Season	Crops other than CMM-1	Total No. of Clusters (To be filled by State/UT)	Rate per Cluster in Rs. (Excluding GST)	Total Amount
1	Kharif 2023	Crop 1			
2	Rabi 2023-2024	Crop 2			
		Crop 1			
		Crop 2			
3	Kharif 2024	Crop 1			
		Crop 2			
4	Rabi 2024-2025	Crop 1			
5	Kharif 2025	Crop 2			
		Crop 1			
		Crop 2			
6	Rabi 2025-2026	Crop 1			
		Crop 2			
		Grand Total			

Table 3: Illustration for CMM1 (Bidder 1)

S. No.	Season	Crops	Total No. of Clusters	Rate per Clusters in Rs (Excluding GST)	Total Amount
1	Kharif 2023	Paddy	15	800	12000
2	Rabi 2023-2024	Wheat	12	800	9600
		Paddy	5	800	4000
3	Kharif 2024	Paddy	20	800	16000
4	Rabi 2024-2025	Wheat	15	800	12000
		Paddy	8	800	6400
5	Kharif 2025	Paddy	20	800	16000
6	Rabi 2025-2026	Wheat	15	800	12000
		Paddy	8	800	6400
		Grand Total	**118**		**94400**

Example:

State/UT Government has sought pricing for Paddy crop in 15 Clusters during Kharif 2023 season, wheat crop in 12 districts during Rabi 2023-24 season and paddy crop in 5 Clusters during Rabi 2023-24 season for implementation of YES-TECH.

Further Bidder-1 has quoted average rate of Rs. 800/- per Clusters for paddy and wheat crop in both Kharif and Rabi seasons. Therefore, total amount quoted by Bidder-1 for paddy crop in Kharif 2023 will be 15 x 800 = Rs. 12,000/-, total amount quoted by Bidder-1 for wheat crop in Rabi 2023-24 will be 12 x 800 = Rs. 9,600/- and total amount quoted by Bidder-1 for paddy crop in Rabi 2023-24 will be 5 x 800 = Rs. 4,000/-.

Accordingly, similar calculation can be done for remaining seasons of the tender cycle and Bidder-1 will arrive at cumulative total of Rs. 94,400/- for six seasons for CMM-1.

Table 4: Illustration for the Crops other than CMM1 (Bidder 1)

S. No.	Season	Crops other than CMM1	Total No. of Clusters	Rate per Cluster in Rs (Excluding GST)	Total Amount
1	Kharif 2023	Crop 1 (Soybean)	15	800	12000
		Crop 2 (Cotton)	12	800	9600
2	Rabi 2023-2024	Crop 1 (Gram)	5	800	4000
		Crop 2 (Mustard)	20	800	16000
3	Kharif 2024	Crop 1 (Soybean)	15	800	12000
		Crop 2 (Cotton)	8	800	6400
4	Rabi 2024-2025	Crop 1 (Gram)	20	800	16000
		Crop 2 (Mustard)	15	800	12000
5	Kharif 2025	Crop 1 (Soybean)	8	800	6400
		Crop 2 (Cotton)	20	800	16000
6	Rabi 2025-2026	Crop 1 (Gram)	15	800	12000
		Crop 2 (Mustard)	8	800	6400
		Grand Total	**161**		**128800**

Example:

For crops other than CMM-1, State Government (Madhya Pradesh and Maharashtra) has sought pricing for Soybean and Cotton crop in 15 and 12 Clusters respectively, during Kharif 2023 season and Gram and Mustard crops in 5 and 20 districts respectively, during Rabi 2023-24 season for implementation of YES-TECH.

Further Bidder-1 has quoted rate of Rs. 800/- per Cluster for all the crops in both Kharif and Rabi seasons. Therefore, total amount quoted by Bidder-1 for Soybean crop in Kharif 2023 will be 15 x 800 = Rs. 12,000/-, total amount quoted by Bidder-1 for Cotton crop in Kharif 2023 will be 12 x 800 = Rs. 9,600/-, total amount quoted by Bidder-1 for Gram crop in Rabi 2023-24 will be 5 x 800 = Rs. 4,000/- and total amount quoted by Bidder-1 for Mustard crop in Rabi 2023-24 will be 20 x 800 = Rs. 16,000/-.

Accordingly, similar calculation can be done for remaining seasons of the tender cycle and Bidder-1 will arrive at cumulative total of Rs. 1,28,800/- for six seasons for crops other than CMM-1.

Similar calculations can be done for the remaining bidders and the final rate for the selection of L1 bidder can be arrived as illustrated in the tables below (Table 5 to Table 9).

Table 5: Illustration for CMM1 (Bidder 2)

S. No.	Season	Crop	Total No. of Clusters	Rate per Cluster in Rs (Excluding GST)	Total Amount
1	Kharif 2023	Paddy	15	1000	15000
2	Rabi 2023-2024	Wheat	12	1000	12000
		Paddy	5	700	3500
3	Kharif 2024	Paddy	20	1200	24000
4	Rabi 2024-2025	Wheat	15	1200	18000
		Paddy	8	900	7200
5	Kharif 2025	Paddy	20	1500	30000
6	Rabi 2025-2026	Wheat	15	1400	21000
		Paddy	8	1000	8000
		Grand Total	**118**		**138700**

Table 6: Illustration for the Crops other than CMM1 (Bidder 2)

S. No.	Season	Crops other than CMM1	Total No. of Clusters	Rate per Cluster in Rs (Excluding GST)	Total Amount
1	Kharif 2023	Crop 1 (Soybean)	15	1200	18000
		Crop 2 (Cotton)	12	600	7200
2	Rabi 2023-2024	Crop 1 (Gram)	5	1200	6000
		Crop 2 (Mustard)	20	600	12000
3	Kharif 2024	Crop 1 (Soybean)	15	1300	19500
		Crop 2 (Cotton)	8	750	6000
4	Rabi 2024-2025	Crop 1 (Gram)	20	1300	26000
		Crop 2 (Mustard)	15	750	11250
5	Kharif 2025	Crop 1 (Soybean)	8	1400	11200
		Crop 2 (Cotton)	20	800	16000
6	Rabi 2025-2026	Crop 1 (Gram)	15	1400	21000
		Crop 2 (Mustard)	8	800	6400
		Grand Total	**161**		**160550**

Table 7: Illustration for CMM1 (Bidder 3)

S. No.	Season	Crop	Total No. of Clusters	Rate per Cluster in Rs (Excluding GST)	Total Amount
1	Kharif 2023	Paddy	15	1200	18000
2	Rabi 2023-2024	Wheat	12	1200	14400
		Paddy	5	600	3000
3	Kharif 2024	Paddy	20	1300	26000
4	Rabi 2024-2025	Wheat	15	1300	19500
		Paddy	8	700	5600
5	Kharif 2025	Paddy	20	1400	28000
6	Rabi 2025-2026	Wheat	15	1400	21000
		Paddy	8	800	6400
		Grand Total	118		141900

Table 8: Illustration for the Crops other than CMM1 (Bidder 3)

S. No.	Season	Crops other than CMM1	Total No. of Clusters	Rate per Cluster in Rs (Excluding GST)	Total Amount
1	Kharif 2023	Crop 1 (Soybean)	15	1000	15000
		Crop 2 (Cotton)	12	700	8400
2	Rabi 2023-2024	Crop 1 (Gram)	5	1000	5000
		Crop 2 (Mustard)	20	700	14000
3	Kharif 2024	Crop 1 (Soybean)	15	1100	16500
		Crop 2 (Cotton)	8	800	6400
4	Rabi 2024-2025	Crop 1 (Gram)	20	1100	22000
		Crop 2 (Mustard)	15	800	12000
5	Kharif 2025	Crop 1 (Soybean)	8	1200	9600
		Crop 2 (Cotton)	20	900	18000
6	Rabi 2025-2026	Crop 1 (Gram)	15	1200	18000
		Crop 2 (Mustard)	8	900	7200
		Grand Total	161		152100

Table 9: Summary (Selection of L1 Bidder)

S No	Bid For	Final Amount	Rank
Bidder 1	CMM1 (Table 3)	94400	
	Crops other than CMM1 (Table 4)	128800	L1
	Total	**223200**	
Bidder 2	CMM1 (Table 5)	138700	
	Crops other than CMM1 (Table 6)	160550	L3
	Total	**299250**	
Bidder 3	CMM1 (Table 7)	141900	
	Crops other than CMM1 (Table 8)	152100	L2
	Total	**294000**	

12. **Implementation of subsequent CMMs (CMM-2, CMM-3, ……. and so on) to be notified under YES-TECH between tender cycle of 2023-24 to 2025-26**

12.1. For implementation of subsequent CMM crops between the tender cycle for the years 2023-24 to 2025-26, the selected TIP for CMM-1 will also continue to work as TIP for subsequent CMM crops.

12.2. The size and the grouping of the cluster shall conform with the PMFBY district clustering as notified by the respective States/UTs.

12.3. **Reference Crop:** Crop having highest area in the /cluster/state (as the case may be), in the previous year, in CMM-1 or subsequent CMMs will be considered as reference crop for calculating the cost for crops notified under subsequent CMMs.

12.4. The cost for subsequent CMM will be discovered by taking the cost per unit area, of the reference crop in the relevant clusters.

12.5. In case of implementation of subsequent CMM in a cluster where CMM-1 has not been implemented, the rate for subsequent CMMs will be discovered through the cost per unit area of the reference crop at state level.

12.6. For any change in crops or district, the TIP should duly be informed and the same shall be binding on the TIP.

12.7. Payment shall be made as per the actual execution of work based on season wise rate discovered for the concerned year.

Table 10: Illustration for calculation of cost per cluster per crop for subsequent CMM in current tender cycle

S. No	Season	CMM-1 Crop	CMM2 Crop	Previous Year Area in the Cluster (ha)	L1 rate per Cluster for Reference Crop in Rs (Excluding GST)	Cost for additional crop
1	Kharif 2023	Paddy		100	800	
			Soybean	50		400 {(800/100)*50}
			Cotton	25		200 {(800/100)*25}
2	Rabi 2023-24	Wheat		200	800	
			Gram	80		320 {(800/200)*80}
			Mustard	110		440 {(800/200)*110}
3	Kharif 2024	Paddy		150	800	
			Soybean	85		453.33 {(800/150)*85}
			Maize	60		320 {(800/150)*60}
4	Rabi 2023-24	Wheat		180	800	
		Paddy		150		
			Gram	50		222.22 {(800/180)*50}
5	Kharif 2025	Paddy		100	800	
			Soybean	30		240 {(800/100)*30}
			Cotton	45		360 {(800/100)*45}
6	Rabi 2023-24	Wheat		130		
		Paddy		170	800	
			Gram	80		376 {(800/170)*80}

Example: In Rabi 2023-24 wheat and paddy crops covered under CMM-1. Previous year area of Paddy (170 ha) is greater than area of wheat (130 ha). In this case paddy crop will be considered as reference crop for Rabi 2023-24 season. Further, for discovering the cost of subsequent CMM crop i.e. Gram, the cost will be calculated by L1 rate per cluster for Paddy Crop (800) divided by area of reference crop (170) i.e. 800/170=4.70 Rs./hectare multiplied by area of subsequent crop Gram i.e. 80*4.70=376 Rs./cluster.

13.   Payment Terms

The Department will release funds for implementing YES-TECH to TIP as per the Payment Terms mentioned in the YES-TECH Manual 2023, as amended from time to time.

Table 11: Payment Terms & Timeline

Instalment	Description	Release Timeline
1	Advance 20% of total project cost of corresponding season (Kharif and Rabi separately)	Within 15 working days after the award of the work order/ start of the season
2	10% of total project cost of corresponding season (Kharif and Rabi separately)	Within 15 working days after the submission of the Inception Report (IR)
3	20% of total project cost of corresponding season (Kharif and Rabi separately)	Within 15 working days after the submission of the Mid-Season Report (MSR)
4	30% of total project cost of corresponding season (Kharif and Rabi separately)	Within 15 working days after the submission of the End of Season Report (ESR)
5	20% of total project cost of corresponding season (Kharif and Rabi separately)	If there is no review/ appeal petition – Within 15 days of the last date for filing of review or appeal petition.
		If there is a review/appeal petition, then the amount will be held till such petition attains finality and shall be disbursed accordingly

14.   Penalty

The Government of <name of the State/UT> reserves the right to impose penalties and recover damages from the TIP as per the YES-TECH Manual 2023, as amended from time to time, in case of non-performance of the Agreement by the TIP, breach of the terms of the Tripartite Agreement/tender document/YES-TECH Manual, delay in performance of work or any other non-compliance as contained in the YES-TECH Manual 2023, as amended from time to time.

Table 12: Penalty Calculation (Calculated on Cluster wise-crop wise amount)

Penalty Calculation (Calculated on Cluster wise-crop wise amount)				
S No	Report	Submission Timeline*	No. of Days or part thereof beyond Timeline	Penalty Percentag
1	MSR	Report is delayed by more than 7 days	8	0.50%
			9	1.00%
			10	1.50%
			11	2.00%
			12	2.50%
			13 and more	3.00%
2	ESR	Report is delayed by more than 7 days	8	1.00%
			9	2.00%
			10	3.00%
			11	4.00%
			12	5.00%
			13	6.00%
			14 and more	7.00%

* Timelines, terms and conditions shall be as mentioned in the Tripartite Agreement

Table 13: Illustration for timeline penalty

If MSR Delayed by 4 days over 7 days buffer by L1 Bidder

If ESR is delayed by 5 days over 7 days buffer

(Amount in Rs.)

S. No.	Report	Submission Timeline*	No. of Days or part thereof beyond timeline	Penalty Percentage	L1 Rate Cluster Wise	Report Delayed for No of Clusters	Total Amount	Total Penalty
1	MSR	Report is delayed by more than 7 days	8	0.50%	800	5	4000	80
			9	1.00%				
			10	1.50%				
			11	**2.00%**				
			12	2.50%				
			13 and more	3.00%				
2	ESR	Report is delayed by more than 7 days	8	1.00%	800	3	2400	120
			9	2.00%				
			10	3.00%				
			11	4.00%				
			12	**5.00%**				
			13	6.00%				
			14 and more	7.00%				
							Total	**200**

Table 14: Illustration for Sustained Petition penalty
(Penalty will be calculated on Cluster wise-crop wise amount)

(Amount in Rs.)

S. No.	Report	Review petition Sustained	Penalty Percentage	Cluster Wise L1 Rate	Petition Sustained for No. of Clusters	Total Amount	Total Penalty
1	MSR	If a review petition filed by the State or IC and is sustained by the MITR	3% of the cluster wise cost	800	7	5600	168
2	ESR	If a review petition filed by the State or IC and is sustained by the MITR	3% of the cluster wise cost	800	3	2400	72
		if an appeal petition is filed by the State or IC & is sustained by the YES-TECH Committee Additional	Additional 4% of the cluster Wise cost	800	2	1600	64
						Total	**304**

15.   GENERAL TERMS

15.1.   The Tripartite Agreement (TA) with the successful bidder shall be governed in accordance with the laws of India for the time being in force and will be subject to the exclusive jurisdiction of Courts at <name of the State> (with the exclusion of all other courts).

15.2.   The duration of Tripartite Agreement (TA) shall be for a period of 36 months (3 years) starting from Kharif <YYYY> season to the end of Rabi/Summer, <YYYY> season.

15.3.   The State/UT reserves the right to terminate the Tripartite Agreement (TA) as per termination of TA clause of the YES-TECH Manual 2023, as amended from time to time, if the work is not proceeding in accordance with the terms of TA or the YES-TECH Manual 2023, as amended from time to time, without prejudice to its right to claim damages.

15.4.   At all times during implementation, successful bidder needs to adhere to required compliances under the YES-TECH Manual 2023, as amended from time to time, vis-à-vis security, confidentiality, integrity, and availability and also any guidelines by any regulatory/government agency on the same.

15.5.   Except with the prior written consent of the State/UT Government, the Successful Bidder and its Personnel shall not at any time communicate to any person or entity any confidential information acquired in the course of the Services, nor shall the Successful Bidder and its Personnel make public the recommendations formulated in the course of, or as a result of, the Services. For this purpose, the successful bidder shall execute a Non-disclosure Agreement (NDA) as per Annexure IV.

15.6.   Neither the Tripartite Agreement (TA) nor any rights granted under the Agreement may be sold, leased, assigned, or otherwise transferred, in whole or in part, by the bidder, and any such attempted sale, lease, assignment or otherwise transfer shall be void and of no effect whatsoever.

15.7.   <Name of the State/UT> Government reserves the right to cancel in full or part of the tender at any stage of the tendering process and can go for Re-Tendering or even extend the Cut-off date for submitting the Bids without assigning any reason thereof.

15.8.   <Name of the State/UT> Government reserves the right to alter the requirements specified in the Tender Document. <Name of the State> also reserves the right to delete one or more items from the list of items specified in the tender document. <Name of the State/UT> Government will inform all bidders about changes, if any.

15.9.   Any subject matter not dealt with herein shall be governed by the YES-TECH Manual 2023, as amended from time to time, and in case of any discrepancy between the tender document, the Tripartite Agreement (TA) and the YES-TECH Manual 2023, the provisions of YES-TECH Manual 2023, as amended from time to time, shall prevail and be binding upon all the Parties.

[On the Letter Head of the TIP]

INTEGRITY PACT

Between

Department of (Name of Department) of Government of (Name of State)
hereinafter referred to as "The Principal"

and

M/s <Name of Technology Implementing Partner (TIP)>
hereinafter referred to as "The Bidder".

Preamble

The Principal intends to engage Agency, under laid down organizational procedures, for implementation of YES-TECH in <name of the State/UT>. The Principal values full compliance with YES-TECH Manual 2023, as amended from time to time, and all relevant laws of the land, rules, regulations, economic use of resources and of fairness / transparency in its relations with its Bidder(s).

In order to achieve these goals, the Principal has appointed <Name of the Authority/Contract Management Committee> who will monitor the Bid process and the execution of the Tripartite Agreement for compliance with the Principal mentioned above.

Section 1 – Commitments of the Principal

1. The Principal Commits itself to take all measures necessary to prevent corruption and to observe the following principles: -

  a. No employee of the Principal, personally or through family members, will in connection with the Tender for, or the execution of a Tripartite Agreement, demand, take a promise for or accept, for self or third period, any material or immaterial benefit which the person is not legally entitled to.

  b. The Principal will, during the Tender process treat all Bidder(s) with equity and reason. The Principal will in particular, before and during the Bid process, provide to all Bidder(s) the same information and will not provide to any Bidder(s) confidential /additional information through which the Bidder(s) could obtain an advantage in relation to the Bid process or the execution of Tripartite Agreement.

  c. The Principal will exclude from the process all known prejudiced persons.

2. If the Principal obtains information on the conduct of any of its employees which is a criminaloffence under the IPC / PC Act, or if there be a substantive suspicion in this regard, the Principal will inform the Chief Vigilance Officer/appropriate authority and in addition can initiate disciplinary actions.

Section 2 – Commitments of the Bidder(s)

1. The Bidder(s) commit himself to take all measures necessary to prevent corruption. He commits himself to observe the following principles during his participation in the Bid process and during the Tripartite Agreement execution.

  a. The Bidder(s) will not directly or through any other person or firm, offer, promise or give to any of the Principal's employees involved in the Tender process or the execution of the Tripartite Agreement or to any third person any material or other benefit which he / she is

not legally entitled to, in order to obtain in exchange any advantage of any kind whatsoever during the Tender process or during the execution of the Tripartite Agreement.

b. The Bidder(s) will not enter with other Bidders into any undisclosed agreement or understanding, whether formal or informal. This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bids or any other actions to restrict competitiveness or to introduce cartelization in the bidding process.

c. The Bidder(s) will not commit any offence under the relevant IPC / PC Act, further the Bidder(s) will not use improperly, for purposes of competitive or personal gain, or pass on to others, any information or document provided by the Principal as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.

d. The Bidder(s) of foreign origin shall disclose the name and address of the Agents / representatives in India, if any. Similarly, the Bidder(s) of Indian Nationality shall furnish the name and address of the foreign principals, if any. Further details as mentioned in the "Guidelines on Indian Agents of Foreign Suppliers" shall be disclosed by the Bidder(s). Further, as mentioned in the Guidelines all the payments will be made in Indian Rupees Only.

e. The Bidder(s) will, when presenting his bid, disclose any and all payments he has made, is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the work order.

f. Bidder(s) who have signed the Integrity Pact shall not approach the Courts while representing the matter to <Name of the Authority/Contract Management Committee> and shall wait for their decision in the matter.

2. The Bidder(s) will not instigate third persons to commit offences outlined above or be an accessory to the offences.

Section 3 – Disqualification from Bid process and exclusion from future Contracts

If the Bidder(s), before award or during execution has committed a transgression through a violation of Section 2, above or in any other form such as to put his reliability or credibility in question, the Principal is entitled to disqualify the Bidder(s) from the Tender process or take action as per the procedure mentioned in the "Guidelines on Banning of business dealings".

Section 4 – Compensation for Damages

1. If the Principal has disqualified the Bidder(s) from the Tender process prior to the award according to Section 3, the Principal is entitled to demand and recover the damages equivalent to Earnest Money Deposit / Bid Security.

2. If the Principal has terminated the Tripartite Agreement according to Section 3, or if the Principal is entitled to terminate the Tripartite Agreement according to Section3, the Principal shall be entitled to demand and recover from the TIP damages as per the YES-TECH Manual.

Section 5 – Previous transgression

1. The Bidder declares that no previous transgressions occurred in the last 3 years with any other Company in any country conforming to the anti-corruption approach or with any other Public Sector Enterprise in India that could justify his exclusion from the Tender process.

2. If the Bidder makes incorrect statement on this subject, he can be disqualified from the Tender process or action can be taken as per the procedure mentioned in "Guidelines on Banning of business dealings".

Section 6 – Equal treatment of all Bidders

1. The Principal will enter into agreements with identical conditions as this one with all Bidders and Contractors.

2. The Principal will disqualify from the Tender process all bidders who do not sign this Pact or violate its provisions.

Section 7 – Criminal Charges against violating Bidder(s)

If the Principal obtains knowledge of conduct of a Bidder, or of an employee or a representative or an associate of a Bidder, which constitutes corruption, or if the Principal has substantive suspicion in this regard, the Principal will inform the same to the Chief Vigilance Officer/appropriate authority.

Section 8 – <Name of the Authority/Contract Management Committee>/ Monitors

1. The Principal appoints competent and credible <Name of the Authority/Contract Management Committee> for this Pact after appropriate internal approvals. The task of the Monitor is to review independently and objectively, whether and to what extent the parties comply with the obligations under this agreement.

2. The Monitor is not subject to instructions by the representatives of the parties and performs his functions neutrally and independently. The Monitor would have access to all Tripartite Agreement documents, whenever required. It would be obligatory for him/her to treat the information and documents of the Bidders as confidential. He reports to the _____, Government of <name of the State/UT>.

3. The Bidder(s) accepts that the Monitor has the right to access without restriction to all Project documentation of the Principal including that provided by the Bidder. The Bidder will also grant the Monitor, upon his request and demonstration of a valid interest, unrestricted and unconditional access to his project documentation.

4. The Monitor is under contractual obligation to treat the information and documents of the Bidder(s) with confidentiality. The Monitor has also signed declarations on Non-Disclosure of Confidential Information' and of 'Absence of Conflict of Interest'. In case of any conflict of interest arising at. Later date, the <Name of the Authority/Contract Management Committee> shall inform the _____, GOVERNMENT OF <NAME OF THE STATE/UT> and recuse himself/herself from that case.

5. The Principal will provide to the Monitor sufficient information about all meetings among the parties related to the Project, provided such meetings should have an impact on the contractual relations between the principal and the Bidder. The parties offer to the Monitor the option to participate in such meetings.

6. As soon as the Monitor notices, or believes to notice, a violation of this agreement, he/she will so inform the Management of the principal and request the Management to discontinue or take corrective action, or to take other relevant action. The Monitor can in this regard submit non-binding recommendations. Beyond this, the Monitor has no right to demand from the parties that they act in a specific manner, refrain from action or tolerate action.

7. The Monitor will submit a written report to the _____, GOVERNMENT OF <NAME OF THE STATE/UT> within 8 to 10 weeks from the date of reference or intimation to him by the Principal and, should the occasion arise, submit proposal for correcting problematic situations.

8. If the Monitor has reported to the _____, a substantiated suspicion of an offence under relevant IPC /PC Act, and the _____ has not, within the reasonable time taken visible action to proceed against such offence or reported it to the Chief Vigilance Officer/Appropriate authority.

9. The word 'Monitor' would include both singular and plural.

Section 9 – Pact Duration

The Pact begins when both parties have legally signed it. It expires for the Bidders 6 months after the Tripartite Agreement has been executed. Any violation of the same would entail disqualification of the bidders and exclusion from future business dealings. If any claim is made/ lodged during this time, the same shall be binding and continue to be valid despite the lapse of this pact as specified above, unless it is discharged/determined by GOVERNMENT OF <NAME OF THE STATE/UT>.

Section 10 – Other provisions

1. This agreement is subject to Indian Law; Place of performance and jurisdiction is the Registered Office of the Principal i.e. <Nodal Department Headquarters>.

2. Changes and supplements as well as termination notices need to be made in writing. Side agreements have not been made.

3. If the Bidder is a partnership or a consortium, this agreement must be signed by all partners or consortium members.

4. Should one or several provisions of this agreement turn out to be invalid, the remainder of this agreement remains valid. In this case, the parties will strive to come to an agreement to their original intentions.

5. Issues like Warranty/Guarantee etc shall be outside the purview of <Name of the Authority/Contract Management Committee>.

6. In the event of any contradiction between the Integrity Pact and its Annexure, the clause in the Integrity Pact will prevail.

(For & On behalf of the Principal)   **(For & On behalf of Bidder)**

(Office Seal)   **(Office Seal)**

Place: _____

Date: <DD/MM/YYYY>

Witness 1:

(Name & Address)

Witness 2 :

(Name & Address)

[On the letter head of the TIP]

UNDERTAKING LETTER

To,   Date: <DD/MM/YYYY>

_____,

Department of Agriculture,

Government of <name of State/UT>

_____,

_____

Dear Sir,

Sub: Tender for Implementation of YES-TECH

Having examined the Tender documents including all annexure the receipt of which is hereby duly acknowledged, we, the undersigned, offer to provide the services as mentioned in Tender document in conformity with the said Tender documents and the YES-TECH Manual and in accordance with the financial bid.

H. We understand that the Tender document provides generic specifications about all the items, and it has not been prepared by keeping in view any specific bidder. We have ensured ourselves about the eligibility criteria before submitting the tender.

I. We have read, understood and accepted the terms/ conditions/ rules mentioned in the Tender document and the YES-TECH Manual.

J. We undertake that in competing for and if the award is made to us, in executing the subject tender, we will strictly observe the laws against fraud and corruption in force in India namely "Prevention of Corruption Act 1988".

K. We certify that we are not blacklisted currently by any Government/ Ministry/Department/PSU nor debarred currently from dealing with any company/ public department.

L. We certify that we are registered with all Government /statutory authorities as required in the normal course of business to render similar services.

M. We understand that the Government of <name of the State/UT> is not bound to accept the lowest or any offer it may receive. We also understand that the whole bidding exercise may be scrapped without assigning any reason and it is acceptable to us.

N. Upon being selected as L1 bidder, we undertake to enter into a Tripartite Agreement with the Government of <name of the State/UT> and submit the Performance Security within the timelines prescribed in the tender document. We undertake to comply all the terms and conditions of the tender document and the YES-TECH Manual.

O. We undertake to carry out the Study and the work as per YES-TECH Manual.

P. We understand that if we withdraw or modify our Bids during the period of validity, or if we are awarded the tender and we fail to submit the required performance security before the deadline defined in the request for bids document, we will be suspended for the period of three years from being eligible to submit Bids for tenders with Government of <name of the State/UT> and the EMD shall be forfeited by Government of <name of the State/UT>.

Q. We hereby certify that we have submitted the following documents in the requested format along with this undertaking:

1. Annexure A: A brief description of the agency's background mentioning the address of its registered head office, the address of the local office in India, contact no. (Mobile, landline, fax and email id), names of important persons who may be contacted etc.

2. Annexure B: Certificate of Incorporation/ Registration of Agency/ Memorandum and Articles of Association/Partnership Deed/ Proprietorship Deed/ Declaration of Proprietorship etc. as the case may be.

3. Annexure D: Copy of PAN/TAN card.

4. Annexure E: Proof of Bid Security (EMD) of <Amount in Rs.>

5. Annexure F: Non-Disclosure Agreement

6. Annexure G: Letter of Authority/Power of Attorney/Board Resolution/any other document indicating unequivocable authority to sign and submit the bid.

R. We also understand that Government of <name of the State/UT> has the exclusive right to reject this offer in case Government of <name of the State/UT> is of the opinion that the required information is not provided or is provided in a different format. It is also confirmed that the information submitted is true to our knowledge and Government of <name of the State/UT> reserves the right to reject the offer if anything is found incorrect.

Place:

Date: <DD/MM/YYYY>   (Seal and signature of the authorized signatory of TIP)

FINANCIAL BID

(On the letter head of the TIP)

To,
Date: <DD/MM/YYYY>

_____,

Department of Agriculture,

Government of <name of State/UT>

_____,

_____.

Dear Sir,

In terms of the TENDER document, we submit herewith the following financial bid:

FINANCIAL BID FOR CMM1

S No	Season	Crop	Total No. of Districts (to be filled by the State/UT)	Rate per District in Rs (Excluding GST)	Total Amount
1	Kharif 2023	Paddy			
2	Rabi 2023-2024	Wheat			
		Paddy			
3	Kharif 2024	Paddy			
4	Rabi 2024-2025	Wheat			
		Paddy			
5	Kharif 2025	Paddy			
6	Rabi 2025-2026	Wheat			
		Paddy			
		Grand Total(in figures)			
		Grand Total (in word)			

(Signature and seal of the authorized signatory)

FINANCIAL BID FOR THE CROPS OTHER THAN CMM-1

(Applicable to Madhya Pradesh & Maharashtra only as per YES-TECH Manual)

S No	Season	Crops other than CMM-1	Total No. of Districts (To be filled by State/UT)	Rate per District in Rs (Excluding GST)	Total Amount
1	Kharif 2023	Crop 1			
		Crop 2			
2	Rabi 2023-2024	Crop 1			
		Crop 2			
3	Kharif 2024	Crop 1			
		Crop 2			
4	Rabi 2024-2025	Crop 1			
		Crop 2			
5	Kharif 2025	Crop 1			
		Crop 2			
6	Rabi 2025-2026	Crop 1			
		Crop 2			
		Grand Total(in figures)			
		Grand Total (in word)			

Note:

1. The rates quoted are inclusive of all items as mentioned in the scope of work and all other charges including but not limited to travel, accommodation, mobilization charges, etc.

2. The quoted rates shall be exclusive of GST only.

3. Rates should be quoted **(without any overwriting, correction, error, omission, etc. Correction, if any, should be properly attested by the TIP)** In case of discrepancy, the rates mentioned in the words will be taken for consideration.

4. Where there is a discrepancy between the unit rate and the line-item, total resulting from multiplying the unit rate by the quantity, the unit rate will govern unless, in the opinion of Government of <name of State/UT>, there is an obvious error such as rounding offer, misplacement of a decimal point etc., in which case the line-item total will prevail.

5. The financial bid shall be valid up to **90 days** from the date of opening of the bid.

Place:

Date: <DD/MM/YYYY   (Seal and signature of the authorized signatory of TIP)

NON-DISCLOSURE AGREEMENT (NDA)

between

<Name of State/UT> Government & <Name of TIP>

THIS AGREEMENT is entered into on this ___Day of _<Month>, YYYY,

Between:

<Name of TIP> (Hereinafter referred to as Receiving Party") whose expression shall include its nominees, permitted assigns and legal representatives on the first part

AND

<Name of State/UT > Government (hereinafter referred to as "Disclosing Party"), which expression shall include its successors, permitted assigns and legal representatives on the second part

WHEREAS The <Name of TIP> has been awarded the work of Implantation of YES-TECH framework as brought out by YES-TECH Manual 2023, in the <Name of the State/UT> by virtue of Tripartite Agreement (TA) dated <DD/MM/YYYY>. (Hereinafter referred to as "the Work").

WHEREAS in connection with the Work, it may be necessary or desirable for Disclosing Party to disclose to Receiving Party confidential information relating to Work or the Disclosing Party has already disclosed such information as on the date of execution of this agreement as defined hereinafter ("the Confidential Information"). Now, it is desirable by the Disclosing Party that no use, disclosure or dissemination shall be made or has been made by the Receiving Party to any third party, of the Confidential Information other than in the circumstances specified and permitted hereinbelow by the Disclosing Party. Hence this agreement.

NOW THE AGREEMENT WITNESSETH AS FOLLOWS

Definition of Confidential Information

(a) For purposes of this Agreement, "Confidential Information" refers to any data, document, information etc. of whatsoever nature, supplied by the Disclosing Party, whether proprietary or non-proprietary to the Disclosing Party and not generally known to the public, whether in tangible or intangible form, in whatever medium provided, whether unmodified or modified by Disclosing Party whenever and however disclosed, including, but not limited to: (i) any marketing strategies, plans, financial information, projections, operations, sales estimates, business plans and performance results relating to the past, present or future business activities of the Disclosing Party, its affiliates, subsidiaries and affiliated companies; (ii) plans for products or services, and customer or supplier lists; (iii) any scientific or technical information, invention, design, process, procedure, formula, improvement, technology or method; (iv) any concepts, reports, data, know-how, works-in-progress, designs, development tools, specifications, computer software, source code, object code, flow charts, databases, inventions, information and trade secrets; and (v) any information generated by the Receiving Party that contains, reflects, or is derived from any of the foregoing. Confidential Information need not be novel, unique, patentable, copyrightable or constitute a trade secret in order to be designated Confidential Information. The Receiving Party acknowledges that the Confidential Information may be proprietary or non-proprietary (including information submitted under any NDA with any other entity to whom such information is proprietary) to the Disclosing Party, has been developed and obtained through great efforts by the Disclosing Party and that Disclosing Party regards all of its Confidential Information as trade secrets.

(b) Notwithstanding anything in the foregoing to the contrary, Confidential Information shall not include information which: i) was lawfully possessed except under any NDA, as evidenced by the Receiving Party's records, by the Receiving Party prior to receiving the Confidential Information from the Disclosing Party; (ii) becomes rightfully known by the Receiving Party from a third-party source not under an obligation to the Disclosing Party to maintain confidentiality; (iii) is

generally known by the public through no fault of or failure to act by the Receiving Party inconsistent with its obligations under this Agreement; (iv) is required to be disclosed in a judicial or administrative proceeding, or is otherwise requested or required to be disclosed by law or regulation; and (v) is or has been independently developed by the Receiving Party without violation of the terms of this Agreement, as evidenced by the Receiving Party's records, and without reference or access to any Confidential Information.

Disclosure of Confidential Information

From time to time, the Disclosing Party may disclose Confidential Information to the Receiving Party. The Receiving Party will: (a) keep all Confidential Information strictly confidential by using a reasonable degree of care, but not less than the degree of care used by it in safeguarding its own confidential information; and (b) not disclose any Confidential Information received by it to any third parties (except as otherwise provided for herein).

Use of Confidential Information

The Receiving Party agrees to use the Confidential Information solely and exclusively in connection with the scope of the Work and not for any purpose other than as authorized, with the prior written consent of an authorized representative of the Disclosing Party. No other right or license, whether expressed or implied, in the Confidential Information is granted to the Receiving Party hereunder. Title and all rights including Intellectual Property Rights to the Confidential Information shall be and vest solely in the Disclosing Party. The Confidential Information by the Receiving Party shall be solely used for the purpose of said Work and not for any other purposes whatsoever and any modifications and improvements thereof by the Receiving Party shall be the sole property of the Disclosing Party.

Compelled Disclosure of Confidential Information

Notwithstanding anything in the foregoing to the contrary, the Receiving Party may disclose Confidential Information pursuant to any governmental, judicial, or administrative order, subpoena, provided that the Receiving Party promptly notifies, to the extent practicable, the Disclosing Party in writing of such demand for disclosure so that the Disclosing Party, at its sole expense, may seek to make such disclosure subject to a protective order or other appropriate remedy to preserve the confidentiality of the Confidential Information; provided that the Receiving Party will disclose only that portion of the requested Confidential Information that, in the written opinion of its legal counsel, it is required to disclose under this Para. The Receiving Party agrees that it shall not oppose and shall cooperate with efforts by, to the extent practicable, the Disclosing Party with respect to any such request for a protective order or other relief. Notwithstanding the foregoing, if the Disclosing Party is unable to obtain or does not seek a protective order and the Receiving Party is legally requested or required to disclose such Confidential Information, disclosure of such Confidential Information may be made without liability.

Remedies

The Receiving Party acknowledges that the Confidential Information to be disclosed hereunder is of a unique, sensitive and valuable character and includes all trade secrets, and that the unauthorized dissemination of the Confidential Information would destroy or diminish the value of such information and also impact the business of the Disclosing Party. The damages to Disclosing Party that would result from the unauthorized dissemination of the Confidential Information would be impossible to calculate. Therefore, the Receiving Party hereby agrees that the Disclosing Party shall be entitled to injunctive relief preventing the dissemination of any Confidential Information in violation of the terms hereof. Such injunctive relief shall be in addition to any other remedies available hereunder, whether at law or in equity. The Disclosing Party shall be entitled to recover its costs and fees, including reasonable attorneys' fees, incurred in obtaining any such relief. Further, in the event of litigation relating to this Agreement, the Disclosing Party shall be entitled to recover its reasonable attorney's fees and expenses. As such, the Receiving Party hereby undertakes to indemnify and hold harmless the Disclosing Party from and against any loss or damage suffered, including all costs, expenses, attorney's fees, loss of income, incurred to the Disclosing Party due to breach or noncompliance of the terms and conditions of this agreement

Return of Confidential Information

The Receiving Party shall immediately return and redeliver at its own cost, to the Disclosing Party all tangible material embodying any Confidential Information provided hereunder and all notes, summaries, memoranda, drawings, manuals, records, excerpts or derivative information deriving therefrom, and all other documents or materials ("Notes") (and all copies of any of the foregoing, including "copies" that have been converted to computerized media in the form of image, data, word processing, or other types of files either manually or by image capture) based on or including any Confidential Information, in whatever form of storage or retrieval immediately but not later than 30 days, upon: (i) the completion or termination of the dealings between the parties contemplated hereunder; (ii) the termination of this Agreement; or (iii) at such time as the Disclosing Party may so request; provided however that the Receiving Party may retain such of its documents as is necessary to enable it to comply with its reasonable document retention policies. Alternatively, the Receiving Party, with the written consent of the Disclosing Party may (or in the case of Notes, at the Receiving Party's option) immediately destroy any of the foregoing embodying Confidential Information (or the reasonably nonrecoverable data erasure of computerized data) and, upon request, certify in writing such destruction by an authorized officer of the Receiving Party supervising the destruction).

Notice of Breach

The Receiving Party shall notify the Disclosing Party immediately upon discovery of, or suspicion of, (1) any unauthorized use or disclosure of Confidential Information by the Receiving Party; or (2) any actions by the Receiving Party inconsistent with their respective obligations under this Agreement, and the Receiving Party shall cooperate with any and all efforts of the Disclosing Party to help the Disclosing Party regain possession of Confidential Information and prevent its further unauthorized use, disclosure or dissemination.

Miscellaneous

This Agreement between parties supersedes any prior written or oral agreements relating hereto and can only be amended or modified by subsequent agreement in writing signed by both the Parties.

The construction and performance of this Agreement shall be governed by the laws of India. Both Parties accept the exclusive jurisdiction of the <State/UT Name> courts.

Notwithstanding anything contained herein or in any other agreement/document with respect to the said Work, the provisions of this Agreement shall survive and continue even after the termination or early termination of Tripartite Agreement (TA).

IN WITNESS HEREOF, this Agreement has been executed by the Parties hereto, as of the date first hereinabove stated:

For and on behalf of <Name of the Department>, Government of <Name of State/UT>	For and on behalf of <Name of TIP>
Name: _____	Name: _____
Title: _____	Title: _____
Date: <DD/MM/YYYY>	Date: <DD/MM/YYYY>

List of Abbreviations

ANGRAU	Acharya N. G. Ranga Agricultural University
ARG	Automatic Rain Gauge
AWS	Automatic Weather Station
AY	Actual Yield
BISA	Borlaug Institute for South Asia
CART	Classification and Decision Tree
CCEs	Crop Cutting Experiments
CCM/CHM	Crop Condition Monitoring/Crop Health Monitoring
CHF	Crop Health Factor
CIMMYT	International Maize and Wheat Improvement Center
CRIDA	Central Research Institute for Dryland Agriculture
CROPIC	Collection of Real Time Observations and Photo of Crops
CSM	Crop Simulation Model
CV	Coefficient of Variation
DA&FW	Department of Agriculture and Farmers Welfare
DEM	Digital Elevation Model
DNN	Deep Neural Network
DSSAT	Decision Support System for Agro-technology Transfer
EMD	Earnest Money Deposit
FAPAR	Fraction of Absorbed Photosynthetically Active Radiation
GP	Gram Panchayat
GT	Ground Truth
HARSAC	Haryana Space Applications Centre
HI	Harvest Index
IASRI	Indian Agricultural Statistics Research Institute
ICAR	Indian Council of Agricultural Research
IIT	Indian Institute of Technology
IMD	India Meteorological Department
IP&GIS	Image Processing and Geographical Information System
ISRO	Indian Space Research Organization
IT	Information Technology
IUs	Insurance Units
LSWI	Land Surface Water Index
MAPE	Mean absolute percentage error
MITR	Mentor Institutions for Technology Rollout
MNCFC	Mahalanobis National Crop Forecast Centre
MoA&FW	Ministry of Agriculture and Farmers Welfare
MODIS	Moderate Resolution Imaging Spectro-radiometer
MOSDAC	Meteorological and Oceanographic Satellite Data Archival Centre
MSA	Mid-Season Adversity
NAS	Network Attached Storage
NASA	National Aeronautics and Space Administration
NBSSLUP	National Bureau of Soil Survey & Land Use Planning

NCIP	National Crop Insurance Portal
NDA	Non-Disclosure Agreement
NDVI	Normalized Difference Vegetation Index
NESAC	North Eastern Space Applications Centre
NIR	Near Infrared
NN	neural network
NRMSE	Normalized Root Mean Square Error
NRSC	National Remote Sensing Centre
NSIC	National Small Industries Corporation
NSO	National Statistical Office
OUAT	Orissa University of Agriculture and Technology
PAR	Photosynthetically Active Radiation
PBG	Performance Bank Guarantee
PJTSAU	Prof. Jayashankar Telangana State Agril University
PMFBY	Pradhan Mantri Fasal Bima Yojana
PROBA	Project for On-Board Autonomy
RF	Random Forest
RMSE	Root Mean Square Error
RS&GIS	Remote Sensing and Geographical Information System
RUE	Radiation Use Efficiency
RVI	Radar vegetation index
SAC	Space Application Centre
SAN	Storage Area Network
SAUs	State Agricultural Universities
SLA	Service Level Agreement
SMAP	Soil Moisture Active Passive
SOP	Standard Operating Procedure
SPOC	single point of contact
SRSACs	State Remote Sensing Application Centers
SRTM	Shuttle Radar Topography Mission
SVM	Support Vector Machine
SWIR	Shortwave Infrared
T Scalar	Temperature Scalar
TIP	Technology Implementation Partners
TNAU	Tamil Nadu Agricultural University
TY	Threshold Yield
UAV	Unmanned Aerial Vehicle
VCI	Vegetation Index
W scalar	Water Scalar
WINDS	Weather Information Network Data System
WOFOST	World Food Studies Simulation Model
WRF	Weather Research & Forecasting

SECTION 3
Tripartite Agreement

Implementation of YES-TECH

under

Pradhan Mantri Fasal Bima Yojana (PMFBY) & Restructured Weather Based Crop Insurance Scheme (RWBCIS)

Tripartite Agreement (TA)

among

Department of <Name of Department> of Government of <Name of State/UT>,

and

<Name of MITR Organisation> MITR.

and

<Name of Technology Implementing Partner (TIP)>,

TA Period: _____

Tripartite Agreement

This Tripartite Agreement (hereinafter called the "Agreement/TA") is Made on the ___ day of _____ 2023, between the Department of Agriculture, Government of <Name of State/UT>, <Department Address> (hereinafter referred to as "Department" which expression shall, unless repugnant to the context or meaning thereof, be deemed to mean and include its successors and permitted assigns), as the First Party

And

(Name of MITR), having its Head Office at (address of office), (hereinafter referred to as "Mentor Institutions for Technology Rollout (MITR)" which expression shall, unless repugnant to the context or meaning thereof, be deemed to mean and include its successors and assigns) as the Second Party;

And

(Name of TIP), having its Head Office at (address of office), (hereinafter referred to as "TIP" which expression shall, unless repugnant to the context or meaning thereof, be deemed to mean and include its successors and assigns) as the Third Party.

(The Department, MITR and TIP shall be collectively referred to as "Parties" and individually as a "Party".)

Whereas

1. Government of (Name of State/UT) AND Government of India (GoI) have decided to execute YES-TECH project under the national scheme, Pradhan Mantri Fasal Bima Yojana (PMFBY), across the State/UT of <Name of State/UT>, for technology-based yield estimation at IU level.

2. Government of (Name of State/UT) has selected/nominated <Name of the MITR> as MITR, for providing mentorship for the overall implementation of YES-TECH in the State/UT.

3. The MITR is national/state level body in the business of research and development, education and innovation which inter alia includes collection and analysis of remote sensing and weather datasets for crop mapping, crop yield estimation and crop damage assessment.

4. Government of (Name of State/UT) floated bids for the execution of YES-TECH in the State/UT on <DD/MM/YYYY> and the <Name of the WIP> has been selected as L1 bidder.

   'Or'

   The Government of (name of State/UT) has nominated <Name of the TIP> from the TIPs

   empaneled by the YES-TECH Committee, for implementation of YES-TECH.

5. The TIP is in the business of research and development and innovation inter alia includes collection and analysis of remote sensing and weather datasets for crop mapping, crop yield estimation and crop damage assessment.

6. Mahalanobis National Crop Forecast Centre (MNCFC), Department of Agriculture and Farmers Welfare (DA&FW), Ministry of Agriculture and Farmers Welfare (MoA&FW), GoI, is the nodal agency and will serve as the secretariat of the YES-TECH Committee, managing day-to-day matters and acting as the Single point of Contact (SPOC) with the GoI for all YES-TECH related activities and implementation of the said project and Programme.

7. Execution of YES-TECH will be done as per the YES-TECH manual notified by DA&FW, MoA&FW, GoI, under PMFBY, commencing from Kharif 2023 onwards, the terms and conditions of the YES-TECH manual as notified by DA&FW, MoA&FW, GoI, including any subsequent amendments thereof, shall also form part and parcel of the present agreement.

8. The Parties shall carry out all the activities, duties and responsibilities) as outlined in the YES-TECH manual published and circulated amongst all stakeholders under PMFBY, vide letter <insert letter number and date> and as per the terms of tender floated by the Government of <name of the State/UT>.

9. The Parties shall execute the work under this Tripartite Agreement in compliance of all prevailing and applicable Laws/Rules/Regulations/Guidelines as amended from time to time

10. Government of (Name of State/UT) shall be the custodian of all the information/datasets created on implementation of the individual project(s), as posed by and sanctioned by DA&FW, MoA&FW, GoI.

11. Government of (Name of State) have authorized the TIP to operate and maintain these information/datasets for YES-TECH implementation in the project areas and shall be governed by Data sharing protocols of the YES-TECH Manual 2023, as amended from time to time.

12. The "Parties" agree to implement YES-TECH as above and conforming with the YES-TECH Manual 2023, as amended from time to time.

13. Any provision not specifically provided under this Agreement shall be governed by the YES-TECH Manual 2023, as amended from time to time.

NOW, therefore, in consideration of the premises and mutual, covenants and conditions set-forth herein (which shall form an integral part of this Agreement), it is hereby agreed by and amongst the "PARTIES" as follows:

1. Preamble

1.1. <Brief description of the Project>

1.2. Brief Description of the Department, Government of <Name of State/UT>

1.3. Brief Description of the MITR < Name of the Organization>

1.4. Brief Description of the TIP < Name of the Organization>

1.5. Roles and Responsibilities of the Parties

The Parties shall be bound by the roles and responsibilities as provided in the YES-TECH Manual 2023, as amended from time to time.

2. Authorized Signatories

Party	Authorized Signatory

2.1. Functionaries and Contact Addresses

The addresses and contact details of functionaries who will serve as nodal officers for carrying out YES-TECH execution, coordination and monitoring

\<Name of State/UT Department\>, Government of \< Name of State/UT\>

S. No.	Name	Contact Address	Telephone/ Fax	e-mail
1				
2				
3				

\<Name of MITR\>

S. No.	Name	Contact Address	Telephone/ Fax	e-mail
1				
2				
3				

\<Name of TIP\>

S. No.	Name	Contact Address	Telephone/ Fax	e-mail
1				
2				
3				

3.   Date of Signing, Effective Date and Duration of Agreement

The term of this Agreement shall be for a period of _____ years/months and shall be effective from \<DD/MM/YYYY\>.

4.   Payment Terms

The Department will release funds for implementing YES-TECH to MITR and TIP as per the Payment Terms mentioned in the YES-TECH Manual 2023, to meet the expenditure incurred upon for carrying out the services described in the YES-TECH Manual 2023, as amended from time to time.

5.   Project Management (Scope of Activities)

5.1.   The TIP shall create a dedicated team for implementation of project for providing all necessary information including physical & financial progress related to the projects, arrange to get relevant orders/clearances from the state Govt., enhance level of awareness and redress grievances of public & public representatives in the project areas.

5.2.   The TIP shall carry out all the activities as outlined YES-TECH Manual 2023, as amended from time to time, in conjunction with the terms and conditions of the model tender document floated by Government of (name of State).

6.   Timelines / Deliverables (Reports)

6.1.   The TIPs will submit the following technical reports (Cluster wise) at pre-defined intervals as per the YES-TECH Manual 2023, as amended from time to time, conforming with the Seasonality Discipline, for review by the State department, MITRs and Insurance Companies:

- Inception Report (IR)

- Mid-Season Report (MSR)

- End of Season Report (ESR)

- Special Reports (SR)

6.2. TIP shall take all necessary steps to complete the project(s) within the approved time frame starting from the date of award of project.

6.3. The performance evaluation of the TIP shall be done as per the Monitoring and Evaluation (M&E) framework, as described in the YES-TECH Manual 2023, as amended from time to time.

7.   Dispute Resolution

All disputes between the Parties, arising out of or in connection to this TA shall be governed by the dispute resolution mechanism as mentioned in the YES-TECH Manual 2023, as amended from time to time.

8.   Implementation of the Agreement

All discretions to be exercised and directions, approvals, consents and notices to be given and actions to be taken under these presents, unless otherwise expressly provided herein, shall be exercised and given by the signatories to this Agreement or by the Authorized representative(s) that each party may nominate in this behalf and notify in writing to the other party by Registered Post. Any other nomination of Authorized representative(s) and/or changes in designation shall be informed likewise in writing to/ the Department within one month of signing of the Agreement. Any changes in designations/ registered office address shall be intimated in writing to all concerned parties.

9.   Penalty & Damages

The Government of <name of the State/UT> reserves the right to impose penalties and recover damages from the TIP per the YES-TECH Manual 2023, as amended from time to time, in case of non-performance of the Agreement by the TIP, breach of the terms of this Agreement/tender document/YES-TECH Manual, delay in performance of work or any other non-compliance as contained in the YES-TECH Manual 2023, as amended from time to time.

10.   Intellectual Property Rights

The State/UT Government and the GOI shall, jointly and severally own all right, title and interest in the study, reports including but not limited to Inception Report (IR), Mid-Season Report (MSR), End Season Report (ESR) and all data or information created in implementation of YES-TECH. Each Party shall own and retain all rights in its own IP including trademarks, logos and other brand elements. The TIP and MITR shall have access to data and information exclusively for the purpose defined in YES-TECH Manual and this Agreement. To the extent a party grants any rights or licenses of its IP to the other party in connection with this Agreement, the other party's use of such IP shall be for the purpose as agreed by Parties in writing. Each Party will ensure appropriate protection of their respective intellectual property rights. The original information, the methodology adopted, original data, derived data, the originals of any reports and documents or materials prepared, or inventions or information produced as a result of the services and all intellectual property rights therein, unless otherwise specifically stated in the YES-TECH Manual 2023, as amended from time to time, and this agreement, shall be and shall remain exclusive property of the <Name of the State/UT> Government and the GOI, jointly and severally, as per the Data Sharing Protocols of the YES-TECH Manual 2023, as amended from time to time. Each Party will ensure appropriate protection of intellectual property

rights generated from cooperation pursuant to this Agreement, consistent with laws, rules, and regulations of India.

11. Confidentiality

Except with the prior written consent of the <Name of the State/UT> Government, the TIP shall not at any time communicate to any person or entity any confidential information acquired in the course of implementation of YES-TECH Manual, nor shall the TIP and its Personnel make public the recommendations formulated in the course of, or as a result of, the execution of this Agreement. For this purpose, the Parties shall execute a Non-disclosure Agreement (NDA) in the prescribed format.

12. Notice(s)

All notices required or referred to under this Agreement, shall be in writing and signed by the respective authorized signatories of the parties mentioned herein above, unless otherwise notified. Each such notice shall be deemed to have been duly given if delivered or served by registered/speed post of Department of Posts to the respective heads on the addresses mentioned in the recital.

13. Termination

13.1. Either party shall be entitled to terminate the Tripartite Agreement (TA) under specific situations and conditions as mentioned below, with an advance notice of ninety (90) days prior to commencement of the crop season that follows. However, the TA cannot be terminated within the ongoing season. The special conditions that invite termination of TA are as follows:

4. In case, the TIP is debarred/black-listed/de-empaneled by the YES-TECH committee.

5. Failure of the State/UT and/or the TIP in performing one's core responsibilities as prescribed in the YES-Tech Manual.

6. Any material changes in the YES-TECH parameters as listed in the empanelment criteria of TIPs and their roles and responsibilities, by the Centre/State/UT.

13.2. However, termination of TA by either party due to any reason not listed above shall be taken up by the concerned State/UT govt. with the approval of competent authority, as per their financial rules.

14. Indemnification

14.1. Each party agrees to indemnify and keep indemnified the other party from and against all claims, losses, injuries, liabilities, reasonable costs and expenses, damages, actions or proceedings which may be made or taken against such indemnified party by any third party arising out of the breach of this Agreement, non-performance of the Agreement or non-compliance of any statutory compliances by the indemnifying party.

14.2. The TIP shall, at its own cost and expenses, defend and indemnify the <Name of the State/UT> Government against all third-party claims including those of the infringement of intellectual property rights, including patent, trademark, copyright, trade secret or industrial design rights, breach of confidentiality, arising from the performance of the Tripartite Agreement.

15. Relationship between the Parties

15.1. Parties to this Agreement are independent Parties and nothing in this Agreement shall make them Parties to a joint venture, partners, employee, agents, or representatives of the other Party hereto, none of the Parties shall make any representation that implies otherwise.

15.2. Each Party assures, agrees, confirms, and undertakes that during the term of this Agreement and after the termination or expiration of this Agreement, it shall not make any statement verbally or in writing or in any other form or manner which may in any manner whatsoever contrary to factual detail, which could cause harm, damage or be detrimental to the reputation or goodwill or brand value or business or clients of such other Party.

16.   Jurisdiction & Governing Law

The competent Courts of <Name of City/State> shall have exclusive jurisdiction in all matters relating to or arising out under these presents and the Parties shall be governed by the laws prevailing in India.

17.   Force Majeure

Neither Party shall be liable for any delay or failure to perform any duty or obligation it may have pursuant to this Agreement, if such delay or non-performance is attributable to a an event which is beyond the reasonable control of a Party, is not foreseeable, is unavoidable and not brought about by or at the instance of the Party claiming to be affected by such events including, but not limited to, war, riots, civil disorder, earthquake, fire, explosion, storm, flood or other extreme adverse weather conditions, strikes, lockouts or other industrial action (except where such strikes, lockouts or other industrial action are within the power of the Party invoking Force Majeure). In case of a Force Majeure event the Party affected by the Force Majeure shall notify the other Party thereof without undue delay. Performance deadlines under this Agreement shall be extended for a period of time equivalent to the duration of the Force Majeure event; provided, however, that if the Force Majeure event, in the aggregate, lasts for a period of more than 30 days, the other Party, at its option, may terminate this Agreement upon written notice to the affected Party.

18. Amendments

This Agreement hereto, constitute the sole record of the agreement between the Parties in relation to the subject matter hereof. Neither Party shall be bound by any express, tacit, or implied term, representation, warranty, promise or the like not recorded herein or in the YES-TECH Manual 2023, as amended from time to time. This Agreement supersedes and replaces all prior commitments, undertakings, or representations, whether oral or written, between the Parties in respect of the subject matter hereof. No addition to, variation, novation or agreed cancellation of any provision of this Agreement shall be binding upon the Parties unless reduced to writing and signed by or on behalf of the Parties.

IN WITNESS WHEREOF the parties have executed these presents through their authorized Representative at _____.

Signatures			
Name of the Authorized Signatory			

Party	For and on behalf of <Name of the Department>, Government of <Name of State/UT	For and on behalf of <Name of MITR>	For and on behalf of <Name of TIP>
Date			

Witness 1.

Witness 2.

कृषि रक्षक

Pradhan Mantri Fasal Bima Yojana

DEPARTMENT OF AGRICULTURE & FARMERS WELFARE
MINISTRY OF AGRICULTURE & FARMERS WELFARE
GOVERNMENT OF INDIA

Please write us at
Secretariat YES-TECH
Mahalanobis National Crop Forecast Centre

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