Report

of the Committee

to draft

Guidelines for setting up Automatic Weather Stations (AWSs) and Automatic Rain Gauge (ARG) by private agencies and their accreditation, standardization, validation and quality management of weather data etc.

Submitted to

Department of Agriculture & Cooperation,

Ministry of Agriculture, Government of India

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PREFACE

Ever since the introduction of weather indexed crop insurance in India, there have been many challenges confronted in respect of siting and installation for Automated Weather Stations (AWS) / Rain Gauges and recording, transmission and validation of weather data. There are guidelines issued by World Meteorological Organization (WMO) and India Meteorology Department (IMD) for AWS siting, installation norms, data recording, quality control, validation etc. But these guidelines are applicable for weather stations used for the purpose of research or for weather monitoring and forecasting. Here, we have a different purpose at hand i.e. capture and dissemination of weather data for crop insurance. With the advent of weather based crop insurance, there is an urgent need to increase the density of AWS which is currently being fulfilled by the private weather data service providers. This has brought into focus the absence of norms for siting of AWSs and ensuring data quality. This report attempts to draft the guidelines for AWS siting, installation and weather data quality and management for insurance purpose.

Agriculture in India is prone to a variety of risks and most of the farmers are small and marginal. Weather plays a critical role in production of various crops. Weather indexed crop insurance is designed to compensate the farmers in the event of variation in weather parameters which adversely impact crop yield. Though weather indexed crop insurance works on the assumption of strong yield-weather correlation for most of the crops, the correlation is not so well defined at micro level for every crop. At present weather index based insurance is implemented on area approach basis and data recorded at an AWS usually is applied for insured farms within a radius of 10-15 kilometer. As a result, weather experienced at the farm may be different from the weather recorded by the AWS. Thus a farmer who has suffered loss due to an adverse weather event may not be eligible for claim as the AWS has not captured the weather event as experienced at his farm. This leads to dissatisfaction among farmers and ultimately the veracity of weather data and/or appropriateness of AWS siting/ installation is questioned.

The Committee, throughout the interactions and discussions, kept in view the specific purpose i.e., the use of AWS data for weather index based insurance. It also took note of the practical difficulties encountered in obtaining suitable safe and secure locations for installing AWSs. In the process WMO and IMD guidelines have been relaxed without compromising on the need for data accuracy and quality to the extent required for crop insurance purpose.

In order to formulate its recommendations the Committee considered the views and suggestions of stakeholders and experts received through MoA as a feedback on the draft report.

We wish to express our deep gratitude to the Ministry of Agriculture, Government of India for taking the initiative in constituting the Committee to draft guidelines for AWS installation for weather index based insurance.

Dr Ashish Bhutani, Joint Secretary, Department of Agriculture and Cooperation, Ministry of Agriculture and Cooperation participated enthusiastically in the deliberations of the Committee and provided all possible help. Shri H.P. Verma, Consultant (former Chief Director), MoA also contributed to a great deal and facilitated the smooth functioning of the Committee.

The Committee would like to express its deep sense of appreciation for the valuable contribution of Dr. K. K. Singh, Shri S. C. Bhan, Shri R. R. Mali and Shri B. S. Tyagi from IMD, Shri N Radhamadhav from NCML and Shri M. K. Poddar and Shri Ashok Yadav from AIC who assisted in the working of the Committee and preparation of the Report.

Subject to Dissent Note.

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Chairman cum Managing Director	Director General of Meteorology	Managing Director & Chief Executive Officer
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(Chairman)	**(Member)**	**(Member)**

Abbreviations used

AIC	Agriculture Insurance Company of India Limited
ARG	Automatic Rain Gauge
AWS	Automatic Weather Station
CMD	Chairman cum Managing Director
DGM	Director General Meteorology
GoI	Government of India
ICAR	Indian Council of Agricultural Research
IMD	India Meteorological Department
MoA	Ministry of Agriculture
NCML	National Collateral Management Services Limited
QC	Quality Control
PHC	Primary Health Centre
PM	Preventive Maintenance
RCC	Roller-compacted concrete
UTC	Universal Time Coordinate
WBCIS	Weather Based Crop Insurance Scheme

List of Annexures

Annexure I: GoI letter constituting the Committee

Annexure II: GoI letter seeking views of various stakeholders

Annexure III: Views of various stakeholders

Background:

Weather Based Crop Insurance Scheme (WBCIS) is being implemented since Kharif 2007 season. WBCIS is subsidized programme with varying subsidies in premium, which is equally shared by the Centre and concerned State. Over a period of last 7 years, the size/ level of coverage of WBCIS has increased and covered about 10-12% of the country's total number of operational holdings during 2013-14.

Weather insurance scheme assumes that there is a strong correlation between yield and weather, and it is possible to estimate the yield losses by capturing the weather deviations. In view of this, WBCIS was piloted for those crops where the yield and weather correlation is strong. While traditional crop Insurance specifically indemnifies the cultivator against shortfall in crop yield, WBCIS is based on the fact that weather conditions affect crop production even when a cultivator has taken all the care to ensure good harvest. Historical correlation studies of crop yield with weather parameters help us in developing weather thresholds (triggers) beyond which crop growth and yield is adversely impacted. Payout structures are developed to compensate cultivators to the extent of losses deemed to have been suffered by them using the weather triggers. In other words, WBCIS uses weather parameters as 'proxy' for crop yields in compensating the cultivators for deemed crop losses. One serious challenge of weather insurance is 'basis risk', which broadly corresponds to difference in the weather experienced at the location of weather station and the farm (field) which is referenced to the weather station under the scheme. In other words, the farms closer to the location of weather station tend to experience almost similar weather and therefore the 'basis risk' is lower. Given that the weather aberrations are on the rise and the patterns are changing at micro level, the effectiveness of weather insurance can be enhanced only by enhancing the density of reference weather station network. Crops within a radius of 5 km from a weather station could be insured with reasonable reduction in basis risk, and anything beyond 5 km tend to increase the uncertainty in terms of increased 'basis risk'. Assuming 5 km radius, about 40,000 weather stations would be required at the national level to service WBCIS. Given the enormity of the task, private weather data providers have entered the market to supply the data to the insurance companies at a fee. However, in order to fully utilize the public network of weather stations, insurance companies are using the data from private network only in areas where public weather stations are not available. At present different State Governments have prescribed different guidelines for distances to be covered by an AWS and most of the State Governments

recommend 10 to 15 Km radial distance for every AWS. Along with the weather stations the country would also need ARGs to provide a reliable weather data base. While a 10 KM radius from a weather station may be adequate in respect of terrains which are plain in nature and have a similar geography, in hilly, mountainous regions, or where the terrain varies intermittently, the distance of weather stations may have to be reduced to a radius of 5 Km.

With the increase in the number of private weather data providers there is a need to stipulate norms/standards in weather station set up, maintenance and data accuracy. Initially the Government desired IMD to undertake this task of weather station accreditation and validation process. However, IMD could not agree to take up the task because of its preoccupation with more important and urgent tasks.

Constitution of Committee and its TOR:

In view of above, Ministry of Agriculture vide its letter dated 25th April 2011 (Annexure I) set up a committee to draft **guidelines for setting up Automatic Weather Stations (AWSs) and Automatic Rain Gauge (ARG) by private agencies and their accreditation, standardization, validation and quality management of weather data etc.** as its Terms of Reference (TOR). The TOR also envisaged that such accreditation and validation process could be entrusted to one or more third parties with requisite experience and resources.

The composition of the Committee is as follows:

1. Chairman cum Managing Director, Agriculture Insurance Company of India - Chairman.
2. Head (Agromet Services), India Meteorological Department - Member.
3. Managing Director & CEO, National Collateral Management Services Limited - Member.

The usage of weather data under weather insurance is to measure the expected yield losses on account of weather aberrations. This being the case perhaps the weather stations used for weather insurance purpose need not have the same level of sophistication and standards as required by IMD for climatological and forecasting purposes. Under weather insurance the parameter used are rainfall (volume, number of rainy days, dry spell and wet spell), temperature, humidity, sunshine and wind speed.

Procedure adopted by the Committee:

The Committee through its various meetings deliberated thoroughly, prepared and submitted the draft report to Ministry of Agriculture in January 2012 covering following aspects

i. AWS equipments standards
ii. AWS installation standards & maintenance standards and
iii. Guidelines for third party accreditation and data certification services

The Ministry of Agriculture, GoI uploaded this report on its website and sought the views of various stake holders including the State Governments, ICAR, and private Insurance companies on the draft report submitted by the Committee. The views received from the stakeholders are annexed to this report. IMD also organized a Brainstorming Session on Integration of Automatic Weather Station under National Umbrella on 3 September 2012 at Pune to address various related issues. Almost all the important stakeholders participated in the session including state government representative, private insurance companies, private weather data service providers, MoA, ICAR, and IMD etc. and provided important feedback for consideration by the Committee.

The Committee in its subsequent meetings examined all the comments/ views received from different stakeholders on the draft report. The difficulties and constraints in implementation presented by members and other experts participating in the meetings were debated to finalize the report on 'Guidelines/ system protocol for setting up Automatic Weather Station (AWSs) and Automatic Rain Gauge (ARGs) & their accreditation, standardization, validation and quality management of weather data' for implementation of Weather Based Crop Insurance Scheme (WBCIS) by Ministry of Agriculture.

Section 1: Deliberations of the Committee

The committee deliberated at length on the views received from the stake holders on the draft report submitted by the Committee, and also the difficulties/limitation/constraints presented by members and others. This chapter contains the observations of Committee.

Final guidelines prepared by the Committee are given in section-2. While suggesting the guidelines on AWS siting conditions, AWS Sensors accuracy, data handling and validation, Maintenance & Calibration processes and Accreditation Regulatory Authority, the Committee understands that some of the ideal conditions may not be completely practical for meeting such large network of stations as envisaged under the WBCIS scheme meant to be implemented across the country. Purchase of small parcels of open lands meeting such siting conditions across the country by the service providers and securing such open places against vandalism, theft, curiosity, etc., may be a difficult proposition, for achieving such siting conditions, which may involve huge costs to all the parties involved.

The Committee took note of the following facts given the remoteness of the locations:

1.1 That existing service providers face major challenges in finding sites that are ideal from the weather data point of view and data security.

1.2 That even where weather stations are fenced, security remains an issue as there are instances of fencing being broken and parts of the weather stations having been damaged/stolen.

1.3 That in such circumstances weather data service providers have been installing the AWS under the care of "host" – a farmer whose house is on the periphery/outskirts of the main village, abutting the farms, where the weather station is installed at a height 7 to 10 feet, and who is given the responsibility to provide security to prevent damage as well as prevent tampering and also to reduce the costs associated with acquisition of land, civil works, fencing, painting, and round the clock security as these items have a direct bearing on the cost of weather data services.

1.4 Unattended weather stations even when fenced are susceptible to damage or data tampering.

In the past even where State Governments have come forward to provide sites, it has been observed that such sites, such as Panchayat offices, Government School premises, PHC

premises etc., are in the midst of the village and may not meet the siting guidelines with regards to open and obstruction-free grounds at some places.

It is also brought to the notice of the Committee that very often State Governments notify the districts for the implementation of the Scheme just at the beginning of the season which will not provide sufficient time for the service provider to search for ideal location meeting the stipulated siting conditions.

Section 2: Recommendations of the Committee

After due deliberations following recommendations on aspects related to Installation, Maintenance, Calibration, Data Validation, quality management and Certification Agency are proposed by the committee;

2.1 Siting, Exposure and Installation

The siting and exposure of AWS/ARG should be as per recommendation of IMD/WMO as described in following sub-sections. However, the committee noted that one of the impediments that led to installation of AWS/ARG on roof tops was non-availability of suitable land/site. Hence, the committee recommends that the state governments/ local bodies may facilitate WBCIS through providing suitable sites free of charge for installation of AWS/ARG which are of paramount importance for successful implementation of the scheme. The data providers may enter into a suitable MoU with state governments/ local bodies and provide data to local bodies on real time basis for their use, display etc.

2.1.1 Automatic weather station siting considerations

2.1.1.1 The general principle is that a station should provide measurements of weather parameters of the site that are, and will remain representative of the surrounding area for WBCIS.

2.1.1.2 The AWS is to be located on a level piece of ground, covered with short grass or natural earth ideally **5 m x 7 m** in dimension.

2.1.1.3 In the case of an Automatic Rain-gauge Station (ARG) the size of the plot may be **3 m x 4 m.**

2.1.1.4 The proposed AWS site must be free from obstructions like tall buildings, trees etc.

2.1.1.5 The site should be free from any encumbrance.

2.1.1.6 Surroundings should be assessed for potential obstructions to selected sensors. Potential sensor contaminants (e.g., water and dust sources) should be identified & avoided.

2.1.1.7 The site should be located on the same level as the roadway of the station.

Conditions to be avoided:-

2.1.1.8 Rooftops, steep slopes, sheltered hollows, high vegetation, shaded areas or swamps.

2.1.1.9 Obstructions like tall buildings, trees etc.

2.1.1.10 Locations of the site on the edge of a slope, hillocks, cliff or inside a valley

2.1.1.11 Large industrial heat sources

2.1.1.12 Low places holding standing water after rains

2.1.1.13 Underground obstructions like buried cables or conduits

2.1.2 Exposure conditions for sensors:

2.1.2.1 Wind speed and direction

2.1.2.1.1 The wind speed and direction sensors are required to be installed on a mast, at a height of 10 feet from ground level.

2.1.2.1.2 The sensors are required to be located on the mast, which is installed at a distance of at least ten times the height of nearby buildings, trees or other obstructions.

2.1.2.2 Air temperature and Relative Humidity

2.1.2.2.1 The standard measurement height for air temperature and relative humidity sensor is 2 m.

2.1.2.2.2 The sensor is to be located at a distance of at least two times the height of obstructions like trees, buildings etc.

2.1.2.2.3 Large paved areas, bitumen surfaces in the vicinity of at least 30 m have to be avoided.

2.1.2.3 Rainfall

2.1.2.3.1 The rainfall sensor is placed in an open area at a minimum distance of two times the height of any obstruction.

2.1.2.3.2 The standard measurement height is 30 cm above ground level.

2.1.2.3.3 In places where flooding is more, the height may be 1 m from the ground level.

2.2 Enclosure

The approach to the site should be free of obstacles like bushes, trees etc.

2.2.1 The barbed wire fencing of the AWS/ARG site should be done in such a manner that it ensures the safety of the instruments in the remote locations.

2.2.2 The instrument should be beyond the reach of animals.

2.2.3 The site should be easy to access.

2.2.4 Barbed wire fencing should be used for the enclosure for unobstructed flow of wind.

2.3 Tower Foundation This is the platform on which the life of the AWS/ARG system is dependent. It should be built strong enough with RCC to sustain the weight of the mast of the AWS/ARG instruments even in adverse weather.

2.3.1 Rain Gauge foundation The foundation of the rain-gauge should be such that it can sustain the sensor even in the case of very heavy rain. The orientation of the sensor should not be perturbed in case of heavy rain. Sensor should be levelled properly using spirit level.

2.3.2 Anchor Rod and Guy rope In case of AWS system, the anchor rod supports the AWS mast. It should be rugged & strong.

2.3.3 Local Earth points

It is a common experience that most of the outdoor instruments start malfunctioning because of the improper earth points. It should be done in such a manner that it protects the AWS from the electrical surges, lightning induced transients. It is recommended to use latest technology of chemical earth points rather than providing conventional earth points. Separate earth points for power, signal & lightening is required to be provided at each site.

2.3.4 Painting

To protect the AWS from environmental hazards and avoid rusting, the AWS and its various components should be painted white accordingly.

2.4 Sensors Specifications

The AWS sensor details and characteristics to record necessary weather parameters as per standard requirement for weather based crop insurance are:

Parameter	Desirable Height above which it is to be installed	Characteristics(Range, Accuracy, Resolution)
Air temperature	2 m	-5^{0}C to +60^{0}C, Accuracy: ± 0.1^{0}C, Resolution: 0.1^{0}C (plains). -20^{0}C to +60^{0}C, Accuracy: ± 0.1^{0}C. Resolution: 0.1 ^{0}C (hills).
Relative humidity	2 m	0% to 100%, Accuracy: ± 3%, Resolution: 1%.
Rainfall	0.6 to 1 m	Accuracy: (+/-) 2% of true value up to 50 mm/hr, (+/-) 5% of true value for > 50mm/hr and <=100 mm/hr and +/- 10% of true value for > 100 mm/hr, Resolution: 0.5
Wind speed	3m (10 ft)	0 to 60 m/sec, Accuracy: ±5%, Resolution: 0.1 m/s.
Wind direction	3m (10 ft)	0 to 360°, Accuracy: ±5°, Resolution: 5°.

2.5 General Guidelines for the format of the data

To report daily weather data, a day will be defined from 03 UTC of previous day to 03 UTC of the current day, as followed by IMD. Both the temperature and rainfall will be reported up to one point after decimal.

The general guidelines for the transmission of the data are:

2.5.1 One minute averaged value with sample taken at say every 10 seconds.

2.5.2 Averaged value of air temperature in degree Celsius at every 1 minute interval and at every full hour UTC. One minute averaged value with samples taken at every 10 seconds prior to observation.

2.5.3 Maximum air temperature of the hour (with instantaneous samples taken every minute).

2.5.4 Minimum air temperature of the hour (with instantaneous samples taken every minute).

2.5.5 Daily maximum temperature.

2.5.6 Daily minimum temperature.

2.5.7 Averaged wind speed in km/hour at every **1 minute** interval with samples taken every second.

2.5.8 Vector averaged wind direction in degrees at every **10 minute** interval with samples taken every second for 1 minute prior to observation time.

2.5.9 Daily minimum and maximum wind speed based on 1 minute observations of the day

2.5.10 Peak wind gust (Maximum observed wind speed during one hour i.e. wind extreme in last one hour with samples taken at every 10 sec.)

2.5.11 Averaged value of RH in % at every **1 minute** interval and at full hour UTC. One minute average value with samples taken at say every 10 seconds prior to observation.

2.5.12 Daily maximum and minimum value of Relative Humidity with samples taken at every minute.

2.5.13 Derived parameter (dew point etc.) at an interval of every 1 minute and at full hour UTC

2.5.14 Hourly and daily rainfall ending at 03 UTC.

2.5.15 Battery voltage (hourly)

2.6 Data transmission and Reception

Data transmitted from each AWS is to be received, in near real time, using any suitable mode of communication at a centralised data receiving station facility to be established by the weather data service provider, for further work on data quality and data dissemination.

2.7 Quality Control of the AWS data

The quality of AWS data depends on instruments used, site exposure conditions, installation of instruments, measurement schedule, maintenance and calibration of instruments etc. It is desirable to know the quality of data being recorded at AWS and make it known to end users. The quality of data may be affected during transmission from field station and reception at centralised receiving Station. The purpose of quality control of AWS data is to detect errors and gaps in data. The comprehensive guidelines on quality control of AWS data are given in WMO guide on the global data processing system. On receipt at the centralised receiving Station, data are subjected to gross error check/ range check. This check ensures that the values of all meteorological parameters are within sensor range. The software also has a provision to check the current value of parameter for climatological consistency.

The values are then subjected to time consistency check to ensure that temporal variation of value is within acceptable limit. The software has a provision to set maximum and minimum allowable change in the value of parameter in an hour and raise appropriate flag depending upon the result of QC procedures. The algorithms for internal and spatial consistency are developed at AWS laboratory. After passing the data through QC checks, the data are disseminated to end users in required format. The quality of the AWS data has to be ensured at each and every stage. Some important steps are:

2.7.1 Site Level: The AWS site must be installed as per the established norms to avoid deviations in recording the weather parameters.

2.7.2 Sensor Level: All the sensors must be installed as per the norms specified (usually provided by the manufacturers) to avoid any deviations in recording the weather parameters.

2.7.3 Data Logger Level:

The data logger must check the quality of the data before it is sent to the transmitter. Some of the important aspects which can be verified are:

2.7.4 Range check/Gross error check

2.7.5 Climatological Average – temporal consistency

2.7.6 Transmission level: In case of GSM/GPRS based communication, the quality of transmission of the data is totally dependent upon the service provider, and as such, the data needs to be put through a quality check routine at the centralised receiving station.

2.7.7 Centralised Receiving Station Level: The quality of the AWS data can be monitored at the server of the central receiving station compulsorily over and above the checks at the Sensor and Data logger levels. As per the standard norms and protocols, the weather data service provider should not provide the final data report without following this stipulated quality check by qualified meteorologists at the central receiving station.

The brief features of these standard procedures of data quality check at the Central Receiving Station would be:

2.7.7.1 Parity check

2.7.7.2 Range check

2.7.7.3 Consistency checks (time consistency, absolute checks like max value not less than min value etc.)

2.7.7.4 Comparison of the data with nearby stations

2.7.7.5 Comparison of the data with climatological average

2.7.7.6 Generation of statistics of data reported on daily basis for quick detection and redressal of fault.

2.8. Metadata

2.8.1 The weather data service provider has to generate a final weather data report of a reference weather station after carrying out all these data quality checks within 10 days' time. The detailed specifications of these standard procedures/protocols for data quality check at various levels are needed to be followed uniformly by all service providers.

2.8.2 Elements of a Metadata Database related to an AWS

A metadata database should provide detailed information necessary for users to gain adequate background knowledge about the station and observational data, together with updates due to changes that occur. Major database elements include the following:

2.8.2.1 Station information (coordinates, station identifier, date of installation, relocations, shifting etc.)

2.8.2.2 Individual sensor information

2.8.2.3 Data processing information

2.8.2.4 Data handling information

2.8.2.5 Data transmission information

2.8.2.6 Quality Check information

2.8.2.7 Exposure condition

2.8.2.8 Information about sensor replacement or life of sensor

2.8.2.9 Information about relocation if any

2.9 Importance of third party weather station accreditation and data verification

As explained above, the siting and exposure of stations have an important influence on the performance of the stations and quality of the data. Hence, it is important to verify the weather station location, sensor specifications etc., to ensure the quality of weather data as these data are important for insurance claim settlement. Occasional missing values or recording of erroneous data are common in most of the systems. Hence, one should be careful while selecting the data. It is important to verify the whole network physically once in a year and data quality on regular basis through a competent third party, who uses many different

information sources, such as reference stations, neighbouring stations, geographic and topographic data, climatological data, model calculations, satellite information, etc. for weather data auditing. Though it takes extensive and very costly efforts to construct a perfect quality control system, rational and effective manual control can reduce the number of incorrect observations in the data stream.

In order to maintain the sanctity of the process, it's suggested that the accreditation process shall be done by a competent third party. The following are the guidelines finalized by the Committee constituted by the Ministry of Agriculture (GoI) for identifying a Third Party Accreditation/Certifying Agency.

2.9.1 At least one meteorologist/ agro meteorologist

2.9.2 One or more IT experts, with adequate experience and exposure to latest technologies and data transmission systems

2.9.3 Adequate manpower and resources to undertake quality assurance and accreditation as may be required by the weather data providers and the users

2.9.4 Should not be having business interest in installation/ supply/ maintenance etc. and any kind of business dealings with weather data/service providers.

2.9.5 Third Party Accreditation/Certifying Agency shall constitute a panel of competent firms / vendors for providing quality AWS data. The validity of this panel may be two years. This agency shall consider that the vendor / competent firm should have experience / competence / resources in the following areas to establish and maintain AWS network as detailed below:

2.9.5.1 Previous experience of handling large weather datasets

2.9.5.2 Facility to check the quality of the data as per the IMD guidelines.

2.9.5.3 Proven track record of experience in weather data quality checks

2.9.5.4 Expert(s) to develop algorithms for weather data quality checks and / or certification

2.9.5.5 Exposure / experience of other data networks available in the market, including meteorological satellites, and

2.9.5.6 Exposure / experience of meteorological satellite and experience in handling the weather data from those satellites.

2.9.5.7 A vendor / competent firm shall be chosen for a particular activity by the weather data provider

2.9.5.8 The vendor / competent firm empanelled shall in no case directly or indirectly be related to or promoted by the weather data provider in the market

2.9.5.9 Professional charges / fees of the certification & accreditation vendor / competent firm shall be borne by the weather data provider.

2.10 Detailed protocols and standards for maintenance, inspection and calibration

2.10.1 For timely maintenance, multiple instruments maintenance centres should be established across the region of network equipped with minimal set of spare sensors, maintenance tools, travelling standards, rain gauge calibrators. The preventive maintenance (PM) tours to stations should be undertaken once in three months and corrective maintenance tours as and when needed. A Standard Operating Practice (SOP) for inspection and maintenance is as follows

2.10.1.1 Inspection of site for siting and exposure conditions of instruments. In case of change in exposure conditions same should be documented in metadata.

2.10.1.2 Photograph of site should be taken before and after maintenance at least from four different angles.

2.10.1.3 Cutting of Grass/bushes etc. (once in four months)

2.10.1.4 Cleaning of solar panel and rain gauge, radiation shield, filter of air temperature/ relative humidity sensor etc. (once in four months)

2.10.1.5 On site calibration of sensors with handheld travelling standards including levelling of rain gauge once in a year with correction to be applied with immediate effect. (It should be taken up during a scheduled PM prior to monsoon season).

2.10.1.6 Painting of tower (in orange and white colour), fencing and gate (in silver colour), foundation of tower (white colour) and guy wires (smoke blue) etc. (once in a year and for coastal stations could be twice in a year)

2.10.1.7 Logged data should be retrieved from the system once in four months and sent by email to central receiving station

2.10.1.8 Check the mounting poles and the brackets are secure. Also check the condition of the earthing of the equipment.

2.10.1.9 Ensure that the connecting cables and connectors are intact and plugged properly. If required military (MIL) grade connectors should be coated with water proof solution.

2.10.2 Randomly inspect 10% AWS each year targeting the functional stations. The data user may also indicate the AWS schedule to be inspected. Sampling criteria can be set which need to be followed.

2.10.3 The vendor / competent firm who inspected the weather station for certification & accreditation shall submit the report to both the weather data provider and the data user within three weeks from the inspection.

2.10.4 Weather data provider shall strengthen and improve the installation, maintenance and data quality standards as recommended by the certification & accreditation Agency/ Regulatory Authority within a reasonable time.

2.10.5 The calibration/maintenance of the flagged AWS station would depend on the quality of the sensors used and the requirement of the network which will be taken care by the network holder agency.

2.10.6 The calibration of instruments/ sensors shall reveal departures from the ideal output, necessitating corrections to be made to observed data during normal operations. As far as possible, the corrections are retained with the instruments at the AWS site.

2.10.7 The instruments in operational use at AWS should be periodically compared directly or indirectly with the standards maintained by IMD/ACCREDITED LAB. Comparisons of instruments in service should be made at the time when the instruments are issued to a station and subsequently during each regular inspection of the station.

2.10.8 Portable standard instruments used by inspectors should be checked against the standard instruments of IMD/ACCREDITED LAB before and after each tour of inspection.

2.10.9 Sensors with electrical outputs show accuracy drifts in time and, consequently, need regular inspection and calibration. In principle, the calibration interval shall be determined by the drift specifications given by the manufacturer and the required accuracy. WMO international instrument inter comparisons also provide some objective indications of sensor accuracy drifts and desirable calibration intervals. As signal conditioning modules, data acquisition and transmission equipment also form a part of the measuring chain, their stability and correct operation have also to be controlled or calibrated periodically. The summary given below is limited to those practical aspects related to AWSs.

2.10.10 Attention should also be paid to the calibration of the different components forming the measuring and telemetry chain, in particular the signal conditioning modules. This involves appropriate voltage, current, capacitance and resistance standards, transmission test equipment, and high accuracy digital multimeters. Highly accurate instruments or data acquisition systems are required for the calibration. A computer is desirable for the calculation of calibration constants. These constants will accompany the sensor or module between calibrations and have to be entered in the AWS whenever a sensor or module is replaced or installed in an AWS during field maintenance.

2.10.11 AWS data generated by the service provider will be validated by using other standard data such as IMD observatories wherever possible.

2.10.12 Government of India / IMD in consultation with data users may issue further guidelines from time to time, if necessary.

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DISSENT NOTE BY MR SANJAY KAUL

Suggestions on various points of differences that NCML has with the views of IMD

The major objective of the Committee was to streamline and bring in credibility to the collection of weather data through Automatic Weather Stations by third party entities, by taking onto account the reality of the situation on the ground and make recommendations that are practical and implementable.

IMD's views relating to several recommendations (that has been the basis of the Report) have not taken into account the experience of establishing and maintaining AWSs in remote locations. NCML would like to suggest the following points to Min. of Agriculture, GoI, for their consideration and inclusion in the final implementation of WBCIS Scheme:

1. The siting norms recommended cannot be implemented on the ground. It is not possible for State governments to provide secure sites fully compliant with IMD norms. Even if such sites exist in the possession of the State government they will not be secure. It is not cost effective or feasible to provide round the clock security even where WMO compliant sites are identified. The recommendation to leave the site identification and allocation to data providers free of cost to State governments has been made without their consultation. Such a recommendation if made mandatory will render the entire WBCIS scheme inoperable and the scheme will have to be suspended. In many cases districts for implementation of the WBCIS scheme are notified only a month or so before the commencement of the season. In such situations States will not be in a position to identify and handover suitable WMO compliant sites in time. In such situations there has to be flexibility allowed to third party entities to identify sites that are mostly WMO compliant except for permitting these stations to be installed at rooftops. Failure to permit this flexibility will mean that the scheme would come to a standstill. We are of the view that this flexibility will not significantly alter the results and the credibility of the data generated.
2. We also differ with the Committee's suggestions on the sensor specifications – we are of the opinion that a 0.5° C accuracy for Temperature sensor, and a 4% accuracy for raingauge upto 240 mm/hr, fairly meets the requirements of the WBCIS Scheme. Higher and more stringent sensors will unnecessarily increase the overall costs of the Scheme.
3. GoI needs to carefully look into the cost aspects, for making available weather data by fully meeting the proposed siting & exposure norms, sensor accuracy norms, calibration & maintenance norms, and finally the periodic Third-party Audit norms, as these costs will get built into the overall costs of WBCIS Scheme itself.

4. Min. of Agriculture, GoI and respective State Govt.s should mandatorily fix the WBCIS scheme implementation periods for a minimum period, unlike a season-to-season basis being followed now by all State Govts. NCML recommends a minimum period of 3 Years for WBCIS notification for a location.
5. Min. of Agriculture, GoI should clearly stipulate the proposed guidelines are effective from a future date, for all new AWSs, as the relocation of existing ones will be a costly and time-consuming one. If this is not done there could be potential litigation under the existing scheme.

File No. 12014/02/2010-Cr.II
Government of India
Ministry of Agriculture
Department of Agriculture & Cooperation

Krishi Bhawan, New Delhi
25th April, 2011

Subject: Constitution of the Committee for preparation of draft guidelines for setting up Automatic Weather Stations (AWSs) and Automatic Rain Gauge (ARG) & their accreditation, standardization, validation and quality management of weather data etc. –reg.

In pursuance of decision taken in the meeting held on 11th April, 2011 under the Chairmanship of Shri G. C. Pati, Additional Secretary, Department of Agriculture & Cooperation , a Committee to draft **guidelines for setting up Automatic Weather Stations (AWSs) and Automatic Rain Gauge (ARG) by private agencies & their accreditation, standardization, validation and quality management of weather data etc.,** is hereby constituted with following composition:

1. Shri M Parshad, - **Chairman**
   Chairman cum Managing Director,
   Agriculture Insurance Company of India, New Delhi

2. Shri L. S Rathore, Scientist G & Head (Agromet)
   Indian Meteorological Department,
   Mausam Bhawan, Lodhi Road, New Delhi

3. Shri Sanjay Kaul, Managing Director & CEO,
   National Collaterals Management Services Ltd. (NCMSL)
   Gyatri Towers, 954, Appa Saheb Marathe Marg,
   Prava Devi, Mumbai 400025

The committee will submit the draft guidelines to this Department within two months and AIC will provide all necessary secretariat assistance to the Committee for aforesaid work.

(H. P. Verma)
Chief Director (Crop Insurance)

Distribution:

1. Shri M Parshad,
   Chairman cum Managing Director,
   Agriculture Insurance Company of India, New Delhi

2. Dr. Ajit Tyagi, Director General of Meteorology
   Indian Meteorological Department,
   Mausam Bhawan, Lodhi Road, New Delhi

3. Shri Sanjay Kaul, Managing Director & CEO,
   National Collaterals Management Services Ltd. (NCMSL)
   Gyatri Towers, 954, Appa Saheb Marathe Marg,
   Prava Devi, Mumbai 400025

Copy to

Shri L. S Rathore, Scientist G & Head (Agromet), Indian Meteorological Department, Mausam Bhawan, Lodhi Road, New Delhi

Copy for information to PPS to Additional Secretary (GCP)/PPS to Joint Secretary (C&C), Department of Agriculture & Cooperation, Krishi Bhawan, New Delhi

(H. P. Verma)
Chief Director (Crop Insurance)

REMINDER-III
MOST URGENT

No. 12014/02/2010-Credit II
Government of India
Ministry of Agriculture
Department of Agriculture & Cooperation

Krishi Bhavan, New Delhi
Dated 1st April, 2013.

To,

1. APC/Secretary (Agri./coop.) of Government of Andhra Pradesh, Assam, Bihar, Chhatisgarh, Gujarat, Haryana, Himachal Pradesh, Jammu & Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, Uttarkhand and West Bengal.
2. Dr. Inder Jit Singh, Joint Secretary, Department of Science & Technology. Technology Bhawan, New Mehrauli Road, New Delhi-110016 (email ID: inder.jit@nic.in).
3. Dr. Swapan Kumar Datta, Dy Director General (Crop Science), Inian Councile for Agricultural Research, Krishi Bhawan, New Delhi-110001 (e-mail ID: ddgcs@nic.in).
4. Shri L. S. Rathore, Director General of Meteorology, Indian Meteorological Department (IMD), Mausam Bhawan, Lodhi Road, New Delhi.
5. Managing Director & CEO, National Collaterals Management Services Ltd. (NCMSL), Gyatri Towers, 954, AppaSaheb Marathe Marg, Prava Devi, Mumbai 400025
6. Shri Bhargav Das Gupta, MD & CEO, ICICI-Lombard General Insurance Company Ltd., ICICI Lombard House, 414, Veer Savarkar Marg, Near Siddhi Vinayak Temple Prabhadevi, Mumbai – 400025.
7. Shri S. Narayanan, MD, IFFCO-Tokio General Insurance Company Ltd., IFFCO Tower, 5th Floor, Plot No. 3, Sector 29, Gurgaon – 122001.
8. Shri S.S. Gopalarathnam, MD, Cholamadalam MS General Insurance Company Ltd., Dare House, 2nd Floor, No. 2 NSC Bose Road, Chennai – 600001.
9. Shri Ritesh Kumar, Managing Director, HDFC-ERGO General Insurance Company Limited, 6th Floor, Leela Business Park, Andheri-Kurla Road, Andheri (E), Mumbari – 400 059.

Subject:- Draft report of the Committee constituted for preparation of draft guidelines for setting up Automatic Waether Stations (AWSs) and Automatic Rain Gauge (ARGs) & their accreditation, standardization, validation and quality management of weather data -reg.

Sir,

I am directed to refer to this Departments' letter of even number dated 1st March, 2012 on the subject mentioned above and to say that comments/views on the draft report of the above Committee containing guidelines for automatic

weather station, installation and maintenance have not been received so far. Copy of the afore said draft report is available at the website of this Department (Latest updates): http://www.agricoop.nic.in/Guidlines2352012.pdf

It is requested that the comments/views, if any, on the draft report may please be furnished to this Department latest by 12th April, 2013 so that the report could be finalized for implementation from Kharif 2013 season.

Yours faithfully,

14/3/13

(Vasanthy Pal)
Deputy Director (Credit)
e-mail: agri-insurance@nic.in

Hkkjrh; d`f"k vuqla/kku ifj"kn
INDIAN COUNCIL OF AGRICULTURAL RESEARCH
d`f"k Hkou] MkW0 jktsUnz izlkn ekxZ] ubZ fnYyh&110 114
Krishi Bhawan, Dr. Rajendra Prasad Road, New Delhi 110 114
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&&&

Dr. T.P. Rajendran
Assistant Director General (Plant Protection)

No.PS /ADG(PP)/2013
15th April, 2013

To

Ms. Vasanthy Pal
Dy. Director (Credit)
Deptt. of Agriculture & Cooperation
Krishi Bhavan,
New Delhi-110 001

Ref. File No. 12014/02/2010 -Credit II 1st April, 2013

Sir,

The following comments are offered:

- Guidelines for AWSIM may provide skill development, capacity enhancement of metadata on medium and long term storage system.
- The guidelines may specify institutional backstopping take up troubleshoot in the performance of hardware/software weather station instruments, data logging systems etc.
- The guidelines may spell out if ToR permits the financial support system for recurring contingencies that become essential to keep the AWSIM in running conditions as well as to log and store the accrued data securely.

On the technical note on weather index consistence based on AWS and ARG the following points may be noted.

1. The items 8 to 11 need specific monitoring for both of their performance as also for mitigation of breakdown.
2. Critical inputs especially during natural calamities such as high rainfall, floods, drought, wind damage etc. of crops need to be regularly put in place under dedicated office setup up, with supervision and monitoring.
3. Reliance on the date accrued over a period time could be put to use in verification of presently logged data integrity.

(TP. Rajendan)

243/Cr II/2013
29/4/13

Subject	ICAR comments on draft report of the Committee for guidelines for AWSs & ARGs
From	RAJENDRAN <adgpp.icar@nic.in>
Date	Monday, April 15, 2013 3:02 pm
To	agri-insurance@nic.in
Cc	ddgcs.icar@nic.in

Madame
With reference to your letter No.12014/0202010-Credit II dated 1st April, 2013 the comments are attached herewith.
(TP Rajendran)
Asst DG (PP), Crop Science Division
ICAR

29/04

2-44/Credit II/2013
29/4/13

No. HTC-F (5)-4 /2010.
Government of Himachal Pradesh
Department of Horticulture.

From

ACS (Hort.) to the
Government of Himachal Pradesh.

To

The Deputy Director(Credit),
Government of India, Ministry of Agriculture,
Department of Agriculture & Cooperation,
Krishi Bhawan, New Delhi.

Dated, Shimla-02, the 18-04-13

Subject: Draft report of the Committee constituted for preparation of draft guidelines for setting up Automatic Weather Stations(AWSs) and Automatic Rain Gauge(ARGs) & their accreditation, standardization, validation and quality management of weather data-reg.

Sir,

I am directed to refer to your letter No. 12014/02/2010-Credit-II, dated 1-4-2013 on the subject cited above and to say that comments on draft report of the Committee have already been sent to you vide this department's letter of even No. dated 12-4-2012. However, photocopy of letter dated 12-4-2012 is being enclosed for information and necessary action please.

Yours faithfully,

18.4.13

Deputy Secretary (Hort.) to the
Government of Himachal Pradesh.

No. HTC.F (5)-4/2010
Government of Himachal Pradesh
Department of Horticulture

From

Pr. Secretary (Hort.) to the
Government of Himachal Pradesh

To

The Chief Director(Crop insurance),
GOI, Ministry of Agriculture,
Deptt. of Agriculture.& Cooperation ,
Krishi Bhawan , New Delhi

Dated 12 April , 2012

Subject:- Draft report of the committee constituted for preparation draft guidelines for setting up Automatic Weather Stations(AWSs) and Automatic Rain Gauge(ARGs) and their accreditation, Standardization validation and quality management of weather data -reg.

Sir,

I am directed to refer to your letter No.12014/02/2010-Credit II dated 1st March,2012 on the above cited subject to furnish herewith the comments on the said report which are as under:-

The Weather Based Crop Insurance is directly correlated with the data obtained from Automatic Weather Stations installed for the purpose. Hence the accuracy of weather data is very important for compensating the farmers on account of adverse weather conditions or deviation from the trigger points specified for the weather parameters for a particular crop, which is recorded at the AWS and is required for settlement of individual farmer claim. The location of AWS in particular coverage area directly influences the outcome of quality of weather data. Hence, the weather station should be located at an ideal place, which represents the Reference Unit Area(RUA) in a more reasonable manner. The effectiveness of the weather insurance can only be enhanced by increasing the density of the Reference Weather Stations (RWSs) network in coverage area. This is more relevant in hilly state like Himachal Pradesh where the altitudinal difference is more pronounced as compared to other regions of the country. The third party weather stations accreditation, data verification and certification is very important for obtaining quality weather data. Weather data provider should strengthen and improve the installation, maintenance and data quality standards as recommended by the Certification and Accriditation agencies with in a reasonable time. Regular inspection and caliberation of AWS should be carried out jointly by the officials of IMD, AIC & NCMSL, so that these stations are well maintained for receiving quality weather data.

Yours faithfully,

Dy. Secretary (Hort.)to the
Govt. of Himachal Pradesh
p/4/12

2-66/Credit II/2013
3/5/13

सर्व शिक्षा अभियान
सब पढ़ें सब बढ़ें

भारत सरकार
विज्ञान और प्रौद्योगिकी मंत्रालय
विज्ञान और प्रौद्योगिकी विभाग
टेक्नोलॉजी भवन, महरौली मार्ग
नई दिल्ली-110 016

GOVERNMENT OF INDIA
MINISTRY OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF SCIENCE AND TECHNOLOGY
TECHNOLOGY BHAVAN, NEW MEHRAULI ROAD
NEW DELHI-110 016

Telegram : Scienctech
दूरभाष/Tel : 26962819, 26567373,
: 26562134, 26562122 (EPBAX)
फैक्स/Fax : 26569908, 26864570,
: 26863847, 26862418

No. A-11019/2/2013-CDN

Dated:- 23/04/2013

OFFICE MEMORANDUM

Subject:- Draft report of the Committee constituted for preparation of draft guidelines for setting up Automatic Weather Stations (AWSs) and Automatic Rain Gauge (ARGs) & their accreditation, standardization, validation and quality management of weather data-reg..

The undersigned is directed to forward herewith a letter No. 12014/02/2010-Credit II, dated 01/04/2013 received from Ministry of Agriculture (Department of Agriculture & Cooperation) on the subject mentioned above

2. Since the subject matter of the above, falls under the purview of Ministry of Earth Sciences, the same is forwarded, in original, to Director, CDN, Ministry of Earth Sciences and requested to send requisite comments/views directly to Ministry of Agriculture (Department of Agriculture & Cooperation).

Encl. As above

(Ashish Dutta)
Under Secretary to the Govt. of India
Telephone No. 26565471

To

The Director, CDN Section,
Ministry of Earth Sciences,
Prithwi Bhawan, IMD Campus,
Opp. India Habitate Centre, Lodi Road,
New Delhi- 110 003.

Copy forwarded for information to:-

Shri Vasanthy Pal,
Deputy Director,
Ministry of Agriculture,
Department of Agriculture & Cooperation, Rafi Marg,
New Delhi-110 001.

In future all correspondence may be done with Department of Agriculture & Cooperation since the matter does not pertain to this Department.

MOST URGENT
PARLIAMENT MATTERS
LOK SABHA QUESTION
H-11016/13-NA/LS-18/36

INDIA METEOROLOGICAL DEPARTMENT

Subject: **Lok Sabha provisional Starred Question Dy. No. 25563 due to answer on 7th May 2013 regarding 'Setting up of Automatic Weather Stations and Automatic Rain Gauge' by the Hon'ble MP Shri Chaudhary Lal Singh.**

Reference: **(i). Fax No. 6/6(1)/PQ/2013-MNCFC, Min. of Agriculture**
(ii). DO. No. JS/IT/PQ-NCFC/2013 dated 1ST May 2013.

Sir,

The relevant material for framing the answer in respect of above question is enclosed for necessary action.

This has the approval of Director General of Meteorology.

Yours sincerely

(T.N.Jha)
Scientist 'E'
for Director General of Meteorology

To:
Shri Sanjeev Gupta
Joint Secretary,
Department of Ag. & Cooperation,
Govt. of India, Min. of Agriculture,
Krishi Bhavan, New Delhi.
Fax. No. 011-23382357
e-mail: gupta.sanjeev@nic.in

Copy to:
Dr. Ramesh K.J.,
Scientist 'G'/Adviser
Ministry of Earth Sciences,
IMD Complex, Lodi Road,
New Delhi-3.
e-mail: kj.ramesh@nic.in
kjramesh2607@gmail.com
Mobile No: 9868733464
Fax No. 24622059

DGM UOI No. No. H-11016/13-NA/LS-18/36, dated New Delhi, the 3rd May, 2013

GOVERNMENT OF INDIA

MINISTRY of EARTH SCIENCES

LOK SABHA

PARLIAMENT QUESTION DY. NO. 25563

TO BE ANSWERED ON 7th May, 2013

25563 **Hon'ble MP Shri Chaudhary Lal Singh**

QUESTIONS

(a) whether the Government has constituted any Committee for preparation of guidelines for setting up of Automatic Weather Stations and Automatic Rain Gauge across the country;

(b) if so, the details thereof;

(c) whether the Committee has submitted its draft report to the Government;

(d) if so, the details thereof;

(e) whether the Government has accepted the recommendations/suggestions made by the Committee; and

(f) if so, the details thereof ?

Inputs from India Meteorological Department (IMD)

(a) & (b) Yes. Ministry of Agriculture, Government of India has constituted a committee for preparation of guidelines for setting up Automatic Weather Stations (AWSs) and Automatic Rain Gauge (ARGs) across the country.

(c) & (d) The committee has prepared a draft for the guidelines for setting up AWSs and ARGs and their accreditation, standardization, validation and quality management of weather data. The committee in their draft covered mainly about AWS equipment standards, AWS installation standards & maintenance standards and guidelines for 3rd party accreditation and data certification services. Committee prepared the guidelines for setting up AWS, Installation and Maintenance which broadly covered about the sensor specification, hardware component, network, quality control, exposure conditions etc.

(e) & (f). No. India Meteorological Department organized a brain storming session on Integration of Automatic Weather Station under National Umbrella" on 3rd September 2012 at Indian Institute of Tropical Meteorology, Pashan, Pune. The objective of the meeting is to develop a national consortium by all the concerned organizations to integrate the existing AWS and install new ones with the required sensors, maintenance, reception of quality controlled and uninterrupted data, data sharing mechanism etc. Participants from Indian Space Research Organization, State Natural Disaster Monitoring Centre of various states, software professionals, Agricultural Universities, Central Research Institute for Dryland Agriculture, Insurance companies and Companies like Vaisala, Komoline, Spatika and Astra etc. involved in manufacturing sensors for Automatic Weather Station and high profile dignitaries of State Departments of various states

involved in management of AWS participated in the workshop. In the workshop in depth discussion were held on the various topics such as Site network design, Finance and Manpower, Data frequencies, Quality control and Sharing loss, Role of Private Companies and Insurance Sector.

Subsequently following recommendations were framed:

1. There is urgent need to integrate all AWS already installed in the country with proper built-in mechanism for better service to the user community (Weather Forecasting, Weather insurance for agriculture, Aviation, Hydrology, Transport, Disaster Management etc.).
2. Category of AWS should be done for different applications such as climatological records, weather forecast, water resource assessment, agricultural insurance.
3. Implementation of this mega project being a mammoth task, availability of adequate funds is required to be ensured for timely execution. IMD may make the funds available in 12th and subsequent Five Year Plans for installing AWS at block level for generation of high resolution forecast. Funds for establishing a network of AWS may also be made available by Agriculture Insurance Company of India Ltd (AICIL).
4. Every AWS owner should maintain comprehensive metadata such as geographic data of site (latitude, longitude, elevation etc), sensor accuracies, measurement schedule, quality control methods, data logger features, exposure conditions, date of last calibration, date of last inspection, date of last maintenance, etc. The metadata should be made available by the agencies through their websites.
5. Metadata of AWS should be verifiable and certified by IMD/ BIS through outsourcing. The date of last verification should also be published on the website for each station.
6. Data for past 1 to 3 days should be made available by the network owner on their websites free of cost.
7. Based on overall accuracies of sensor values, AWS may be divided into two types. First complying with the requirements of WMO and other with mutually agreed compromised sensor accuracies.
8. AWS owners may consider obtaining ISO certification for quality management.
9. Either IMD or BIS will provide certification of AWS after proper verification. This exercise may be carried out through outsourcing giving proper training. Inspection/certification charges shall be paid by owners.
10. All state administration should help and extend cooperation in site selection for AWS and make the sites available for installation of AWS without any charges.
11. In initial phase, preference should be given to unrepresented districts/ locations of the country for installation of AWS.
12. All AWS owners should have a mechanism for long term archival at their servers and this archived data should be shared through mutual MoUs.

It was also decided that in additional meeting the recommendation will be finalized.

Details guidelines in 1st and 2nd meetings are enclosed in Annexure-I and Annexure-II.

सत्यमेव जयते

Telegram : Scienctech
दूरभाष / Tel : 26962819, 26567373, 26562134, 26562122 (EPBAX)
फैक्स / Fax : 26569908, 26864570, 26863847, 26862418

भारत सरकार
विज्ञान और प्रौद्योगिकी मंत्रालय
विज्ञान और प्रौद्योगिकी विभाग
टेक्नोलॉजी भवन, नया महरौली मार्ग
नई दिल्ली–110 016

GOVERNMENT OF INDIA
MINISTRY OF SCIENCE AND TECHNOLOGY,
DEPARTMENT OF SCIENCE AND TECHNOLOGY,
TECHNOLOGY BHAVAN, NEW MEHRAULI ROAD,
NEW DELHI-110 016

No. A-11019/2/2013-CDN Dated:- 10/05/2013

OFFICE MEMORANDUM

Subject:- Draft report of the Committee constituted for preparation of draft guidelines for setting up Automatic Weather Stations (AWSs) and Automatic Rain Gauge (ARGs) & their accreditation, standardization, validation and quality management of weather data-reg..

Reference is invited to this Department's communication of even number, dated 23/04/2013. The undersigned is directed to forward herewith a reminder No. 12014/02/2010-Credit II, dated 25/04/2013 in original (copy enclosed) received from Ministry of Agriculture (Department of Agriculture & Cooperation) on the subject mentioned above.

2. Since the subject matter of the above, falls under the purview of Ministry of Earth Sciences, and requested to send requisite comments/views directly to Ministry of Agriculture (Department of Agriculture & Cooperation).

Encl. As above

2

(Ashish Dutta)
Under Secretary to the Govt. of India
Telephone No. 26565471

To

The Director, CDN Section,
Ministry of Earth Sciences,
Prithwi Bhawan, IMD Campus,
Opp. India Habitate Centre, Lodi Road,
New Delhi- 110 003.

Copy forwarded for information to:-

Shri Vasanthy Pal,
Deputy Director,
Ministry of Agriculture,
Department of Agriculture & Cooperation, Rafi Marg,
New Delhi-110 001.

In future all correspondence may be done with Ministry of Earth Sciences, since the matter does not pertain to this Department.

भारत सरकार
भारत मौसम विज्ञान विभाग
मौसम भवन, लोदी रोड,
नई दिल्ली - ११० 003

Government of India
India Meteorological Department
Mausam Bhavan, Lodi Road,
New Delhi – 110 003

632/CoII/
09/10/12

(45)

No. ASC-44/Crop Insurance/ 2009

26th September, 2012

Dr. K. K. Singh
Head Agromet Services

To,
Dr. H. P. Verma
Chief Director (Crop Insurance),
Ministry of Agriculture,
Department of Agriculture & Cooperation.
New Delhi

Sub: Draft guidelines for setting up of AWS and ARGS & their accreditation, standardization validation and quality management of weather data.

Ref. : Your letter no. 120/4/02/2010-credit-11 dated 24.08.2012

Respected Sir,

With reference to your above letter it is to inform that India Meteorological Department has hosted a Brainstorming Session on integration and standardization of all AWS network under one national umbrella on 03.09.2012 at IMD Pune. All stake holders viz. States and public agencies having their AWS network, agencies manufacturing and supplying AWS and different user agencies participated in the deliberations.

The recommendations of the session will be submitted to the competent authority to prepare guidelines for setting up of AWS and ARGS in the country and will be sent to your office shortly.

With kind regards

Yours Sincerely

(K. K.Singh)

Tele: 011-43824282 Telefax: 011-24620766 Email: asc-imd@yahoo.co.in

300/Credit II/2013
22/5/13.

GOVERNMENT OF WEST BENGAL
AGRICULTURE DEPARTMENT
INPUTS BRANCH
WRITERS' BUILDINGS
BLOCK-'F', 3RD FLOOR, KOLKATA – 700 001

No.674-Inpt./9M-30/2013 **Kolkata, the 8th May, 2013.**

From : O.S.D. & Ex-officio Deputy Secretary to the Govt. of W.B.

To : The Deputy Director (Credit),
Government of India,
Ministry of Agriculture,
Department of Agriculture & Cooperation,
Krishi Bhawan, New Delhi.

Sub : Draft Report of the Committee constituted for preparation of draft guidelines for setting up Automatic Weather Stations and Automatic Rain Gauge and their accreditation, standardization, validation and quality management of weather data.

Sir,

In response to the letter No.12014/02/2010 Credit II dated 01.04.2013 received from Deputy Director and Cooperation, Ministry of Agriculture, the undersigned is directed to inform you that the guidelines for setting up of Automatic Weather Stations and Automatic Rain Gauge are quite appropriate for this state. We have nothing to add to the same.

Yours faithfully,

8/5/13

O.S.D. & Ex-officio Deputy Secretary
to the Govt. of West Bengal

22/5/13

AD (Credit) 23/5/13

JD/Sus.Bhat/9M-30-2013/|PND-MISC./2

305 | Credit II | 2013
22/5/13

IFFCO-TOKIO GENERAL INSURANCE
Muskurate Raho

To,

Dated: 15.05.2013

Mrs Vasanthy Pal
Deputy Director (Credit)
Department of Agriculture & Cooperation
Ministry of Agriculture
Government of India
Krishi Bhavan, New Delhi- 110001.

Sub: Draft report of the Committee constituted for preparation of draft guidelines for setting up Automatic Weather Stations (AWSs) and Automatic Rain Gauge (ARGs) & their accreditation, standardization, validation and quality management of weather data.

Dear Madam,

This has reference to the letter No. 12014/02/2010-credit II, dated: 1st April 2013 regarding the captioned subject. We have gone through the draft report and please find below our comments/views.

1. The accreditation, standardization, validation and quality management of weather data process of AWS & ARGs should be done by IMD or any Government affiliated agency only.

2. Regarding installation of around 40,000 weather stations across India we suggest that it should be done on a Public Private Partnership (PPP) mode and in a phased manner.

3. Weather Data of Indian Air Force & Indian Space Research Organization (ISRO) weather stations should also be made available to implementing Insurance Companies for Research & Product Development purposes.

With kind Regards,

Yours Faithfully,

For IFFCO-TOKIO GENERAL INSURANCE CO. LTD.

Kunal Soni

Chief Manager – Agriculture Insurance

22/05/13
AD (Credit)
23/5

IFFCO-TOKIO GENERAL INSURANCE CO. LTD.
A JOINT VENTURE OF INDIAN FARMERS FERTILISER COOPERATIVE LIMITED AND THE TOKIO MARINE & NICHIDO FIRE INSURANCE CO., LTD.
Corporate Office: IFFCO Tower, Plot No. 3, Sector-29, Gurgaon-122001 (Haryana)
Phones: 2850100, Fax: 2577923, 2577924
Please prefix: 95124 (From Delhi), 0124 (From outside Delhi), +91-124 (From aboard)
Regd. Office: "IFFCO Sadan", C-1 Distt. Centre, Saket, New Delhi - 110017
TOKIOMARINE NICHIDO

423/Cr II/2013
23/7/13

Agriculture (AU) Department,
Secretariat, Chennai-9.

Letter No.7523/AU/ 2012- 9, dated:16.07.2013

From
Thiru.Sandeep Saxena, I.A.S.,
Agricultural Production Commissioner
and Principal Secretary to Government,

To
The Chief Director, (Crop Insurance),
Government of India, Ministry of Agriculture,
Department of Agriculture & Co-operation,
New Delhi.

Sir,

Sub: Draft report of the committee constituted for preparation of draft guidelines for setting up Automatic Weather Stations (AWSs) and Automatic Rain Gauge (ARGs) and their accreditation, date-comments called for – Reg

Ref: From the Chief Director (Crop Insurance)Department of Agriculture & Co-operation , Ministry of Agriculture, Government of India, Lr.No.12014/02/2010- Grade II dated 01.03.2012 and reminder dated 25.04.2013.

*****

I am to invite your attention to the reference cited.

23/07
To me

2. The comments on "Draft guidelines for setting up Automatic Weather Stations (AWSs) and Automatic Rain Gauge (ARGs) of their accreditation, Standardization validation and Quality Management of Weather data" as furnished by the Vice Chancellor, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu is communicated as below:-

Report 1: Guidelines for Automatic Weather Station, Installation and Maintenance

1. The first report covers all the specifications of World Meteorological Organization guidelines for setting up Automatic Weather Stations (AWS) and is similar to the WMO guidelines.

2. For many of the Agricultural Meteorological purpose wind speed is measured at 2 m height is normally used as is being practiced in Agricultural Meteorological observatories of the entire Indian sub continent. Some estimation like Potential Evapo Transpiration (PET) uses 2 m height wind speed only. However, the report suggests 10 m height for wind speed measurements based on the WMO guide. The 2010 edition updated in 2012 of "Guide to Agricultural Meteorological Practices" of WMO indicates the height of measurement in the following lines.

   "Agricultural meteorological stations need toposcale reference observations of both wind speed and direction, preferably at 10 m height, but at least at three times the height of any nearby vegetation (for instance, crops) and any nearby obstacles, in order to be above significant flow interference. Lower-level wind measurements are not representative at toposcale and cannot be properly correctec, either, so they cannot be used as local reference or for comparison with other stations (WMO, 2001b)."

3. The above lines of the guide indicates that if the station requires toposcale reference to be compared with the other stations the preference is for 10m height measurement otherwise it is only 3 times the height of the surrounding crop. The requirement of wind for crop insurance is the occasional wind squall that normally damages the crops like banana and sugarcane and the area grown with this crops be alone the wind measurement may be done at 10 m height and the remaining areas we recommend 2-3 m height only.

4. The ideal space requirement suggested is 15X12m and it again indicates that under non-availability of space the area of 10m X 10 m is sufficient. This space requirement is essential when we erect mast for 10 m height for measuring the wind speed otherwise we recommend a spacing of 6-7 m X 5 m in which the length should be on the south-north direction.

5. The space requirement indicated for ARG in the report is 10m x 7m. Here we recommend 1.2m height fence and 1m heights for rain gauge whether it is flooded or not. This uniformity will bring down the space requirement even to 2m x 2m under space constraint other wise we recommend 3m x 3m space area.

6. The temperature is the main parameter that might get affected because of the fence materials used as enclosure in the AWS site. To avoid the influence of

fence on the temperature sensor we recommend 1.2 m height fence and which leave all sensors above the fence that are likely to be affected by it.

7. We recommend the visiting frequency AWS site as once a month for cleaning purposes especially during monsoon. The cleaning and calibration of sensors to be done at the beginning of the season.

Report 2: Vendor requirements for "Automatic Weather Station and Data Quality Certification" by third party agencies

1. The report indicates only the criteria for choosing certifying agencies and it is not clear on the guidelines to be followed to issue a certificate of fitness of AWS and quality of data to be used for insurance claims. A step by step procedure to be followed for accreditation is important and the same has to be included in the report.

2. The report has proposed different percentage proportion of station to be inspected for certification based on the age of weather station. Here the quality and traceability of the sensor plays a major role than the age of stations. Besides as requirement increases a vendor can add new stations every year and this will complicate the percentage proportion concept based on the age of the stations. Hence, we recommend random sampling of at least 1/5th of the AWS possessed by the vendor for certification purpose.

Report 3: Weather Index Insurance A Technical note on Automatic Weather Station (AWS) and Automatic Rain Gauge (ARG)

1. The main disadvantage of using satellite communication is the license fee to be paid to DoT, cost of earth station and the cost of unidirectional Yagi antenna which are likely to enhance the cost of operating AWS. Worldwide 5% data loss is reported in Satellite based communication because of the TDMA technology and this places the GSM-GPRS technology on the advantageous side.

2. Under data logger section the report indicates that it should be remotely programmable. This can never happen in satellite-based communication as only one-way communication is possible. However, GSM-GPRS has the advantage of two-way communication and the drawback indicated on the dependency of service provider is likely to be negligible as the companies will quickly act if there are shortfalls to prevent their loss.

3. The sensors standard requirement lacks the information on the response time for each of the sensor and its traceability standard. (International or National)

4. Under the data requirement one important missing item is intensity of rainfall, which could easily be estimated by logging the second by which the tip occurred in the tipping bucket rain gauge.

5. The space requirement of 5m x 7m recommended here is sufficient only for 2-3m wind speed measurement but for the 10m mast fixing of stay wire is difficult within the enclosure area.

3. I am also to state that weather forecast is uploaded in the Agriculture Department website every day. Based on the forecast the Joint Directors of Agriculture at District level and Assistant Directors of Agriculture at Block level are instructed to recommend the package of practices to the farmers.

Yours faithfully,

for Agricultural Production Commissioner
and Principal Secretary to Government

389/cr II/2013
11/7/13

GOVERNMENT OF MEGHALAYA
AGRICULTURE::: DEPARTMENT

NO.AGRI(G)123/2008/522, Dated Shillong, the 28th June,2013.

From:- Smti V.R.Syiem,MCS,
Joint Secretary to the Govt.of Meghalaya.

To

The Chief Director (Crop Insurance),
Govt.of India,
Ministry of Agriculture,
Department of Agriculture & Cooperation,
Krishi Bhavan, New Delhi-110001.

Subject- Draft report of the Committee constituted for preparation of draft guidelines for setting up Automatic Weather Stations (AWSs)and Automatic Rain Gauge (ARCs) & their accreditation, standardization, validation and quality management of weather data.

Reference:- No.12014/02/2010-Credit-II, dt.1.3.2012.
NO.12014/02/2010-Credit-II, dt.1.4.2013.

Sir,

In inviting a reference to your letters on the subject cited above, I am directed to enclose herewith the views/ comments on the Draft Report for favour of your information and necessary action.

Yours faithfully,

(V.R.Syiem)
Joint Secretary to the Govt. of Meghalaya,
Agriculture Department.

11/07
F.N. 12014/02/2010-CR-II PL

VIEWS AND COMMENTS ON THE DRAFT REPORT OF THE COMMITTEE CONSTITUTED FOR THE PREPARATION UP OF AUTOMATIC WEATHER STATIONS (AWs) AND AUTOMATIC RAIN GAUGE (ARGs) & OTHER ACCREDITATION, STANDARDIZATION, VALIDATION AND QUALITY MANAGEMENT OF WEATHER DATA.

At the very outset, we are very thankful to the Government of India for setting up of a Committee under the Chairmanship of the Managing Director, Agricultural Insurance Company of India for drafting the guidelines for setting up of AWS and ARGs, for Accreditation, Standardisation, Validation and Quality Management of Weather Data, for the purpose of implementation of Weather Based Crop Insurance Scheme (WBCIS) in the State.

After an in-depth study & thorough examination of the Draft Report, submitted by the above Committee, it may be stated that the Installation of the AWS and ARGs by the State Government in different selected areas of the State are not in conformity with the guidelines of the above Committee except for one or two Stations.

Secondly, going by the guidelines and the recommendations of the above Committee for setting up of AWS/ARGs, it may be pointed out that the personnel of the State Government, concerned with the Technical Operational aspects of the aforesaid Technical Equipments are yet to be trained for operation of the same .

Further, it may be stated that all the 12 Technical Operational Guidelines of the Committee have been examined and Studied . It may be mentioned that most of our Raingage Stations that are available in the State, have not been following the Technical Operational Guidelines as recommended by the said Committee of the GOI, designed, particularly, for suitable Implementation of the Weather Based Crop Insurance in the State.

The Information Technology Connectivity at the Block Level in our State are yet to be operationalised.The Computer Set-up/availability & connectivity in the far-flung Rural Development Blocks are absent, which otherwise ,should be the criteria for assessing the over all weather conditions etc for measuring the crop loss.

As per the Regional Meteorological Centre, Guwahati there are only Four(4)Weather Stations in Meghalaya ; (1) Barapani (2) Upper Shillong Seismological Observatory (3) Cherrapunji and (4) Tura Seismological Observatory.

But under the WBCIS,it is necessary that there should be One Weather Station in an area of 30-35 Sq.km.Further ,considering the Hilly Terrain, the Rainfall may vary greatly in one side of the hill to another ,which is not the Case in the Plain Areas, and hence, the data obtained from such Rain Gauge Station may not represent the actual Rainfall, etc,over such areas.

Similarly at various altitudes, the temperature will also vary greatly. If the Weather Station is Located in lower altitudes and the crop is grown at higher altitudes, the Weather Station will not represent the accurate data of minimum temperature (say,for damaged to the crop by frost).hence, this will not serve the purpose of insurance and the Insurance Farmers may also get aggrieved.

The Weather Insurance Company can set up Automatic Weather Stations in various areas of the State,but, for this, as has been pointed above,a communication (telephone) line and electricity is necessary. Further, as has been stated above ,the electronic communication network is very weak in various areas of the State, particularly in the interior areas, where the crops are actually cultivated.

Contd-2

Considering the Low Density of Weather Stations, it is highly unlikely that Good Quality of Past Weather Data for last 25-30 years will be available. Hence, in the absence of good quality past weather data and Yield Data for Crops Not Notified Under NAIS, it is very difficult to design insurance products and work out the Premium Rates.

It may further be stated, that since the Premium Rates under WBCIS are much higher than the Premium Rates of the present NAIS, farmers may not afford the High Premium Rates to be paid under WBCIS.

However, after considering all the above, in-effectiveness ,unsuitable topography , poor connectivity of electronic communication network,electricity and other related constraints, it very encouraging to state that the State Government in the Agriculture Department have seriously taken the initiatives of Installation and Setting up of AWS/ARGs in all the Districts of the State, in line with the Guidelines of the afore mentioned GOI Committee. Presently, the Department have already installed 3 Nos of AWS, one each in Cherrapunjee , Mawsynram and in the Fruit Garden Shillong. Two (2nos) more number of AWS will be installed Garo Hills, one each in Tura and Willianagar and the process is likely to be completed bebore the end of April 2012. One AWS each, will be installed by the Department, in all the remaining Districts during the next financial year (2012-2013). It may also be worth mentioning that the Agriculture Department, will be installing ARGs and Manual Rain Gauge Instruments, in a phase wise manner, in all the Civil Subdivisions and selected areas of different Community Development Blocks, in addition to the Departmental Agricultural/Horticultural Farms. In between and after the installation of the said AWS/ARGs & Manual Rain Gauge Equipments, with Technical (computer) ets supports, training will be imparted to all the concerned personnel by the Meteorological Expert of the Meteorological Department, pertaining to the technical operation of the said equipments for effective reporting of the Weather Conditions in the State.

In conclusion, it may be stated, that, till such time, when all the above constraints are sorted out and the Meteorological Equipments are properly in stalled in all the Specified Locations of Weather Stations, with all the Logical Supports Required for Obtaining Qualitative Data of Rainfall, Temperature,Humidity & Wind Speed (velocity) which are the YARD STICKS, required for determining the Crop Loss under WBCIS, it may be suggested that the Implementation of WBCIS in the State at this juncture is not very feasible and may not be to the benefit of the farmers of the State, as a whole.

छत्तीसगढ़ शासन
कृषि विभाग
मंत्रालय
महानदी भवन, नया रायपुर 492 002

क्रमांक 2715 /एफ–11/12/2012/14–2 रायपुर, दिनांक 24/06/2013

प्रति,

श्री राजेन्द्र कुमार तिवारी
संयुक्त सचिव (केडिट एवं कॉपरेशन),
भारत सरकार, कृषि मंत्रालय,
कृषि एवं सहकारिता विभाग,
कृषि भवन, नई दिल्ली

विषयः Draft report of the Committee Constituted for preparation of draft guidelines for setting up Automatic Weather Stations (AWSs) & Automatic Rain Gauge (ARGs) & their accreditations, Standardization, Validations & quality management of Weather data-reg.

संदर्भः आपका पत्र क्र. 12014/02/2010-Credit-II दिनांक 25.04.2013

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आपके प्राप्त पत्र के संदर्भ में मौसम विज्ञान केन्द्र लालपुर, रायपुर एवं इंदिरा गांधी कृषि विश्वविद्यालय, रायपुर से जानकारी प्राप्त हुई है। जिसके अनुसार मौसम विज्ञान केन्द्र, लालपुर, रायपुर द्वारा छत्तीसगढ़ के 18 जिलों में 19 AWS की स्थापना की गई है तथा शेष 9 नए जिलों में AWS की स्थापना नहीं हुई है। छत्तीसगढ़ में कुल 27 जिलें है। ARG की स्थापना 33 तहसीलों में की गई है। AWS एवं ARG की सूची Annexure-I एवं II में संलग्न है।

मौसम विज्ञान केन्द्र, लालपुर, रायपुर के निदेशक के अनुसार स्वचलित मौसम नेटवर्क बढ़ोत्तरी करने हेतु शेष 9 जिलों में एक–एक AWS तथा शेष 114 तहसीलों में एक–एक ARG (with temperature Sensor) लगाने को सुझाव दिया गया है।

AWS की अनुमानित लागत राशि रू. 3.00 लाख
ARG की अनुमानित लागत राशि रू. 2.00 लाख

इंदिरा गांधी कृषि विश्वविद्यालय, रायपुर के अनुसार CRIDA हैदराबाद (ICAR) द्वारा भाटापारा, बिलासपुर, दंतेवाड़ा एवं महासमुन्द में AWS स्थापित किया गया है। इसके अतिरिक्त IMD द्वारा कृषि विश्वविद्यालय के 04 केम्पस रायपुर, अंबिकापुर, जगदलपुर, एवं अंजोरा (दुर्ग) में AWS स्थापित किया गया है। इनसे कुछ सुझाव इसे संबंध में प्राप्त हुए है जो निम्नानुसार हैः–

1. The humidity sensors fail oftenly and they need frequent replacement.
2. The frequency of calibration of the sensors needs to be clarified. Otherwise, the accuracy of the data may become a problem.
3. In case of agromet AWS, it is suggested to install leaf wetness sensors. For this purpose a long cable wire is needed to place the sensors in nearby field.
4. The soil temperature sensor was suggested at 20 cm depth. It is suggested to give the choice to the local station to change the depth as per the need.
5. It is suggested that one agrometeologist should be in the certification agency.

क्रमशः ...2...

इसके अतिरिक्त छत्तीसगढ़ में दूरस्थ क्षेत्र जैसे दंतेवाड़ा (बस्तर) में नियमित अन्तराल में रख–रखाव पर ध्यान दिया जाना चाहिए।

अतः मौसम विज्ञान केन्द्र, लालपुर, रायपुर एवं इंदिरा गांधी कृषि विश्वविद्यालय, रायपुर से प्राप्त अभिमत/सुझाव आवश्यक कार्यवाही हेतु आपकी ओर प्रेषित है।

24.6.13

(प्रदीप कुमार दवे)
उप सचिव
छत्तीसगढ़ शासन, कृषि विभाग

2716
पृष्ठां. क्र./ /एफ–11/12/2012/14–2 रायपुर, दिनांक 24/06/2013

प्रतिलिपिः–

1. संचालक कृषि, छ.ग., रायपुर की ओर सूचनार्थ एवं आवश्यक कार्यवाही हेतु प्रेषित।
2. निदेशक, मौसम विज्ञान केन्द्र, लालपुर, रायपुर की ओर सूचनार्थ प्रेषित।
3. कुलसचिव, इंदिरा गांधी कृषि विश्वविद्यालय, रायपुर की ओर सूचनार्थ प्रेषित।

24.6.13

उप सचिव
छत्तीसगढ़ शासन, कृषि विभाग

Annexure –i

LIST OF AWS STATIONS OF C.G.

SNo.	Station Name
1.	Raipur M.C. (Met. Centre)
2.	Raipur (Agri.)
3.	Mahasamund
4.	Dhamtari
5.	Durg
6..	Rajnandgaon
7	Kawardha
8	Bilaspur
9	Raigarh
10	Korba
11	Janjgir
12	Koya
13	Jashpur
14	Ambikapur(Agri)
15	Jagdalpur(Agri)
16	Dantwwada
17	Bijapur
18	Narayanpur
19	Kanker

([illegible] कुमार [illegible])
उप सचिव
छत्तीसगढ़ शासन कृषि विभाग
मंत्रालय, रायपुर

Annexure –ii

LIST OF ARG of C.G.

S.NO	ARG sites	District
1	Surajpur	Ambikapur
2	Ramanujganj	Ambikapur
3	Mungeli	Bilaspur
4	Lormi	Bilaspur
5	Nagri	Dhantari
6	Kurud	Dnantari
7	Bemetara	Durg
8	Balod	Durg
9	Kondagaon	Jagdalpur(Bastar)
10	Keshkal	Jagdalpur(Bastar)
11	Sakti	Janjgir
12	Nawagarh	Janjgir
13	Patthalgaon	Jashpur
14	Bagrcha	Jashpur
15	Bhanupratappur	Kanker
16	Pakanjore	Kanker
17	Katghora	Korba
18	Janakpur(Bharatpur)	Korba
19	Sonhat	Koria
20	Chilpi	Kabirdham
21	Pandari	Kabirdham
22	Saraipali	Mahasamudh
23	Pithora	Mahasamudh
24	Baloda	Raipur
25	Gariyaband	Raipur
26	Saranggarh	Raigarh
27	Dharmjaygad	Raigarh
28	Dongargarh	Rajnandgaon
29	Mohala	Rajnandgaon
30.	Naya Raipur	Raipur
31.	Tilda	Tilda
32.	Balrampur	Balrampur
33.	Mainpat	

22-6/13

(प्रदीप कुमार दवे)
उप सचिव
छत्तीसगढ़ शासन कृषि विभाग
मंत्रालय, रायपुर