DETAILED REPORT

NATIONAL SEMINAR
On

Agrometeorological Interventions for Enhancing Farmers' Income

(AGMET-2020)

Kerala Agricultural University, Thrissur, Kerala
20 – 22 January, 2020

Organised by
Association of Agrometeorologists, Anand
and
Kerala Agricultural University, Thrissur

Inaugural Function-National Seminar-AGMET-2020

The National Seminar on "Agrometeorological Interventions for Enhancing Farmers Income (AGMET-2020)" organised by Kerala Agricultural University and Association of Agrometereologists has been inaugurated at Kerala Agricultural University, Thrissur, Kerala. The welcome address was given by Dr. P Indira Devi The Director of Research, KAU. Chief guest of the seminar Dr. Vinay K. Dadhwal (Director, IIST, Thiruvanathapuram) inaugurated the function. Presidential address was given by Hon. Vice -Chancellor of KAU, Dr. R. Chandra Babu. Dr. Vyas Pandey, President, Association of Agrometeorologists gave a talk regarding the Association of Agrometeorologists. Dr. B. Ajithkumar, Organising Secretary, AGMET-2020 gave note about AGMET-2020. He mentioned that near about 500 oral and poster presentations on 10 different themes are going to be held in the coming days. The new mobile application ASK (Agromet Services for Kerala) was also launched during the Inaugural function. This mobile application helps farmers to assess weather services throughout the year. Eminent Scientists from the field of Agricultural Meteorology was also honoured during the ceremony. Dr. C. Narayankutty, Associate Dean, College of Horticulture, Dr. K. K. Singh, Head, Agromet Advisory Service Divison, IMD, New Delhi and Dr. L. S. Rathore, International Consultant, The World Bank and Former Director General of Meteorology has felicitated the function. Vote of Thanks was given by Dr. K. Ajith, Chairman, Association of Agrometeorologists, Thrissur chapter.

Technical Sessions-AGMET-2020

Minutes of the Plenary Session
(20.01.2020 at Venue-I, KAU, Thrissur)

Chairman: Dr. L. S. Rathore, International Consultant, The World Bank Former DG, IMD

Co-chairman was Dr. P. VijayaKumar, Project Cooridnator, AICRPAM, CRIDA, Hyderabad

Rapporteur : Dr. K. K. Dakhore, VNMKV, Parbhani

The First presentation was on Dr. L. A. Ramdas Memorial lecture on Opportunities & Challenges in Agrometeorology by Dr. L. S. Rathore, International Consultant, The World Bank Former DG, IMD . He indicated that the Role of weather & climate in agriculture is known since inception of agriculture but the agrometeorology as discipline came to focus when it engaged in science issues which have an impact on lives of Farmers (Scientists like Dr. LA Ramdas played role)

It developed science information based Agromet Advisory service. He also highlighted on opportunities for Agromet like Increase per unit yields of farm produce like reduction in production costs, enhance the quality of farm produce, efficient water management, Developing resilience to Climate Change, Environmental protection, Land management: microclimate modification, crop and soil management, Integrated Pest Management and Integrated Nutrient Management etc. Also

explored the Challenges for Agromet like Agromet Observations & data, Defining Crop Weather Relations, Understanding Crop-Pest-Weather, use less accurate forecast, translate weather info into advisory, Non availability of Agromet tools, Information dissemination, On farm application of agromet information, Assessing the socio-economic impacts etc. these issues need to be resolve. He narrated the prime areas for future growth like use of frontier techniques of instrumentation in Agromet observations and use of community radio centers needs to be establish on large scale for dissemination of agromet services. Similarly, now IMD is expanding at block level so needs more emphasis to automization of AAS.

Farm decision making is a complex process in which many risks need to be considered so production risk is manifestation of weather forecast & climate variability associated with farming process and includes variability in yield and quality. The farmers with limited access to agromet information, technological resources and with limited development of infrastructure are more prone to risks. Data as a support system for agrometeorology is often not up to the mark like data inadequacy; leaf area, canopy structure, photosynthesis, soil erosion, soil moisture, biological phenomena, pest & disease, direct and indirect damage owing to weather etc. MoES (IMD), ISRO (SAC) & ICAR (CRIDA, NBSSLUP) needs to set up a Joint Working Group for data bank.

We also do not have any data on meteorological variables or local special factors affecting agricultural production on a local mesoscale that are not representative of the general climate of the region. This needs to be done by carrying out agricultural meso-climatological surveys by District Agromet Field Units (DAMU).

Rapid advances in electronic technology facilitate effective exchange of data files, summaries and charts of recording instruments for this multiple data agencies must be linked with common data protocol like IMD/CRIDA/NRSC/NBSSLUP are required to come together to set up a Joint National Agromet Data Centre.

Need to improve the ease and efficiency of preparation and dissemination of agromet bulletins, automation of advisories for multiple crops and different stages of crop growth be developed as response farming tool and incorporated in database. Weather scenario of each block have to be developed separatel y for past and future weather. Agromet Community Radio; MoES should prepare guidelines and facilitate opening of Agromet Community Radio Stations in different agro-climatic zones of the country through providing finance for infrastructure and operating costs so the dissemination mechanism needs to become strong. All AICRPAM Centres and SAU HQ should develop capabilities of Ground Based RS to measure crop, soil, pest and diseases. In same fashion IMD/ICAR should provide suitable software to graph information that can be presented in agromet bulletins in a farmer friendly way.

Considering the importance of preparedness to cope with risks & uncertainties as compared to the practice of reactive responses, it is necessary to take stock of the opportunities that exist in coping with agromet risks to develop suitable practices/strategies and to disseminate them widely.

Need to understand the public perception on both aspects of weather forecast and agromet advisory on real time basis. Quantification of socio-economic impacts of advisories is essential for high impact advisories and their socio-economic impacts be made by all units. At the end he mentioned that radar & satellite monitoring & agromet advisories be strengthened.

The second presentation was made by Dr. P. Vijakumar, Project Coordinator, AICRPAM, CRIDA, Hyderabad on Crop-weather/pest-disease relationship and forewarning under changing climate, he highlighted on climate change over India using long period data from 1901to 2017 & 1981 to 2017 but it was no much variation in the climate variations for rainfall and temperature. Inter-annual variability of crop yield in long time series can be caused due to Technological trend

besides the Direct and indirect effects of weather factors. In developed countries, technological trends due to improved management accounts for 80% and weather, pests etc account for 20%.

Weather directly or indirectly influences the crops in their growth cycle, directly affects-structural characters like stand, leaf area, No. of tillers, No. of heads per plant etc and there by yield and indirectly affects-pests and diseases, weeds etc. Crop Weather Relationship (CWR) has many uses including Forecasting of yield of crops in advance, Optimum management decisions in agriculture, Weather based crop insurance, Agromet Advisory services and Crop Weather Calendars etc.

The important weather parameters influencing agriculture are precipitation in terms of amount and distribution, Air temperature both maximum and minimum, moisture content of the air as relative humidity and saturated vapour pressure and solar radiation or sunshine hours. The various studies of crop weather relationship were explored and explained the importance of temperature for phenology duration of crops and this kind of information is useful for fining the crop yield. The temperature thresholds of major crops were computed using long term crop phenology data with respect to weather data. these kind of data set are useful to analysis the crop condition or prediction of crop yields as well as for interventions while preparing agromet advisories.

Changes in concept of crop-weather relationship studies like statistical techniques like correlation, simple and multiple regression, step-wise regression etc. was used earlier years but after introduction of water use or Evapotranspiration, ratio of actual and potential evapotranspiration (AE/PE) known as Moisture Adequacy Index , PET by Penman method and water budgeting using Thorntwaite method was used. He also explained the methods of crop weather relationship evaluation like Correlation techniques, Crop weather analysis model and Crop growth simulation models etc. Similarly, regression techniques were also discussed and how to use best one technique for crop weather relationship studies.

Radiation use efficiency and water use efficiency these two scalars are most important in yield prediction methods. The percentage soil moisture avalabilty (PASM) is most useful for drought prediction.

He also discussed some thumb rules of forewarning models of pest and disease and also how to devolve these models.

Third presentation was made by Dr. Vinay K. Dadhwal on New opportunities for building crop stress and climate resilience with geospatial technologies. The main focus was on the use of multispectral remote sensing to identify the crop stress in terms of biotic and nutrient stress for a region. The potential use of these products enhance the Agromet services on real time basis. Due to availability spatial satellite data on large scale with 1 to 10 km resolution. Also mentioned about new indices developed by the scientist needs to be explore in the agromet field to catter the agromet advisory services for farming community on real time basis.

The entire crop management is better using EVI product than NDVI and lastly he praised about application of multispectral remote sensing is emerging tool for stress management as well as pest and disease forewarning and how to convert these information in useable format to farming community.

Theme 1: Climate variability & change: projections, impact on agriculture and mitigation

(21.01.2020 at Venue-I, KAU, Thrissur)

Chairman : Dr. B. V. Ramana Rao
Co-chairman: Dr. Rajendra Prasad
Rapporteur : Dr. Balaji Naik

Lead talk was delivered by GGSN Rao on the topic "Role of weather products in improving the performance of Agromet advisories". He indicated that many a time the information of livestock and fisheries are missing in Agromet advisory. Requirement of different organizations is different in terms of forecast needs.

Farmers are :

- Urban
- Semi urban
- Rural
- Hill region
- High rainfall region

- Different weather predictions
  a. Weather forecast at 9x9 km
  b. Crop based DSS
  c. Optimum range of weather parameters at different growth stage
  d. Weather lasts- extreme temperature, high rainfall, snow, fog
- Spatial map
  a. Current crop condition- RS(NDVI)
  b. Pest and disease map for hotspots
  c. Animal comfort indices map
  d. Area of damage due to floods and tidal waves
- Crop planning base products
  Micro level resource
- Crop suitability classification
- Contingency crop plan
- Identification of constraints
- Climate risk proofing technology
- Pre- season crop plan based on monsoon forecast
- Shifting crop planning with respect to shift in climate
- Alternate livelihood to improve
- Market based product
  a. Commodity uneven
  b. Market intelligence

Stakeholders requirement

Stakeholders	Requirement	Possible
Farmers	Weather forecast at 3x3 km for 5 days	Weather product crop suitability
	Micro crop plan	Weather forecast at 9x9 km
	Market intelligence	Pre season crop
	Pre season crop plan	Current season
	Contingency	
Peri urban farmers	Agro advisory for vegetable and floriculture	Advisory
Rural farming	Crop based weather advisory Canal water availabilty	Focus more on irrigation and water stress
	Market	Market information
High altitude farmers	More thermal based agro advisories	Weather alert such as temperature, forest fires, landslides, flash flood Spatial climatic maps DSS for crop management Market information
High rainfall area farmers	• Flood alert • Soil and water management • Spices and rainfed rice	• Landslides • Floods • DSS crop
Low rainfall region farmers	• Livestock • Fodder crops • Water mangement	• DSS for livestock • Drought management
Coastal farmers	• Fish culture • Floods • Salinity management	• Block level crop plan • Flood alert • Water monitoring
Dept of irrigation	• Water level • Rainfall in catchment area	
Dept of animal husbandry	• Fodder • Climatic conditions	

Local administration

- NGOs – constraints in agricultural production
- Crop insurance – resources inventory
- Fertiliser company – suitability of improved crop varieties

Conclusions

- Availability of products limited.
- We should try to meet the requirement of various stakeholders through different agro advisories.

<u>**Oral presentations**</u>

1.-

2. **Effect of El Nino on rainfall and crop production in different districts of Chhattisgarh state**
    - **Dr. J .L. Chaudhary**

El Nino causes variability from inter season to intra years. During El Nino year large variation in rainfall (negative) observed . It is observed in most of the districts of Chhattisgarh (1951-2018). He presented well on El Nino effect on seasonal rainfall distribution. Long term analysis of rainfall shows inverse relationship with El Nino. 5 % reduction in rainfall during El Nino years was observed in the state.he also presented on effect of El Nino on food grains. Production decreased by 15 % and productivity by 17 % in the state.

3. Weekly range of weather parameters for higher rice productivity in central Punjab
 - S. S. Sandhu

His study aims to find the favourable weather parameters in Punjab. His study critically analyse impact of weather parameters (Tmax and Tmin). The reason for yield reduction in rice during low yield years was due to higher minimum temperature. Low sunshine hours at reproductive phase leads to a reduction in productivity in 2012. If weather parameters remains within the desired range , it would lead to higher productivity in rice.

4.Rainfall probability analysis of Kalyani, West Bengal for crop planning
- M. K. Nanda

Weekly probability were worked out at 90%, 75% and 50% from 1993 to 2017 data. Monthly rainfall probability at 10 %, 25 %, 50m % and 75 %. High rainfall was recorded in the month of July . Choose crops and variety wisely and judicious use of irrigation water is recommended. Mulching and drought resistant crops should be used to overcome the problem. Conclusions were drawn and he well stated that downscaled output would be able to reduce uncertainty in rainfall. Contrasting results were stated with non downscaled data.

5.-

6.-

7.Assessing the uncertainty exhibited in the downscaling study of summer monsoon rainfall over Indian Sunderbans
- Ratul Chakraborty

The topic was introduced very well. Presentation was well planned with appropriate pictorial representation. He explained various agrometeorological interventions for enhancing farmers income. He indicated summer monsoon shows high uncertainty and the downscale product reduced uncertainty over sunderban and non downscaled data produced contrasting result.

8. Crop planning on the basis of moisture availability index for Ahmednagar district
- Dr. R. K. Andhale

MAI may not be the appropriate approach for crop planning. Instead PET, RF approach is good.Monitoring weekly MAI is suggested for suitable cropping pattern for Rahuri , Rahata, Ahmednagar. Paddy, finger millet ,little millet suggested in Akola block. Based on MAI , suitable crops can be suggested to different regions and soil types.

9.-

10. Integration of seasonal and medium range weather forecast for climate risk management in major crops of Telengana
- Dr. B. Balaji Naik

He commented that the integration of medium range and seasonal forecast has yield advantage and economic gain. Land allocation to different crop and varieties using seasonal forecast and planning day to day field activities using medium range weather forecasting is beneficial.

11. Futuristic changes in monthly meteorological parameters as simulated by four GCMs under four emission based scenarios at Ludhiana ,Punjab.

- Jatinder Kaur

GCM models are used in the study.In the introduction part little more attention is required. The methodology selected was appropriate.

12. Performance of rainfed chilly crop under climate change in RCP 4.5

- N. Kowshika

Good efforts was made in identifying suitable region of chillies under climate change scenario. Conclusion were well documented. Good efforts was made to discriminate the varietal variation in terms of performance under climate change scenario.

13. Rice yield projections for 21 st century over below sea level farming regions of Kerala,India

- P. Shajeesh Jan

Topic was introduced well. Good efforts were made to present the results.

14. How well do the CMIP5 GCMs reproduce the main seasonal cycle and inter-annual variability of rainfall over Sundarbans regions of India.

- Dr. Lalu Das

Blockwise rainfall variation over sunderban region is very less. Most of GCM were not able to capture the observed rainfall. The study was documented.

15.Construction of future downscaled rainfall change scenario over Sundarbans: A case study on Sagar Island

- Sayani Bhowmick

Downscaling methodology was appropriate. Combination of analysis, observations and GCM. MME 23 was found best to minimize uncertainty. Process based MME is best for estimation of future trends. Conclusions were well drawn by the presenter.

16.-

17.-

18.Effect of rainfall and slopes on soil organic carbon under tea and coffe cover in western ghats ,India .

- K. Rajan

Introduction was very good with pictorial representation. Results were well documented with appropriate graphs. The conclusions reflected well on all the parts of his study.

19.-

20. Changing rainfall scenario in Kandi region of Punjab

-M. J. Singh

Introduction of the topic with its basic information was presented very well. Conclusions were good. Frequency of below normal years need to be examined.

21.-

22.-

23. Weekly temperature ranges for higher mustard productivity in Central Punjab

- K. K. Gill

Introduction was fairly covered. Methodology was presented well. Results were also presented well with appropriate data and pictorial form. Conclusion need to be improve.

24. Assessing mid century climatic condition and their influence on maize crop in the semi arid Namakkal district, Tamil Nadu, India.

- Vinothkanna S.

Introduction ,results were well presented. Conclusions are well drawn.

25. Rainfall data analysis for crop planning in Northern Zone of Kerala

- P. K. Ratheesh

Introduction to topic not done well. Conditional probability index and criteria were not explained. Conclusions did not reflect well.

26.-

27.-

28. Potential impact of climate change on surface run off and sediment yield in a watershed of Lesser Himalayas

- Sooryamol K. R.

The research frame work flow chart is well presented. Sensitivity analysis need to be compute NRMSE for better judgement. Summary was drawn but needs to be concise.

29.-

30. Addressing the uncertainty in future climate projections over southern India through Multi model approach

- Gowtham R.

Good presentation about methodologies. Resuls are precise and appropriate with appropriate statistical analysis. Summarisation was good

31.-

32. Studies on crop weather relationship in groundnut in sothern zone of Andhra Pradesh

- T. Prathima

Introduction was good. Methodology followed by optimum weather derivation from historical data was appropriate. Correlation and regression analysis were well presented. Results were concluded well.

33. Impact of ENSO episodes on SW Monsoon rainfall variability and crop production in SW Haryana.

-M. L. Khichar

34. Responses of rice crop yield to climate change in the rice belts of Kerala

- P. Dhanya

35. Augmenting the best sowing week by employing water requirement satisfaction index for pearl millet for selected districts of Tamil Nadu

- Kokilavani. S.

36. Improving climatic projections with bias correction using quantile ,mapping in Punjab, India

Varun Biswas

37. The seasonal trend analysis of temperature and rainfall at Madurai

-Sathyamoorthy N. K.

38. Influence of climate and aerosols on wheat crop over Indo-Gangetic plains of India

- Geetika Sonkar

39. Impact of climate change on wheat production in UP.

-Shubhi Patel

40. Sustainable cropping system under climate change scenario in temperate hilly region of Nilgiris, South India

- K. Kannan

41. Is the downscaling of CMIP5 GCMS providing added information for agricultural impact assessment at local scale?

-Lalu Das

42. Climate change implications and simulated adaptation in rainfed rice production under sub humid climate of North Western Himalaya

- Ranbir Singh Rana

43.-

44.-

45.-

46.Trend and change point detection of rainfall for effective crop planning over southern transition zone of Karnataka.

S. Sridhara

47. Impact of El Nino- Southern Oscilation on rainfall and major kharif crops production of Maharasthra.

K. K. Dakhore

48. Impact of climate change on crop water requirement of rice in central zone of Kerala and assessment using CROPWAT model.

- Harithalekshmi V.

49. Crop weather relations in cassava under moisture stress

-K. Sreelakshmi

50. Climate change impact on waterbalance of Bharathappuzha river basin in Kerala.

-Anu Varghese

51.-

52.Agroclimatic analysis of Raipur station of Chhattisgarh state on the basis of mesoclimatic scale.

- Das G. K.

53. Temperature trends over India-a district wise analysis

-A. V. M. Subbarao

54. Determination of onset and withdrawal of rainy season for crop planning in upper Brahmaputra valley zone of Assam

- Sangeeta Hazarika

56. Use of percent available soil moisture criterion for drought declaration in soy bean crop

- A. R. Tupe

57. Irrigation requirement of major crops Sankareddy district under changing climatic scenarios.

- B . Harini

58. Initial and conditional probability of rainfall for crop planning in Kerala.

- Abin Divakaran A.

59. Crop water requirement of rice during different seasons of Kerala

- Chinnu Raju

60.Agroclimatic onset of sowing for crop planning in Kerala

- Riya K. R.

Theme 2	Micrometeorological modifications for climate resilient farming
Day 1	20-1-2020
Venue 3	Final Year Class Room, CoH, KAU
Time	3.00 PM to 4.45 PM

Chairman	Dr P. Vijay Kumar, PC, AICRPAM, ICAR-CRIDA, Hyderabad
Co-Chairman	Dr P. Raja, Principal Scientist, ICAR-IISWC Research Centre, Udhagamandalam, T.N
Rapporteur	Dr C. S. Dagar, Asstt. Scientist, CCSHAU, Hisar

The Chairman, Dr P. Vijaya Kumar welcomed all the delegates for oral presentations under Theme 2 (Micrometeorological modifications for climate resilient farming). Total 27 presentations were selected for this session and out of which 12 presentations were made. Before the presentations, Dr P. Raja, Principal Scientist, ICAR-IISWC Research Centre, Udhagamandalam (T.N.) delivered a lead talk on "Climate variability-their impacts on agriculture and food security". He discussed about the weather extremes, soil degradation, air & water pollution, poor food quality & depleted nutrients in the context of changing climate. He presented the various challenges for the scientific community and one of them is food grain production to meet out the demand of 493 million metric ton by 2050. He suggested that this challenge can be met out by collaborative work of scientific community along with policy maker. He stressed upon 3Es i.e. *Educate* the farmer, *Employ* the farmer and *Empower* the farmer.

Dr H.M. Meena, Scientist, CAZRI, Jodhpur presented his findings on "water productivity and economics of deficit irrigation in summer clusterbean in arid western Rajasthan, India". He explained the working of mini lysimeter installed and method of computation of water production in clusterbean.

Dr P. Raja presented his findings on "Variations in micrometeorological parameters and their implications on fluxes in parts of temperate mountains ecosystem of Nilgiris, India" with the objectives to measure GHG emission from various land use systems. He explained that the natural forests are natural sinks of CO_2 and concluded that soil moisture was highest in shola forest.

Dr Deepa Thomas, Asstt. Professor, KAU made her presentation on the topic "Integrated farming system options for climate resilience in *Pokkali* ecosystem". He told that *Pokkali* rice is the most salt tolerant rice variety and pests never occur above ETL in this ecosystem. He calculated the B:C ratio for different treatments and concluded that rice with fish plus duck is more remunerative.

Dr Mini Abraham, Professor at KAU showed findings on combating water scarcity through partial root zone drying method of irrigation. The brinzal yield was highest under drip irrigation at 75% PE along with mulching. He concluded that where water is most scare resource, PRD method of irrigation is promising.

The new techniques of marker assisted breeding for climate resilience in rice was presented by Dr P. Sindhumole, Assistant Professor from College of Horticulture, KAU, Thrissur. She explained the screening of germplasm for drought and heat tolerance.

Dr Sudhir Kumar Mishra, Asstt, Scientist, PAU Regional Research Station, Faridkot analysed the growth rate of sugarcane under varying environmental conditions of Punjab to determine the

optimum planting dates. He concluded that sugarcane growth rate is higher when planted early i.e. 25th Feb. He also found that agroclimatic zone II (Gurdaspur) is more sustainable for higher growth and yield of sugarcane.

Micrometeorological study in pearl millet under varying growing environments and varieties in rainfed conditions was presented by Dr Anil Kumar, Asstt. Scientist, CCSHAU, Hisar. He explained the PAR interception, canopy temperature and chlorophyll content behaviour of pearl millet along with their relationship with yield.

Dr Joydeep Mukherjee, Principal Scientist, IARI, New Delhi explained the "seasonal variation of energy fluxes over maize-wheat cropping system in North-western semi arid region of India". He presented the energy balance components in maize crop and drew the temperature and humidity profiles within the crop canopy. The satellite derived ET was compared with the actual measured ET.

The exploration of weather parameters on productivity component of field pea (*Pisum sativum*) under different management practices was presented by Dr Gautam Saha, Prof, BCKV, Mohanpur on behalf of Ms Ankita Chakma. He correlated micrometeorological parameters with yield of field pea and concluded that highest yield was achieved under zero tillage followed by conventional tillage and relay cropping.

Ms Swathy Sugathan P, Research Scholar at KAU, Thrissur presented "water scarcity in coastal area: implication and level of awareness" with the objectives to analyse the dimension of water scarcity and economic burden on households and impact in agriculture sector. She concluded that the cost of irrigation accounts about 45% of total cost of cultivation.

Dr Sharanappa Kuri, Research Associate, UAS Bangalore presented his findings on "effect of sowing dates and row spacing on phenological phases, thermal requirement and HUE in pigeonpea varieties". His findings revealed that HUE was higher in early sown crop and the narrow row spacing realised higher grain yield.

Ms C. Aswathy, PG student at KAU, Thrissur presented "effect of date of planting and mulching on phenological aspects of tomato in the central zone of Kerala". She concluded that more plucking can be fetched with black top white bottom plastic mulching, and the soil under straw mulching retains higher soil moisture as compared to other mulches.

The session ended with the remarks of chairman and he thanked all the presenters.

Theme 3 : **Extreme weather events and its impact on agriculture**
Day 1 : 20-01-2020
Venue 2 : Seminar Hall, CoH, KAU
Time : 3.00 PM to 5.45 PM

Chairman	Dr. G.G.S.N. Rao, Former Project Co-ordinator, AICRPAM, CRIDA
Co-Chairman	Dr. S. Panneerselvam, Director, Water Technology Centre, TNAU, Coimbatore
Rapporteur	Dr. Raj Kumar Pal, Agrometereologist, PAU, Ludhiana

The lead talk was delivered by Dr. S. Panneerselvam, Director, Water Technology Centre, TNAU, Coimbatore on the topic 'technological options for increasing crop yield and farmers' income under changing climate'. Total 19 presentations were selected for this session and out of which eight presentations were made.

Recommendations/Remarks:

1. In order to increase the productivity of the crop as well as to increase the efficiency of irrigation water, micro irrigation methods (specially drip irrigation) should be given top priority.
2. To doubling the farmers' income, allied activities of agriculture like dairy development, poultry etc. should be encouraged and integrated.
3. Value addition through food processing is one of the best method to doubling the farmer's income especially for fruits and vegetables.
4. Pollution related studies (soil, water and environment) should be given more preference for the current climate change and variability scenario.
5. To reduce the crop losses due to extreme weather events, weather based agro advisory services should be strengthened based on the current cropping system.
6. A proper system should be developed in order to have feedback on agricultural losses from farmers/public regarding forecasting of extreme weather events like cyclone, heavy rainfall, drought etc.
7. Crop and region specific economic impact study should be conducted for the losses due to extreme weather events.
8. Agro climatic characterization should be done in order to assess the impact of extreme events on agricultural operation for better productivity.
9. Remote sensing techniques should be used properly for the monitoring and quick access to crop losses due to extreme weather events.

The session ended with the remarks of chairman and he thanked all the presenters.

This session was chaired by **Dr V Geethalakshmi** and Co-Chaired by **Dr A V M Subba Rao** and Rapporteur was **Dr S S Sandhu.**

Dr V Geethalakshmi started this session with the remarks that crop weather models are very important in various spheres of science and can play important in climate resilient agriculture and thus farmers' income.

There were 14 presentations by different scientists:

Dr Ankit Balvanshi presented his work entitled 'Impact of climate change on future Reference Evapotranspiration (ET_0) and Crop Evapotranspiration (ET_c) for Soybean in two districts of Madhya Pradesh' he shared that in the Hoshangabad region, the ET_o and ET_c of soybean values for RCP 2.6 were found to be in range of 375.2 – 450.6 mm and 382 – 428 mm for years 2030, 2060, 2090. While the ET_0 and ET_c soybean values in Hoshangabad region for RCP 8.5 were found out to be in range of 406 – 612 mm and 394 – 577 mm for years 2030, 2060, 2090. In the Sehore region, the ET_o and ET_c values for RCP 2.6 were calculated to be in range of 400.5 – 512 mm and 299.8 – 349 mm for years 2030, 2060, 2090. While the ET_0 and ET_c values in Sehore region for RCP 8.5 were found out to be 466 – 740.5 mm and 386 – 601 mm for years 2030, 2060, 2090 respectively. It is seen that there is variation in the ET_0 and ET_c values under different climate scenarios.

Dr Diwakar Naidu presented his research on 'Development of radial basis function neural network model for rainfall prediction for Chhattisgarh state in east central India'. He stressed that Proposed RBFN models are capable of predicting rainfall using the NCEP predictor variables with considerable accuracy due to Lower RMSE and MAE values and higher R^2 is observed between actual and predicted rainfall in all the three agro-climatic zones. Future predictions of rainfall time series based on HadCM2 B2 scenario using the proposed RBFN models indicated an increasing trend of annual rainfall in the study locations during the period 2021-2050 with decadal variations.

Dr Amresh Chaudhary presented his work on 'Estimating soil organic carbon sequestration potential of Vertisols and associated soils of Madhya Pradesh, Central India as influenced by cropping systems and nutrient management practices using APSIM model' and shared that APSIM Model has good potential to predict the crop yields and soil carbon sequestration potential under different cropping systems and nutrient management practices. Maize – Chickpea cropping system has higher potential of soil organic carbon sequestration than Maize – Wheat cropping system. He further highlighted that Maize yield was higher under Maize –Chickpea cropping system than Maize – Wheat system. SOC sequestration potential and grain yield in both the cropping systems were higher under recommended dose of NPK+ FYM than NPK alone. Interpolation maps were created for identifying priority areas for better carbon sequestration and crop yield, which can be further utilized for delineation of management zones and site specific management practices.

Dr N. Subash shared his research work on 'Potential yields and yield gap of major cereals over India by linking modeling with reference weather and secondary data' he highlighted that Yield gap of major food crops of India varied significantly among different climatic buffer zones.

Technological interventions including agricultural water management techniques need to be prioritized and implemented to bridge the yield gaps of crops to ensure food security of the nation.

Dr Javed Akhter presented his work on 'Evaluation of IITM-IMD extended range forecast products in predicting kharif rice yield over Gangetic West Bengal'. He shared that ERP-F has been able to reproduce observed mean and variability of rice yield better than clim-F. The changes in statistics of yield with planting date have been better depicted by ERP-F. ERP-F captured the inter-annual variability of rice yield better than clim-F for 1st July and 15th July planting dates, as evidenced by higher correlation and lower NRMSE values. However, the performances have been poor for both forecasts in the case of IC1. Skills of ERP-F have gradually improved from IC2 to IC4. ERP-F has shown superior skill in identifying categorical events, especially for below and above normal yields better than clim-F.

Jatinderpal Singh presented his work on 'Performance of DSSAT and WOFOST models in simulating wheat phenology and yield under different growing environment'. He shared that the anthesis date was better predicted by WOFOST model with lower RMSE as compared to DSSAT model. The maturity date and grain yield was better predicted by DSSAT model with lower RMSE as compared to WOFOST model.

A Pooja presented her findings on the topic 'Statistical analysis of rainfall with skewed distribution for better yield prediction and crop planning'. She shared that use of inappropriate statistical measures without considering the distribution followed would lead to misinterpretations. She highlighted that for analysis of rainfall data with skewed distribution median should be used at place of mean.

Dr P Mishra presented his work on 'Forecasting of rice production using the meteorological factor in major states in India and its role in food security'. He highlighted that rainfall has changed randomly during the study period for West Bengal, Uttar Pradesh and Punjab. He also shared that non stationary time series data on different production parameters could be made stationery after I^{st} differencing and which show better accuracy in the ARIMA models after the inclusions of factors (ARIMAX) of productions. This study revealed that knowing the production potentials in association with factors of production will improve the forecasting accuracy which in turn may help in formulating effective agriculture policy related to the particular crop.

Dr R N Singh presented on the topic 'Evaluation of CROPGRO pigeon pea for Delhi NCR' and concluded that CROPGRO-pigeon pea gives reasonable predictions for all three cultivars (UPAS 120, AL 201 and Pusa 992) and the genetic coefficients developed can be used for further climate change studies.

Dr K. Ajith presented his work on 'Rice yield prediction by integration of CERES-rice crop simulation model and MODIS LAI (MOD15A2)' he shared that yield prediction with CERES-rice model integrated with MODIS-LAI gave higher accuracy in all the varieties compared to yield prediction by crop simulation model alone.

Dr S.B.Yadav presented his work on Evaluation of INFOCROP-POTATO model for yield prediction of potato in middle Gujarat. He stressed that the InfoCrop-Potato model simulated phenology, LAI, haulm yield, tuber yield and total biomass of potato under different planting dates satisfactorily with error percent less than 10 except for leaf area index.

Sarabjit Singh presented on the topic 'Evaluating the impact of intra-seasonal change in temperature on grain yield of wheat using CERES-Wheat and InfoCrop model in Punjab' and shared that among the two models, CERES-Wheat is a better research tool in climate change studies. Cv WH-1105 may be recommended for cultivation due to its tolerant traits towards maintaining its yield as well as harvest index which are the most important determinants of high productivity of a cultivar. He further shared that the mid November sowing of wheat would be optimum as compared to late sowing under climate change scenarios.

Dr G. Subramanyam presented on the topic 'Calibration and validation of CERES-Sorghum model in DSSAT v4.7'. He highlighted that DSSAT model was able to predict the yields of all the varieties (Maldandi, Phule Vasudha, Phule Maulee and Phule Chitra) with good RMSE values. It could be used for future climate change studies.

Dr U. Surendran presented on the topic 'Application of Decision Support Systems for improving crop productivity under changing climate'. He highlighted that under GFDL-ESM2M model, the yield of banana, rubber, coffee, black pepper (rain fed), coconut, Arecanut (rainfed) showed a decline of 0.3 to 33.6 %. However, rice, black pepper (irrigated) and Arecanut (irrigated) showed an improvement in yield, which is a positive trend. Altogether, if we look at all the models and different RCPs showed that in most of the cases the yield tend to decline except in a few.

Theme 5 : Biotic and abiotic stress management for climate resilient farming

(21.01.2020 at Venue-II, KAU, Thrissur)

Chair: Dr. G.S.L.H.V. Prasad Rao
Co-Chair: Dr. L. Girija Devi
Rapporteur: Dr H.M. Meena

The session was conducted with chair Dr. G.S.L.H.V. Prasad Rao, Co-Chair: Dr. L. Girija Devi. The total oral presentation papers were 31 including one lead talk given by Dr. G.S.L.H.V. Prasad Rao and out of that 15 papers were presented by research scientist and research scholar in the session. During the lead talk brief about crop water requirement for crop in the Kerala state and the rate of pan evaporation about 10 mm/day even in December month. Indian food grain production depended on rainfall but main key influence factor as rainfall occurring during first fortnight of July and First fortnight of August month. The biotic and abiotic stress management was covered in the session as results of various crop sowing environment and various crop varieties and climate resilient. The papers was presented in majority in relation of growth and phonological stages with agrometeorological indices as heat unit , radiation interception and heat use efficiency by the crop in various region. In sub-tropical region, Rice variety (SJR-129) performance was good as yield production. In- situ moisture conservation showed that ridge sowing of maize is useful climate resilient technology under rainfed condition. A phonological study of grand nain banana resulted that fruit quality and also yield is higher is superior when tree planted in February and July month as compared to other month planted. The impact of seed priming and folier spray on crop of sampoorna multinutrients mixture was good and address micronutrient stress in Kerala state. Optimize the time of application of Paclobutrazol in *kharif* groundnut that was 25 to 30 days after

sowing is more enhancing crop yield. Suppressing of weed population in cotton by increasing plant density. Discussion on productivity of garden pea under biotic and abiotic condition and impact of CO_2 and temperature on vegetable crops. Discussion on what are the causes and protection of sunburn damage in apple and results showed that less damaged of smaller fruit of big tree having well developed canopy with good shade effect as compared to larger fruit on the same tree. Discussion on relation of agrometeorological indices with productivity of finger millet and varities of maize. Enhancing climate resilient in rainfed agriculture as enhancing water use efficiency with intercrop as compared to hole crop and broad bed furrow in-situ technology and spary KNO_3 to stress management during prolonged dry spells.

Theme 6	**Application of remote sensing and GIS for enhancing crop production**
Day 2	20-1-2020
Venue 2	Seminar Hall, CoH, KAU
Time	2.30 PM to 4.45 PM

Chairman	Dr. Vinay Kumar Sehgal, Professor and Principal Scientist, IARI, New Delhi
Co-Chairman	Dr. Joydeep Mukherjee, Principal Scientist, IARI, New Delhi
Rapporteur	Dr. Anil Kumar, Asstt. Scientist, CCSHAU, Hisar

The Chairman, Dr. Vinay Kumar Sehgal welcomed all the delegates for oral presentations under Theme 6 (Application of remote sensing and GIS for enhancing crop production). Total 28 presentations were selected for this session and out of which 8 presentations were made. Before the presentations, Dr Vinay Kumar Sehgal, (Chairman) Professor and Principal Scientist delivered a lead talk on "Mapping and managing climatic risks in agriculture using geospatial technology: Indian case study". He elaborated the remote sensing and GIS work at IARI, New Delhi. The data of satellite image and other can retrieve from the USGS and use gridded data, use Google earth engine. The first experiment conducted based on remote sensing in Kerala particular in coconut wilt root diseases in the year 1969-70. The experiment was collaborative approaches among the collaborated organization of ISRO, IARI and NASA, about 20 year of remote sensing satellite by India. He discussed about the extreme weather extremes, risk, disaster, vulnerability and evaluated by using the free accesses satellite data through RS and GIS application and coefficient are generated context of climate variability and changing climate. He presented the different climatic risks drought, flood, climate variability, temperature extreme or heat wave and cold waves impacted in the kharif and rabi crops. Further presented the climate change implication for agricultural risks due to climate variability and climate change and resulted the Indian Ocean Tsunami event, so risks can characterize different ways. He delivered the heat wave magnitude index calculation and satellite NDVI time series data from 1892-2014, 10 day interval, 4 kilometre resolution accessed for wheat yield. He suggested that this challenge can be met out by more strengthening the work and younger researcher come forward. They can lead to used the RS and GIS platform to derive the product based on climate change and variability based agricultural risks with collaborative work of scientific community for the betterment of feature losses.

Dr. Cuba P., Assistant Professor, Vellore Institute of Technology, Vellore presented her findings on "deploying cheap digital technologies in climate smart agriculture". She explained the working

of digital technology, circuit, sensor of weather parameter tracking with programming. The climate smart agriculture farming emphasized the précised weather parameter i.e. temperature, relative humidity etc., so digital technology can held towards smart agriculture. He delivered open source prototype like Arduino and others, the soil moisture sensor interfacing with Arduino, about programming source code will free provide and user can little change. Cheap digital technology base weather instrument easy adaptation and it extensibility, cost 4 time minimal with the same feature and connectivity via large device

Dr Mohan Singh, Senior Scientist presented his findings on "Analysis of chilling hours over north west India in context to climate change using GIS" with the objectives to measure analysis of chilling hours using GIS (ArcMap 10) for plain, North West India and Hill. Considering 22 station weather data and analysis for chilling hours for the temperate fruit crop the respective categorized zone. He explained that the time series and decadal trend of chilling hours in respective zone i.e. plain, NW and hill was decreasing trend and over all shrinking by 2.2 hours per year. The chilling requirement month explained for hilly area from November, December, January and February month, for plain area notice only three month i.e. December, January and February availability chilling hours.

Mr. Satej PanditRao, Senior Consultant company, Ahmadabad, Gujarat based company his presentation on the topic "Revolutionizing agriculture using remote sensing and GIS: Present and future". He told that project given by Gujarat government, for sis district of Andhra Pradesh and Orisha government for the acreage estimation, crop health and crop cutting experiment for the crop insurance. The accuracy of crop acreage estimation, crop cutting and crop health RS and GIS based analyzed product was varies from 72-73 percentage. The crop classification is also classified in respect to acreage, crop health and disease, UAV survey.

Ms. S. Priyadharshini, Data Analyst made her presentation on the topic "Coconut area mapping at Kozhikode, Kerala using Geo Spatial Technologies". with the objective area or acreage of Coconut in Kozhikode. She told that coconut mapping of coconut area through used of Cortosat, LISS, IV remote sesing image and processing with help of RS and GIS tool through remote sensing indices i.e. NDVI. Acreage estimation of coconut area of Kozhikode, Kerala presented.

Mr. Khilesh, PG student, IGKV, Raipure presented the remote sensing in integrated pest management with integrated pest management through RS. He is delivered the basic of remote sensing with well known recent advance science. He is talk about the remote sensing used in various aspects in the field of agriculture through different mode i.e. use in insec management, pest forecast and diseses appearance can be analyzed to prossesed the remote sensing satellite imageries. He talk about remote sening can help in the habitat survey also. He concluded remote sensing is recent advancement technology which reduced the cost of cultivation of farmers.

Ms. Reshma M. R., Student, presented on "Delineation and mapping of soil available sulphur status in Salem district of Tamil Nadu use GIS and GPS techniques". Elaborated the objective, nutrient content of soil in Salem district, TN and derived soil nutrient index values with the used of RS and GIS (Arc GIS). She explained the screening, sampling and soil analysed by random sampling and further presented the experimental quantify/results over the nutrient status and further draw the thematic map for different soil nutrients, Soil nutrient index value (NIV) and fertility rating map generated of Salem district, TN. Remarked by chairman made, so please validate your fertility rating and other nutrients.

Mr Kamlesh Galhoni, PhD Bhopal presented on "Spectro radiometer in water stress detection." main objective described the use of radiometer and analysed the two water treatment one is flood irrigation and second one sprinkle irrigation and take spectro-radiometer reflective signature comparing wave length and trending. He presented the spectro-radiometer for water stress/deficit and identified sensitive wavelength prior to growth stage of wheat. He presented the reflectivity signature of sprinkler and flood irrigation treatment and 974 & 1195 wave length in use for detecting water stress. Chairman given the suggestion or remarks winter wheat is not cultivated, please mentioned the spring wheat.

Dr R.S. Rana, Professor, CSKHPKV, Palampur presented his findings on "Geo spatial mapping of soil micro nutrients for augmenting quality of weather based agro advisory in agricultural production system of Himachal Pradesh" with the objectives to analyzed and mapping the soil micro nutrient of HP andmapping with used of GIS (ArcMap 10),

The session ended with the remarks of chairman and he thanked all the presenters. Chairman also remarked about the presenters who presented his/her talk, remain present in the hall to get benefited to science.

Theme 7	**Crop-weather-pest-disease relationship and forewarning under changing climate**
Day 2	21-1-2020
Venue 3	Final Year Class Room, CoH, KAU
Time	9.00 AM to 1.00 PM

Chairman	Dr N. V. K. Chakravarty, Former Head, Division of Agricultural Physics, IARI, New Delhi
Co-Chairman	Dr H. Venkatesh, Former Director of Extension, UAS, Dharward
Rapporteur	Ms. Smitha Revi, Assistant Professor, Dept. of Agricultural Entomology, CoH, Vellanikkara

The Chairman, Dr N.V.K. Chakravarty welcomed all the delegates for oral presentations under Theme 7 (Crop-weather-pest-disease relationship and forewarning under changing climate). Total 26 presentations were selected for this session, and out of which 15 presentations were made. Out of 15presentations, students made six presentations.

"Development of weather based model for forewarning incidence of whitefly (*Bemisia tabaci* Gennadius) in cotton (*Gossypium hirsutum*) in Punjab" was presented by Dr. Sandeep Singh Sandhu on behalf of Prabhijot Kaur. He explained the decision support model developed for forewarning incidence of whitefly and correlated with temperature and RH.

Dr. A.K. Srivastava, Professor, JNAU, Madhya Pradesh evaluated the critical weather rule for prediction of yellow mosaic disease on soybean in central India. Mungbean Yellow Mosaic India Virus (MYMIV) infection showed that the weather factors, vector (whitefly) population and crop

age were influencing the disease incidence. The weather rule may be used to predict the peak disease incidence in central India.

Dr. D. S. Mutkule, Oilseeds Research Station, Latur, Maharashtra presented the weather indices based regression model for forewarning of leaf miner incidence in groundnut crop. Predictability of model for leaf miner was 90.75 per cent and 74.04 per cent for age of ground nut crop at peak infestation of leaf miner.

Dr. Mani Chellappan, Professor, KAU presented the topic titled "Giant Malabar Squirrel- a threat to plantation crops in the changed climatic scenario in Kerala". He discussed the results of survey and various management methods.

Dr. Haseena Bhaskar, Professor, KAU presented her findings on "*Oligonychus tylus* (Acari: Tetranychidae) emerged as a new pest of rice and banana in Kerala- a case of changing pest scenario vis-à-vis climate change". Higher temperature might have favoured *O. tylus* a mite species with inherent capacity to breed at a faster rate and shorten life cycle leading to flare up of the population.

Dr. Sharanappa Kuri, Research Associate, UAS, Bengaluru explained the influence of prevailing weather parameters on population dynamics of pigeonpea pod borer complex under eastern dry zone of Karnataka. The multiple linear regression analysis showed that 62 per cent variability in larval population was accounted by minimum temperature, maximum temperature, RHI, RHII, bright sunshine hours and evaporation. Incidence of pest can be predicted using this relationship.

Dr. V.B. Akashe presented his findings on "Development and validation of forewarning model for fig stem borer (*Bactrocera rufomaculata* De Geer) in Maharashtra state". He explained the development of linear regression equation for forewarning the incidence and further spread of fig stem borer.

Ms. Sanghmitra Aditya, Research Scholar form IARI, New Delhi explained the relationship of weather factors with fungal foliar disease development in groundnut (*Arachis hypogaea* L.). He highlighted the role of weather parameters such as date of sowing, cumulative rainfall and cumulative rainy days on fungal foliar disease development and this information strategy can be used to develop specialized climate resilient farming approaches.

Mr. Amith G., Research Scholar, TNAU presented the development of disease forecasting models using agrometeorological and micrometeorological variables. Study was undertaken with a new concept called lead-time for plant disease forecasting, which helps controlling diseases early before they reach to economic injury level.

"Brown rust (*Puccinia melanocephala*) development in sugarcane in relation to weather parameters in western Maharashtra "was presented by Dr. D. V. Indi on behalf of S.V. Nalawade. A multiple linear regression equation was developed for effective estimation of the occurrence and intensity of rust.

Dr. Narayansamy Manikandan presented the topic titled Response of Yellow Stem Borer (YSB), *Scirpophaga incertulus* Walker (Pyralidae: Lepidoptera) to different temperature regimes". The collection of data on life-table at various temperature regimes yields an important task for pest management in different environmental conditions.

Dr. Krishna Rolania, Assistant Professor, CCS Haryana Agricultural University explained the reasons of outbreak of whitefly, *Bemisia tabaci* (Gennadius) on cotton in Haryana. Increased humidity and lowering of temperature as a result of rains during second fortnight of June appear to have favoured whitefly multiplication.

Ms. Snehal G. Kanade, Research Associate, MPKV, Rahuri presented her findings on "Population dynamics of *Spodoptera litura* in relation to weather parameters under different sowing windows". She discussed correlation and regression studies and the positive correlation of larval population with maximum temperature, RHI, RHII, evaporation and sunshine hours.

Ms. Roomi Rawal, Research Scholar, CCS HAU made her presentation on the topic "Effect of weather parameters on population dynamics of cotton leaf hopper on cotton genotypes". She explained the positive correlation of leafhopper population with minimum temperature, morning and evening relative humidity.

Ms. Manisha, Research Scholar, CCS HAU presented the correlation of weather parameters with Pink bollworm incidence in desi cotton. She told that pink bollworm has significant negative correlation with temperature, RH and rainfall and positive correlation with sunshine hours.

Most of the studies are related to regression equations for predicting the pest population. In this session, one interesting topic on Giant Malabar Squirrel was presented. Important recommendation of the session is to use simple weather based dynamic thumb rules for forewarning pests and diseases in various crops. The session ended with the remarks of chairman and he thanked all the presenters.

Theme 8: Use of ITK and ICT tools for climate resilient farming

(21.01.2020 at Venue-I, KAU, Thrissur)

Chairman: Dr. T. N. Balasubramanian

Co-Chairman: Dr. J. D. Jadhav

Rapporteur: Dr. Mahender Singh

The session was chaired by Dr.T.N. Balasubramanyam and co-chaired by Dr.J.D. Jadhav and the rapporteur of Dr. Mahender Singh. In this session out twenty five presentations only eleven presentations were done by different authors. In the session started with the lead talk given by Dr.T.N. Balasubramanyam, ex Professor, TNAU, Coimbatore on the role of ICT and related ITK on the resilience capacity of a region to climate change. He highlighted that the climate change risk is a function of hazards nature, regional vulnerability, the duration and intensity of exposure. These must be integrated by policies, plans and programmes of sustainable development. He also suggested the ways for sustaining Resilience Capacity Enhancement (RCE) by Village knowledge centre, Village level agro-met observatory, people owned and managed, Climate literacy through

night school, Pre-seasonal workshop, Development and adoption of weather based technologies, Sustainable development in village, level infra-structure facilitie. The first oral presentation was done by Ga Dheebakaran that artificial intelligence in weather based agro advisory services was done by automated weather calendar module for individual crop to provide schedule of weather based crop production operations for entire cropping season which would be updated automatically with the current weather and midterm corrections. He has presented another paper on MAI calculator for Tamilnadu. He reported that MAI is a good indicator of the moisture status of the soil in relation to water need. The application is free available in the open web source

htttp://aas.tnau.ac.in/mai.*Thereafter, Dr. Omender Sangwan* presented his paper on e_kapas advisory for the cotton growers of Haryana. He highlighted that timely and relevant information with regard to cotton production with weather based is disseminated to the registered cotton growers of Haryana state. This was great use to illiterate farmers and helping in uplifting economic and social status of farmers. Then the Dr. Chander Shekhar brief about the aadoption of AAS reduced cost of cultivation in terms of farm inputs and also increased the net farm income. He told that by adoption of agromet advisory bulletin on an average the net benefit in wheat crop due to AAS was Rs. 20932 /ha. Dr. Veena Sharma presented the forecast accuracy of rainfall of Jammu district for all 5 days. She told that the higher accuracy of Max. & Min. Temperature, Max. & Min. RH was observed among 5 days during all seasons. The medium range weather forecasts used for preparing agromet advisory bulletins for the farmers of Jammu district. Jinukala Srinivas presented a review paper that web-server for disseminating agrometeorological information which further provides knowledge and training to large number of agriculture stakeholders cost effectively via internet. Dr. S.R. Patel brief about the Average rainfall goes on increasing till Pushya Nakshtra. Pushya (July 20-August 02) and Ashlesha Nakshtra (August 03-16). He also highlighted that after Magha nakshtra, the rainfall quantity goes on decreasing and there is steady decrease in rainfall quantity during Swati Nakshtra. Further, he told that rainfall quantity in Magha (Aug 17-30) and Pu. Falguni (August 31- Sept. 12), the rainfall quantity is sufficiently high with a total of more than 100 mm in each Nakshtra. Dr. Mamatha Alugubelly presented there is significant similarity among the WCs at block –level.This shows that there is scope for *reuse* of the advisory among the similar crops of the adjacent blocks. He stressed that there is a significant *reuse* of weather conditions from one block to other for improving the efficiency of agro-advisory using the notion of *reuse* at block-level advisory generation. Anirudh K. C. told about the reality gaps in weather based crop insurance schemes in India. He told that by enhancing the quantity and quality of ICT enabled weather data collection and analysis which will be enhanced the strength the policy matter for weather based crop insurance scheme of various crops and farmers can get the benefit of such scheme in more better way. Sh. Sarath Kumar a representative of reliance foundation information services presented the impact of weather based agro advisories in empowering and improving livelihood of farmers of India. He told that 55% of the farmers get weather based agromet advisory service through emails, sms, television, radio, newspapers and voice sms.   Some question were raised about the methodology of the damage assessment from participates. The detail discussion was held after the all presentation of session. The chairman also expressed vote of thanks for the participant personated their research in the session in a very better way.

Theme 9   :   **Forest resilience, biodiversity and climate change**
Day 3   :   22-01-2020
Venue 2   :   Seminar Hall, CoH, KAU
Time   :   9.00 AM to 12.00 PM

Chairman	Dr. T. K. Kunhamu
Co-Chairman	Dr. Gautam Saha
Rapporteur	Dr. A. K. Anisha

The lead talk was delivered by Dr. Gautam Saha on the topic 'Application of drone technology in weather monitoring system'. Real time data on forecasting will be available by using this technology.

Total 23 presentations were selected for this session and out of which nine presentations were made.

Dr. Sandeep Arya presented on the topic 'Ecological role of Khejri trees (*Prosopis cineraria*) in resilience of agriculture in semi-arid landscapes of Haryana and Rajasthan located in the western parts of India'. The Khejri trees performed better in the study area compared to other agroforestry trees regarding the biomass produced. The performance of intercrops wheat, mustard and gram crops under the agroforestry system was also studied. Crop biomass were higher in the agroforestry system.

Mr. Gopal Dutta presented on the topic 'Sequestration of carbon as influenced by plant morphology under changed climate'. Eight tree species were studied for carbon sequestration capacities in the Viswabharathy campus. *Mangifera indica*, *Shores robust*a, *Polyalthia longifolis* accumulated more carbon than other species and recommended to combat climate change and air pollution hazards.

Krishma Nanda presented on the topic 'Mitigation of climate change through *Melia dubia* based Agroforestry Systems in Semi-Arid Zones of India'. *Melia dubia* and barley intercropping system was studied. *Melia dubia* performed better on all growth attributes under intercropped system. The physiological parameters of barley was also studied.

Miss Kavya Jeevan presented on the topic 'Floristic wealth of Sharngakavu sacred grove, Chengannur, Kerala'. Sixty seven plant species was observed in the groove. Some of them are endemic to Western ghat. 456.71 mg/ha carbon stored in the core zone. Sequestrtio of 344.36 mg/ha in buffer zone. Survey on importance and awareness on conservation also done.

Miss. Harishma S. J. presented on 'Harnessing agroforestry systems for mitigating effects of climate change'. Homestead Agroforestry system of Southern Kerala was studied. Most of them are of less than 1 ha and based on coconut. It has high carbon sequestration potential to mitigate climate change.

Dr. P. Lincy Davis presented on the topic 'Assessing carbon sequestration potential of coconut plantation in Coimbatore region'. The carbon sequestration potential of coconut varies with type (tall type has more carbon sequestration potential), age (more than 10 years has more carbon

sequestration potential) and management (organic management has more carbon sequestration potential).

Miss. S. S. Priyadarsini presented on the topic 'Performance of some important medicinal plants under changed bio-climate'. The medicinal plants tulsi, aloe vera and kalmegh were studied under three different irrigation level and two different organic nutrient source. Maximum dry matter accumulation observed for aloe followed by kalmegh and tulsi.

Dr. Raihana Habib Kanth presented on the topic 'Yield performance, phenology and micro meteorological observation of wheat in Jammu Kashmir state'. Sowing wheat in Jammu during 15th October was suitable in terms of yield. Application of 100 kg per ha nitrogen improved yield attributes.

Dr. Ranbir Singh Ranah presented on the topic 'Modelling crop weather requirement using weather model under elevated temperature scenarios for scaling up quality advisory services'. Crop weather requirements for all months were worked. The projected increase in crop water requirement clearly portrayed that water requirement estimated was higher by 3 - 8 per cent compared to normal weather condition.

The session ended with the remarks of chairman and he thanked all the presenters.

Theme 10: Interventions to mitigate climate change on Livestock, Poultry and Fisheries
(22.01.2020 at Venue-I, KAU, Thrissur)

1. Indigenous cattles have high adaptability to heat stress with high tolerance to THI and having high HSP expressions.
2. Aberrations in shelter and nutrition will improve the animal health under heat stress.
3. Cattle breed wise thermal neutral zones have to be identified to increase the productivity of each breed.
4. Relationship between THI and animal stress have to be revisited and limits for each breed has to be refined.
5. Study on cold stress and animal behavior and production need to be intensified.
6. Multi-disciplinary approach is needed to tackle the heat stress and related diseases in animal productions.
7. Bio security measures against diseases and regulation of environmental degradation is required to sustain the germplasm of Kuttanad ducks.
8. Heat stress alleviation through water spray and feeding during morning and evening improved the quality of milk.
9. Weather information need to be given in advance with sufficient reaction time for safe guarding animals.
10. Supplementation of Astaxanthin and pril fat helped the animal to tolerate heat stress by altering physiological process. It also help to sustain the production and quality of milk under heat stress.

11. Extreme events are highly impacting the spatial distribution of fishes. IPCC approved models could help in predicting impact of extreme events on fish production.
12. In cattle, Vechur breed have high methane emission than cross breed. Altering feed quality and rumen microbial population will reduce the methane.
13. Relative humidity place a major role in animal disease. Altering the micro climate to maintain the thermal humidity comfort zone would reduce disease problems.
14. Spineless cactus have good nutritional value could be an alternative fodder under fodder emission during drought and future climate change.

Valedictory Function-National Seminar-AGMET-2020

The valedictory function of the National Seminar on "Agrometeorological Interventions for Enhancing Farmers Income (AGMET-2020)" organised by Kerala Agricultural University and Association of Agrometereologists was conducted on 22.01.2020 at Kerala Agricultural University, Thrissur, Kerala. The welcome address was given by Dr. C. Narayankutty, Associate Dean, College of Horticulture. The keynote address was given by the Chief guest, Dr. M. R.Saseendranath, Hon. Vice –Chancellor, Kerala Veterinary and Animal Sciences University. Presidential address was given by Dr. P Indira Devi The Director of Research, KAU.. Dr. Vyas Pandey, President, Association of Agrometeorologists presented the technical report of the National Seminar, AGMET-2020. Awards were distributed to the winners of the oral and poster presentations done for the different themes. Vote of Thanks was given by Dr. B. Ajithkumar, Organising Secretary, AGMET-2020.

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