SUMMARY REPORT AND RECOMMENDATIONS OF THE EXPERT MEETING ON CROP MONITORING FOR IMPROVED FOOD SECURITY
VIENTIANE, LAO PDR ON 17 FEBRUARY 2014

INTRODUCTION

1. The Expert Meeting on Crop Monitoring for Improved Food Security was jointly organized by the Food and Agriculture Organization Regional Office for Asia and the Pacific (FAO RAP) and the Asian Development Bank (ADB) on 17 February 2014 in Vientiane, Lao PDR as a side event of the 25th Session of Asia and Pacific Commission on Agricultural Statistics (APCAS). The objective of the Expert Meeting was to share best practices and experiences in use of Remote Sensing (RS) technology and other similar tools for crop monitoring, area estimation and yield forecasting. About 50 experts and participants from Governments, national and international organizations attended the meeting. List of Participants and the Timetable of the meeting is at Annexes 1 & 2 respectively.

THEMES AND EXPECTED OUTPUTS

2. The meeting focused on following three themes:
   • Estimation of land cover, land use and crop area,
   • Crop yield monitoring and forecasting, and
   • Crop yield estimation using probability surveys and objective measurements.

3. Outputs expected from the meeting were as under:
   • Sharing of country experiences on best practices and latest technological tools.
   • Providing knowledge of advanced methods and tools to countries in the region for improving their crop forecasting and estimation methodologies.
- Draft -

- Technical Review of current practices and methodological issues related to the practices in the region with a view to identifying suitability of methodologies in different situations and areas for further research.

OPENING SESSION

4. The meeting commenced with the inaugural speech of Mr Hiroyuki Konuma Assistant Director-General and FAO Regional Representative for Asia and the Pacific read by Mr Mukesh Srivastava, Senior Statistician, FAO RAP. In his address, Mr Konuma stressed on the importance of availability and better quality of agricultural and rural statistics for monitoring food security situation and the need to exchange ideas and share best practices with the Asia Pacific countries to improve upon their agricultural statistical systems. Mr Savanh Hanephom, Deputy Director General, Ministry of Agriculture & Forestry expressed a warm welcome to all the participants and thanked ADB and FAO for choosing Vientiane as the venue for the meeting.

5. In his welcome address, Mr Douglas H. Brooks, Assistant Chief Economist, ADB thanked Government of Lao PDR for their hospitality and highlighted the importance of accurate data for evidence based decision making in the agriculture sector. He shared his views on the issues impacting agricultural statistics in the AP region such as improvements needed in the administrative reporting systems, assessment of increasing demand on natural resources to produce more, declining national responses to meet national and international data needs and the role new technology can play in improving the situation. He stressed that sustainable food security is of prime importance to ADB and described the research projects being funded by the organization in various countries which have helped them to improve their data collection methods.

SESSION 1: ESTIMATION OF LAND COVER, LAND USE AND CROP AREA

6. The session was chaired by Ms Dalisay S. Maligalig, Principal Statistician, ADB. The following presentations were made during the session.

1. Dot sampling method for area estimation (Mr Issei Jinguiji)
2. Agricultural Land Information System (ALIS) Program (Mr Shoji Kimura, AFSIS)
3. Adoption of ALIS for Agricultural Area Estimation (Mr Romeo Recide, Philippines)
4. Agriculture with Satellite remote sensing & sensors (Mr Preesan Rakwatin, GISTDA, Thailand)
5. A new method to estimate rice crop production and outlook using Earth Observation satellite data (Mr Toshio Okumura, RESTEC, Japan)

DISCUSSION

7. In the discussions that followed after the presentations, participants raised issues relating to suitability of presented methods in different situations. It was observed that Dot matrix and Agricultural Land Information System (ALIS) methods are simple to use and relatively cost-effective as they use freely available google maps as the basis for categorizing geographical area into various land use categories. The methods have also produce a sampling frame for agricultural land use categories which can be used for further sampling and estimation of major crop acreage. Being hugely dependent on google maps which are generally dated, these methods are more suited for measuring the land use patterns which do not change frequently. These methods, however, may not be suitable to capture the real time crop production forecast based on current crop acreage, and productivity needed by most countries particularly for the in-season assessment. ALIS method is also found suitable to forecast acreage of crops which are grown in large contiguous areas but not the sparsely distributed crops.

8. On the use of RS technology, it was observed in many countries, remote sensing is being used as a tool to obtain information for crop condition monitoring, acreage and production forecasting for taking policy decisions relating to food security. In many other countries, remote sensing applications currently in use were still at experimental stage with an accuracy level for crop acreage forecasts ranging from 70-90% which varied with the type of crop and its dispersion on the terrain. Further work is needed to make these methods operationally useful at national level.

SESSION 2: CROP YIELD MONITORING AND FORECASTING

9. The session was chaired by Mr John Latham, Senior Land and Water Officer NRL Division, FAO. The following presentations were made during the session.
   1. Crop Watch Introduction and Crop Area Estimation (Mr Bingfang Wu, Chinese Academy of Sciences (CAS), China)
   2. Pakistan Satellite Based Crop Monitoring and Forecasting System (Mr Ijaz Ahmed, SUPARCO, Pakistan)
   3. Use of Remote Sensing Technology in Crop Monitoring and Assessment of Impact on Natural Disaster (Mr S.S. Ray, National Crop Forecast Centre, India)
   4. Remote Sensing based Crop Yield Monitoring and Forecasting (Mr Tri D. Setiyono, IRRI)
10. In the above presentations, experts from China, India, Pakistan, Bangladesh and IRRI highlighted the country experiences as under:

**China**

11. China has made significant advances in use of remote sensing technology to monitor global, regional and national level agricultural and environmental situation. Global environmental analysis is carried out using remote sensing data on temperature, radiation, rainfall and related variables. This facilitates compilation of indices such as Environmental Index, Cropping Intensity, Vegetation Health Index, and Drought Index. Crop watch bulletins are generated and disseminated through its official website “Crop Watch” on a regular basis. Crop watch is mainly based on remote sensing data and provides crucial information to the central government. For estimating crop acreage, Crop Planting and Crop Type (CPTP) method is used wherein geographical area is stratified according to climatic zones, planting structures and farming density and crop proportions are obtained for these strata using specialized field instruments. Sampling unit for RS data is 4x4 km square grids. Optical data (Photos) of sampling units are taken to classify the area into crop and non-crop area and then using crop proportions are further classified into major crop categories. Validation is carried out using ground survey. Since there are only 4 major crops in China, it is relatively easy to identify them. However, accuracy level is stated to be low for minor crops.

**Pakistan**

12. In Pakistan, SUPARCO uses satellite based area frame sampling, a fully operational system for the estimation of crop areas since 2007. The Satellite Based Area Frame technique uses a three stage stratification process to delineate homogenous areas in order to use statistical procedures to estimate crop areas. Use of smart phones for ground data collection helps in validation of crop forecasts. Crop yield is also a major component for the crop production forecast and estimation in Pakistan. Statistical models are being used by SUPARCO for the estimation of the yield using a number of parameters such as weather, fertilizers, irrigation and remote sensing indices. For information sharing, Pakistan brings out monthly crop bulletin, publications on rapid crop damage assessment (floods / droughts) and related technical reports.

**India**
13. In India, a new centre (Mahalanobis National Crop Forecast Centre) has been established to meet the in-season crop assessment requirements of the Ministry of Agriculture. The centre is responsible for generating RS based multiple crop acreage and production forecasts for selected crops during the season and to provide monthly assessment of drought and flood situation in the country. The forecasts methodology uses both microwave and optical data and is designed to provide 90% area coverage and 90% accuracy. For acreage forecast, stratified random sampling is adopted wherein square grids of 5X5 km area are first stratified into 4 strata based on crop proportions (>75%, 50-75%, 25-50% and <25%) based on past data. A sample of 20% square grids is selected in each stratum and RS data of selected sampled grids are classified into crop types using multi date data and estimates obtained. Satellite images are captured at an interval of about 20-25 days and 3 in-season forecasts are made. On the lines similar to Google Earth, India has developed its own platform “Bhuvan” to help develop thematic applications in various sectors. Bhuvan is also being used for uploading real time ground truth data collected through smart phones by MNCFC officials. For estimating crop yield, econometric and agro-met models have been developed which are used in conjunction with RS acreage data to forecast crop production. Development of crop yield simulation models and spectral models are in experimental stage. RS data is also utilized to assess drought situation and monthly drought assessment reports are generated and disseminated.

IRRI

14. The presentation discussed the project “Remote Sensing-based Information and Insurance for Crops in Emerging Economies (RIICE)” which is a public-private partnership project aiming to reduce vulnerability of rice smallholder farmers in low-income Asian countries using synthetic aperture radar (SAR) technology. SAR data is used to map and observe rice growth, and together with a crop growth model, the technology allows prediction of rice yield in selected rice-growing regions in Cambodia, India, Indonesia, Thailand, the Philippines and Vietnam. The use of SAR technology is crucial given cloud obstruction views from space is common phenomena for region where rice is grown in the tropics due to cloud insensitive feature of radar-based earth observation. National partners in the countries covered by RIICE provide expert knowledge and baseline data, and conduct fieldwork and monitoring of sites.

15. IRRI undertakes Rice yield forecast based on a crop growth simulation model using a combination of real-time and historical weather data such as daily solar radiation, daily minimum and maximum temperature, daily average wind speed, rainfall data and SAR-derived key information such as start of growing season and
leaf growth rate. Results from pilot study sites in South and South East Asian countries suggest that incorporation of remote sensing data (SAR) into process-based crop model improves yield estimation for actual yields and thus offering potential application of such system in a crop insurance program. Remote-sensing data assimilation into crop model effectively captures responses of rice crops to environmental conditions over large spatial coverage, which is practically impossible to achieve with crop modeling approach alone.

Bangladesh

16. In Bangladesh, SPARSSO has developed Decision Support Systems which help government monitor agricultural situation and impact of natural disasters. In agriculture, small holding size and spatial heterogeneity makes crop monitoring a challenging task. RS methodology has been developed for estimation of rice acreage and yield assessment is done using normal statistical procedures. Both moderate and high resolution RS data is used for crop acreage forecast and ground truth is collected using GPS instruments.

DISCUSSION

17. It was observed during the discussion that RS technology is capable of providing acreage forecast for rice and other major crops, generate crop outlook, assess drought and flood situation and help governments make timely policy decisions on issues related to food security. However, for minor crops and cash crops, methodological improvements are needed to make their forecasts operationally useful. Problem of cloud cover is significant for short duration crops and may impact quality of forecasts due to data loss. For long duration cash crops such as cotton and sugarcane, multiple date data helps overcome this problem and the issue of data loss is not major problem.

Besides area and production data, RS inputs such as leaf area index, chlorophyll content/crop condition is also finding applications in crop yield modelling, in stratification of statistical units for optimizing sample size at national and sub-national level and in preparing crop outlook and market monitoring progressively with the season.

18. It was observed that RS methodologies to forecast area coverage and yield are available for only a limited number of major crops while countries require information on a large number of crops. Remote sensing therefore cannot replace the traditional methods used in statistical system which capture data on a large number of crops. Remote sensing also cannot capture the socio-economic data the data on
agricultural practices of the agricultural households which can be obtained through traditional methods of personal contact. Use of Synthetic Aperture Radar (SAR) technology was stated to have helped overcome the problem of loss of satellite data due to cloud cover during rice season. Limited availability of RS data and higher cost of better resolution satellite data are other major constraints for their wide spread use in many countries. It was suggested that use of open source data may help in making the technology cost-effective and free access to 10 meters resolution satellite data is a distinct possibility in near future.

SESSION 3: CROP YIELD ESTIMATION USING PROBABILITY SURVEYS AND OBJECTIVE MEASUREMENTS

19. The session was chaired by Ms Sarah Hoffman, USDA. Following presentations on the country experiences on objective yield assessment through crop cutting experiments (CCE) were made during the session.

1. Rice Objective Yield Survey in Japan (Mr Masahiro Hosaka, Japan)
2. Sampling Frame of Square Segment by Points for Rice Area Estimation (Mr Mubecki Munandar, Indonesia)
3. Experience of Crop Cutting Experiments in Thailand (Ms Supaporn Bongsunun, Thailand)
4. Recent Experiences of Sample Crop (rice) Cutting in Bangladesh (Mr Bidhan Baral, Bangladesh)
5. Agricultural survey improvement program in Islamic Republic of Iran (Mr Mehrdad Nematzadeh Alidash, Iran)
6. Promote the application of spatial information technology in crop production survey (Mr Ge WEI, China)

Japan

20. Objective yield forecasts and estimates of crop yield are attempted with a standard error of 1% based on yield forecast models and Crop cutting Experiments (CCEs). Methodology requires collection of ancillary information during the growth stages of crop every month and culminating into conduct of CCE. Number of crop cuts are decided based on coefficient of variation and desired precision and monthly data on a number of crop characteristics such as plant height, number of leaves, flowers, pods, grains etc depending on crop type are collected and used in crop forecast models to generate yield. Crop situation index is calculated by comparing forecast yield with normal yield. To overcome the manpower constraints for conduct of large number of CCEs, a number of changes have been introduced in yield assessment methodology such as reduction in the number of CCEs from 34000 to 10000, crop cut size from $9M^2$ to $3M^2$. Methodological improvements have also
been made in obtaining normal yield through trend analysis by removing the effect of meteorological parameters.

Indonesia

21. Area Frame Sampling is one of the methodologies recommended for obtaining rice acreage and production. Based on the available land use data, geographical area in classified into 3 strata viz. 1) rice, 2) possible rice and 3) non-agriculture land. For estimation of rice acreage, strata 1 & 2 are divided into 10 km x10 km blocks for sampling purposes. Each block is further subdivided into 400 square segments of 500 m x 500 m size. In each block, a sample of 10 segments (2.5%) is selected with systematic random sampling using distance threshold and assigned a code number and geographical coordinates for identification. Each selected segment is further divided into 25 sample points/cells of 100mX100m each and centre of each cell will be the point for field observation and recording the growth stage of rice in each cell such as vegetative, generative, harvested, fallow etc. The sample information is submitted by the investigators through SMSs thereby speeding up the crop forecast. This sample information and the sample design make it possible to estimate the rice acreage and the likely area to be harvested during the next two months. The main advantage of this method is that it allows sample selection without constructing the sample frame.

Thailand

22. To estimate area planted, yield and production of crops, production surveys are conducted using household approach. The process involves preparation of list frame of households, selection of sample households and conducting interviews with them and preparing a sketch of all paddy fields of the selected household. For better estimation of crop yield, CCEs, dyke survey and gleaning surveys are also conducted.

(Methodological details to be added from the paper)

Bangladesh

23. Bangladesh Bureau of Statistics, Department of Agriculture Extension (DAE) and SPARSO are three organisation producing statistics on crop production and there were differences in the estimates produced by them. In order to overcome the problem of conflicting statistics, a project on harmonization and dissemination of unified crop production statistics has been conceptualized and implemented by FAO for rice crop which is the most important staple crop in the country. On the basis of collaborative research undertaken by these Departments, it has been observed that both DAE following the rectangular plot approach and BBS following circular plot
approach for crop cutting experiments overestimated the yield. Based upon research evidence it was found that the plot size equal to 20 M$^2$ provides more accurate estimates of crop yield. Based on these conclusions, Bangladesh has adopted circular crop cuts of 20 M$^2$ for conducting crop cutting experiments. Teams of all the stakeholders monitor these experiments in the field and the data is processed on computers. As a result of this project, it has been made possible to avoid conflicting statistics from various sources on rice crop. Similar, approach may be needed for other important crops.

Iran

24. Both list and area frame are used to generate agricultural statistics; list frame for livestock and services; area frame for acreage of crops and orchards. Stratification of land cover in the categories of Irrigated agriculture, Rain fed agriculture, Orchard, Range land and Non-agricultural land is made and sample segments are selected from each strata except from non-agricultural strata, and details of operators in each segment and their holdings, crop type and coverage etc. is collected for estimation of acreage under various crops. The presentation identified availability and accessibility of remotely sensed data as a major issue for its potential use. Because of international sanction against Iran, ordering and purchasing satellite data is very difficult.

China

25. In this presentation from China, use of 3 technologies RS, GIS and GPS to collect information from sky, ground and person was demonstrated. Basis of data collection is Area Frame Survey. The frame is constructed using inputs from agriculture census, land survey and RS. Smallest unit for area frame survey is the Elementary Sampling Unit (ESU) comprising of 2-5 hectare of land and village is taken as Primary Sampling Unit (PSU) which have been digitally mapped using high resolution RS data. For survey purposes, PSUs are selected with probability proportional to size and within each PSU, ESUs are selected using simple random sampling. Data collection includes one time survey of all the selected PSU/ESUs collecting their locational and other basic information. Field survey is undertaken using GPS and PDAs. Sampling errors of the estimates are arrived at by using Jackknifing method.

PANEL DISCUSSION

26. The three session chairs, Mr Brooks, Mr Latham and Ms Sarah Hoffman, and the three country representatives, Mr Recide, Mr Ray and Mr Kamikura held a panel
discussion on the themes covered by the meeting. Mr Latham stated that although conventional methods are robust, new technology offers the advantage of being as precise but more timely. Combination of methods will thus have many advantages. Many countries in Asia Pacific region have made big progress in the use of RS, GIS and GPS and there is good scope for building on these resources. He also stressed on the use of multiple frames for meeting growing data demands at national, regional and global level.

27. Mr Kemikura stated that though RS is very effective but its actual applications in many countries would face a lot of restrictions such as lack of resources both human and financial, practice of shifting cultivation in some areas, issues of operators identification when they do not have legal rights on land, problems of reconciliation of conflicting estimates by different technologies, etc. He recommended that use of Dot sampling hold a promise in countries where collecting crop data season by season is found difficult due to lack of resources.

28. Ms Sarah Hoffman stated that all the methodologies and technologies discussed in the meeting are useful but the countries need to adopt them depending upon their budgets and after exploring their suitability. Mr Recide stated that existing procedures of estimating area, production and yield data are serving well but there is also greater scope to improve these methods using latest tools. In many countries where traditional estimates have limitations, RS can play a vital role in improving these data.

29. Mr Ray stated that RS has major advantage in that it depicts relative change in crop situation through pictures/images and the user is able to relate to them easily. He stressed that RS data and traditional data needs to play a complementary role by providing in-season assessment through RS and final estimates through surveys. Considerable work has taken place in acreage estimation but more work is needed in yield forecasting using RS technology. Availability of RS data needs to be promoted so that low cost data is available to the users. In India, institutionalization of RS in the Ministry of Agriculture (user agency) has helped in harnessing its potential use in other applications such as drought and flood assessment, disease and pest surveillance, land use mapping, identifying cropping patterns and crop calendars.

30. In the ensuing discussions, participants raised a number of issues such as accuracy level of RS forecasts, replacement of traditional methods by RS, cost effectiveness of the two approaches, country experiences in actual operationalization of RS approach at country level, its utility in addressing crop yield estimation and in reducing number of CCEs through improved stratification etc. At the end of the discussion, Mr Brooks summarized the discussions enumerating the range of
methodologies available and the need for countries to make choices to use them as per their requirement and situation. He stressed that both the approaches should be seen as complementary and not conflicting with each other by optimal use of strengths of each. He also stressed that there is a great scope to build capacity of countries in utilization of latest technological tools.

RECOMMENDATIONS:

31. Based on the discussions of the meeting, the following recommendations were made.

i. The use of information and communication technologies (ICT) like the GPS applications in smart phones, Google Earth imagery as data source for area sampling frame, space-based technology, computer software applications for automating data processing and estimation should be considered in improving crop monitoring.

ii. Countries in the region have a wide range of methods and technologies to combine and adopt in their current practices. The right mix of technologies to adopt should be based on the desired output and outcome requirements, absorptive capacity of the institution, and the resources that are available.

iii. National statistical systems will greatly benefit from developing strong partnerships with local research institutions and space-technology agencies in institutionalizing data collection methods requiring ICT. In the long term, space-based technology and other ICT should be part of tertiary school’s curriculum, so that future generation will have better understanding of these technologies.

iv. Dot Sampling and ALIS methods are simple to use, cost-effective and do not require much infrastructure and manpower. These are more suited to countries with relatively weak sample survey infrastructure or countries where even administrative reporting systems for agricultural statistics do not exist. These methods may be used for generating land use information which does not change frequently. For crop acreage, these methods may provide baseline information with reasonable degree of precision in such countries. These methods are not suitable for minor crops and for in-season assessments/crop outlook.

v. RS forecast of crop acreage and production is useful as advance information to the policy planners even if it is available with slightly lesser accuracy. RS is suitable for making in-season crop acreage forecasts and provide monthly crop outlook to planners and policy makers. It may be a useful tool for
countries with higher food security risks to help them take ameliorating measures much in advance.

vi. There are certain areas where RS has distinct advantage e.g. quick and objective assessment, no investigator bias, longitudinal assessment (change over time over the same location), hostile terrains, extent of drought and flood affected areas. In many countries, use of remote sensing technology for agricultural monitoring has shown remarkable progress. Other countries may consider adopting it depending upon the availability of resources and trained manpower requirements.

vii. Use of RS in crop yield forecast is still in experimental stage. Use of RS products such as leaf area index, NDVIs is being explored to improve crop yield modelling and is an area for further research.

viii. While the use of remote sensing in deriving crop area estimates and measuring the impact of natural disaster has been proven to be beneficial in some countries, national statistical systems should be careful in adopting it as a full replacement of their traditional field data collection methods for crop monitoring. As staff skills are still being developed and various aspects of institutionalizing the use of remote sensing in official agricultural statistics have not been fully studied, remote sensing can be used to supplement and/or validate data collected using the current practices.

ix. Beyond estimating land use statistics, crop area, production and yield, crop monitoring also involves understanding the perception of farmers, their economic and social profile and agricultural practices followed by them. These data and information are best collected using traditional method of personal interview.

x. Research institutions, space technology agencies and national statistical systems should continue to regularly exchange ideas and experiences for improving crop monitoring.

xi. Technical papers and presentations on the methods that were discussed in the meeting should be widely disseminated.
Annex 1
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# Annex 2

## TIMETABLE

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
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<tbody>
<tr>
<td>08.00 hrs.</td>
<td>Registration</td>
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<tr>
<td>08.30-08.45</td>
<td>Opening session</td>
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<tr>
<td></td>
<td>1. Opening remarks by organizers (FAO and ADB)</td>
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<td></td>
<td>2. Introduction by participants</td>
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<tr>
<td>08.45-10.45</td>
<td>Session 1: Estimation of land cover, land use and crop area</td>
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<tr>
<td></td>
<td>Chairperson: Ms Dalisay S. Maligalig, ADB</td>
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<tr>
<td></td>
<td>1. Dot sampling method for area estimation (Mr Issei Jinguji)</td>
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<td></td>
<td>2. Agricultural Land Information System (ALIS) Program (Mr Shoji Kimura, AFSIS)</td>
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<td></td>
<td>3. Adoption of ALIS for Agricultural Area Estimation (Mr Romeo Recide, Philippines)</td>
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<td></td>
<td>4. Agriculture with Satellite remote sensing &amp; sensors (Mr Preesan Rakwatin, GISTDA, Thailand)</td>
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<td></td>
<td>5. A new method to estimate rice crop production and outlook using Earth Observation satellite data (Mr Toshio Okumura, RESTEC, Japan)</td>
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<tr>
<td></td>
<td>Discussions</td>
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<td>10.45-11.00</td>
<td>Coffee Break</td>
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<tr>
<td>11.00-13.00</td>
<td>Session 2: Crop yield monitoring and forecasting</td>
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<td></td>
<td>Chairperson: Mr John Latham, FAO</td>
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<tr>
<td></td>
<td>1. Crop Watch Introduction and Crop Area Estimation (Mr Bingfang Wu, Chinese Academy of Sciences (CAS), China)</td>
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<td></td>
<td>2. Pakistan Satellite Based Crop Monitoring and</td>
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<td></td>
<td>Forecasting System (Mr Ijaz Ahmed, SUPARCO, Pakistan)</td>
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<td>3.</td>
<td>Use of Remote Sensing Technology in Crop Monitoring and Assessment of Impact of Natural Disaster (Mr S.S. Ray, National Crop Forecast Centre, India)</td>
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<td>4.</td>
<td>Remote Sensing based Crop Yield Monitoring &amp; Forecasting (Mr Tri D. Setiyono, IRRI)</td>
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<td>5.</td>
<td>Satellite Based Crop Monitoring &amp; Estimation System for Food Security Application in Bangladesh (Mr Hafizur Rahman, SPARRSO, Bangladesh)</td>
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Discussions

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<tr>
<th>13.00-14.00</th>
<th>Lunch Break</th>
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<tr>
<th>14.00-16.00</th>
<th>Session 3: Crop yield estimation using probability surveys and objective measurements</th>
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<tbody>
<tr>
<td>Chairperson: Ms Sarah Hoffman, USDA</td>
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<tr>
<td>1.</td>
<td>Rice Objective Yield Survey in Japan (Mr Masahiro Hosaka, Japan)</td>
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<td>2.</td>
<td>Sampling Frame of Square Segment by Points for Rice Area Estimation (Mr Mubekti Munandar, Indonesia)</td>
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<td>3.</td>
<td>Experience of Crop Cutting Experiments in Thailand (Ms Supaporn Bongsunun, Thailand)</td>
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<td>4.</td>
<td>Recent Experiences of Sample Crop (rice) Cutting in Bangladesh (Mr Bidhan Baral, Bangladesh)</td>
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<td>5.</td>
<td>The Agricultural Survey Improvement Program (Mr Mehrdad Nematzadeh Alidash, Iran)</td>
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<td>6.</td>
<td>Promote the application of spatial information technology in crop production survey (Mr Ge WEI, China)</td>
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Discussions
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<th>Time</th>
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<tr>
<td>16.00-16.15</td>
<td>Coffee Break</td>
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| 16.15-17.00 | Panel Discussion: Recommendation on choice of appropriate methodologies  
(FAO, ADB, Representative from India, Philippines, Timor Leste, and USA)  
The conclusion of this session will lead to a set of recommendations of suitability of methodologies in different situations, identification of current issues, best practices and directions for future research. |
| 17.00 hrs. | Closing session (FAO and ADB)                                         |