REPORT

International Training Programme on

"Strategies for Enhancement of Farmers Income in Dryland Agriculture"

16th – 30th January 2018.

Feed The Future - India Triangular Training (FTF-ITT)

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Feed The Future India Triangular Training (FTF ITT)
International Training Programme on

Strategies for Enhancement of Farmers Income in Dryland Agriculture

For Executives of African and Asian Countries

16th-30 January, 2018, ICAR-CRIDA, Santoshnagar, Hyderabad-500059
Telengana, India

REPORT

BY

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From the Desk of Director, CRIDA, Hyderabad

Greetings from ICAR-Central Research Institute for Dryland Agriculture

CRIDA is a premier institute of international repute in the aegis of Indian Council of Agricultural Research under department of agricultural research and education, Ministry of Agriculture & Farmers Welfare Government of India. CRIDA established in 1985 at Hyderabad. The major mandate of this institute remains to carry out basic and applied research in rainfed farming. Since then CRIDA has been pioneer in developing and disseminating improved rainfed farming technologies in different agro-ecological regions of the country.

Feed The Future India Triangular Training (FTF ITT) International Training Program on "**Strategies for Enhancement of Farmers Income in Dryland Agriculture**" held at CRIDA during 16th – 30th January, 2018. The event was organized in collaboration with MANAGE, Hyderabad as an Inter-institutional event. Twenty two participants representing three Asian and seven African countries were participated in this training program. The wider extent of cultural and traditional diversity among the participants provided ample opportunity to CRIDA to strengthen its international linkages and recognition and also to resource person to widen outlook and perspective to global level. The learning process was designed by integrating interactive lectures, field visits and hands-on experiences coupled with cultural exposure.

The main focus area of training was to support productivity enhancement in the thematic area through water management pathways, address social issue and challenges in field water management, water management strategies in changed climate scenario, contingency planning, agro-met advisories & crop insurance and ecosystem services particularly in dryland agriculture.

The efficacy of skills and learning of various dryland farming technologies was reflected in the feedback from the participants and their presentation of Back at work plan. It was of great satisfaction to see their commitment to bring a change in the agricultural practices in their respective country. This way FTF-ITT has created a platform for frequent exchange of information and materials for developing sustainable livelihoods with the participating nations. Moreover, Indian society of dryland agriculture has extended the life membership to the participants to subscribe journals and also provide audience to their future research and development activities. I congratulate the organizing team led by Dr. Manoranjan Kumar, Course Director and his team namely Dr. B K Rao, Dr. R Rejani and Dr K Nagasri for effective planning and execution of this training program. This report is a outcome of sincere, committed and dedicated initiatives of CRIDA and MANAGE and I wish that this collaboration to scale new heights in future. I congratulate all the committee members who had made this event very successful.

Dr K Sammi Reddy,
Director, ICAR-CRIDA

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1. INTRODUCTION

1.1 Background

Agricultural partnership between US and India, to achieve global food security was announced during November, 2010 during the state visit of US President Mr. Barak Obama to India in November 2010. Thereof a MoU signed on India-US trilateral cooperation with Africa to address the food security challenge by adapting technological advances and innovative solutions. Initially as a pilot scheme, National Institute of Agricultural Extension Management (MANAGE), Hyderabad and National Institute of Agricultural Marketing (NIAM), Jaipur conducted 7 program in training of 219 executives from Kenya, Liberia and Malawi. Based on the impact assessment suggesting extremely successful and overwhelming response, it was considered to further extend the program to African and Asian countries.

Accordingly, USAID and Ministry of External Affairs (MEA), India identified additional countries among those involved in GOI-supported development programs and redefined the program as Feed the Future-India Triangular Training Program (FTF-ITT) and was launched on 25th July, 2016. Subsequently, 17 such countries partner from Africa and Asia were considered. Those include Afghanistan, Cambodia, Lao PDR, Myanmar, Mongolia, Vietnam, Botswana (Asian countries) and Kenya, Malawi, Liberia, Ghana, Uganda, Rwanda, Democratic Republic of Congo, Mozambique, Tanzania & Sudan (African countries), It was envisaged that during the program period till 2020, approximately 1400 agricultural professionals from these countries will be trained with skill enhancement. The modus operandi of this program include conducting of 32 such training program on various aspect of agricultural development and livelihood security at selected Indian Institutions and each training program shall include 25 participants. The course module mostly focused on the themes for which Indian institutions of repute has demonstrated the comparative expertise that could effectively contribute in enhancement of human capital on agricultural development and livelihood security to the target countries' existing human resource capacity.

The MANAGE, Hyderabad is implementing this program in collaboration with various Subject Matter Institutions. Accordingly, the MANAGE, identified Central Research Institute for Dryland Agriculture (ICAR-CRIDA) as a potential institute to impart training on one of the

important theme of "**Strategies for Enhancement of Farmers Income in Dryland Agriculture**". Thus MANAGE requested ICAR-CRIDA to organize one 15-days international training program for 22 international executives representing partner countries from Africa and Asia. In view of above, the present international training had been conducted in accordance with standard operating procedure for implementation of FTF-ITT as devised by MANAGE, Hyderabad

1.2 Brief description of ICAR-CRIDA

ICAR-Central Research Institute for Dryland Agriculture (CRIDA) is a National Research Institute under the Indian Council of Agricultural Research (ICAR) established in 1985 with a mandate to carry out basic and applied research in rainfed farming. Since then CRIDA has played pioneering role in developing and disseminating improved rainfed farming technologies in different agro-ecological regions of the country. Over the last 30 years CRIDA and its network of research stations have developed and disseminated large number of technologies in rainwater management, watershed development, soil health management, cropping systems, farm machinery and diversified land use systems.

Increasing climatic variability and climate change pose new challenges to Indian agriculture in terms of increased frequency of droughts, floods, cyclones, extreme temperatures, etc. The institute which is currently implementing the ICAR flagship programme, National Initiative on Climate Resilient Agriculture (NICRA), is playing an important role at national level in evolving adaptation and mitigation strategies in agriculture and allied sectors and also taking up their demonstration in more than 130 villages representing key climate vulnerabilities. Efforts are being made for scaling up these technologies through the National Mission for Sustainable Agriculture (NMSA). CRIDA has developed 580 district agriculture contingency plans involving all agricultural universities, several ICAR universities, Krishi Vigyan Kendra's (KVK's) and other stakeholders related to all the sectors of Agriculture. Near real time implementation of contingency plans is a daunting but important task to be achieved in the coming years through central and state government action plans. All India Coordinated Research Programmes (AICRPs) of ICAR on Dryland Agriculture and Agro-meteorology with 25 partners each are in

CRIDA and are involved in these activities. The Institute also undertakes National/ International Collaborations and Consultancy Projects. This is the lead Institute and the National Nodal point for the National Innovations in Climate Resilient Agriculture (NICRA) which is being implemented at large number of Research Institutes of ICAR, State Agricultural Universities and 100 KVKs.

ICAR-CRIDA is a multi-disciplined institute which has strength of 64 scientists and 61 technical personnel working in the fields of water management, crops and cropping systems, nutrient management, soil health and quality, agro-forestry, dryland horticulture, farm machinery and power, agricultural economics, agricultural extension, agrometeorology, nutrition, agro-energy, microbiology, plant physiology, geography, animal husbandry, farming systems research, alternate land use systems, sustainable rural livelihoods etc.

CRIDA has well-established facilities with laboratories for soil science, agronomy, GIS, plant physiology, entomology, pathology, horticulture and animal science. Agricultural Knowledge Management Unit (AKMU), Library, well developed two research farms of 280 ha and 80 ha area at Hayatnagar and Gunegal respectively nearby Hyderabad are with the institute. Farms have facilities for demonstration of water harvesting and utilization systems. bio resource center, CRIDA KVK, livelihood demonstration units, farm implements centre, class rooms/seminar halls with multi-media presentations.

1.3 Objectives of the training program

The main aim of the training program was to enhance the human resources which in turn could assist in ambitious goal to achieve the food and livelihood security to the billions living in the rural and backward setups. Consequent upon the vigorous consultation with the MANAGE it was decided that the training must focused to enhancing the farmers income in the drylands. Accordingly the training program on "**Strategies for Enhancement of Farmers Income in Dryland Agriculture**" was developed with following specific objectives.

- Generating economic growth and raising incomes of various Dryland agriculture based farm enterprises
- Scaling existing, proven technologies to benefit more people living in thematic area
- Increasing resilience of vulnerable communities and household practicing dryland agriculture

1.4 Key Focus Areas of Training

The content of training program was selected to address the following aspects of dryland agriculture.

- Poverty reduction through water management pathways
- Irrigation machinery and precision farming
- Computers and electronics in management of water resources
- Social issues and challenges in field scale water management
- Climate change and water management strategies
- IWMP (integrated watershed management program) experience for water management
- Contingency planning for water resources management
- Ecosystem services of various water management interventions
- Agriculture, water and ecosystem interface
- Plastic technologies in water resource development and management
- Agromet advisories and crop insurance for sustainability of agriculture

1.5 Selection of Participants/Trainees

The MANAGE, USAID and the Government of India (GoI) formally informed various officials of participating countries' governments about the training program (as developed by ICAR-CRIDA) and its objectives including thematic area of training well before the program implementation begins. The nominating entities and applicants desirous to participate in the training was suggested to submit their respective nominations including credentials and applications directly to MANAGE through their respective countries' Ministries of Agriculture or appropriate government agency. MANAGE reviewed and screened thus received applications and selected the final participants based on diverse working areas viz., Planning, Administration, Teaching, Research and Extension in Agriculture and allied fields namely Livestock, Fisheries, Natural Resources Management, Nutrition, Agribusiness, Post-Harvest and Value Addition, Marketing etc pertaining to the training objectives.

MANAGE, also undertook the responsibility of mobilization of executives for training programs provide funding from USAID and Government of India. The brochure of the training is presented below

FEED THE FUTURE – INDIA TRIANGULAR TRAINING (FTF ITT)

on

Strategies for Enhancement of Farmers Income in Dryland Agriculture

January 16-30, 2018

Venue

ICAR-CRIDA, Hyderabad

Organized by

ICAR-Central Research Institute for Dryland Agriculture, Hyderabad, India

Background

Feed the future (FTF), agriculture partnership between India and US were initiated in 2010 with the objective of to achieve ever green revolution in order to address the issue of global food security. Consequently efforts were made to form triangular cooperation to adapt advanced agricultural technologies and improved and innovative solutions to food security challenges of Africa.

The USAID and MANAGE, Hyderabad, India partnered to address the objectives of human and institutional capacity building in achieving food and nutritional security in selected African and Asian countries. Accordingly, pilot training program for 3 African countries namely, Kenya, Liberia and Malawi were conducted by MANAGE through 7 training programs on various themes related to food and nutritional security. The pilot program covered training of 219 executives of these countries at National Institute of Agricultural Marketing, Jaipur, India. Based on the encouraging results obtained thus, and considerable enthusiasm shown by other potential countries, USAID and MEA, India identified additional countries among those where GOI-supported development program are continuing, and designated as Feed the Future; India Triangular Training Programme.

The India Triangular training (ITT) program proposes 32 such 15 days training program on various identified themes or subsectors in which Indian institutions of repute to offer such trainings and ensure that it effectively responds to the target countries' capacity gaps.

The MANAGE, identified ICAR-CRIDA as a potential institute to impart training on one of the important theme of **"Strategies for Enhancement of Farmers Income in Dryland Agriculture"**. ICAR-CRIDA organizing 15-days international training program during January 16-30, 2018 for 25 international executives representing partner countries from Africa and Asia. MANAGE, Hyderabad undertake the responsibility of mobilization of executives for training programs as well as expenditure.

The ICAR-CRIDA

Central Research Institute for Dryland Agriculture (CRIDA) is a National Research Institute under the Indian Council of Agricultural Research (ICAR) established in 1985 with a mandate to carry out basic and applied research in rainfed farming. Since then CRIDA has played pioneering role in developing and disseminating improved rainfed farming technologies in different agro-ecological regions of the country, through its network of research stations.

The institute currently implementing the ICAR flagship programme, National Initiative on Climate Resilient Agriculture (NICRA). It is playing an important role at national level in evolving adaptation and mitigation strategies in agriculture and allied sectors and also taking up their demonstration in more than 130 villages representing key climate vulnerabilities and scaling up these technologies through the National Mission for Sustainable Agriculture (NMSA). CRIDA has developed 641 district agriculture contingency plans involving all agricultural universities, several ICAR universities, Krishi Vigyan Kendra's (KVK's) and other stakeholders related to all the sectors of Agriculture. All India Coordinated Research Programmes (AICRPs) of ICAR on Dryland Agriculture and Agrometeorology with 25 partners each are in CRIDA and are involved in these activities.

Training objectives

- Generating economic growth and raising incomes of various farm interprises
- Scaling existing, proven technologies to benefit more people of thematic area
- Increasing resilience of vulnerable communities and household practicing dryland agriculture

Key Highlights

- Poverty reduction through water management pathways
- Irrigation machinery and precision farming
- Computers and electronics in management of water resources
- Social issues and challenges in field scale water management
- Climate change and water management strategies
- IWMP (integrated watershed management program) experience for water management
- Contingency planning for water resources management
- Ecosystem services of various water management interventions
- Agriculture, water and ecosystem interface
- Plastic technologies in water resource development and management
- Agromet advisories and crop insurance for sustainability of agriculture
- Agro-machinery in water management

Specific Facility available

CRIDA has well-established facilities with laboratories for soil science, agronomy, GIS, plant physiology, entomology, pathology, horticulture and animal science. Agricultural Knowledge Management Unit (AKMU), Library, well developed two research farms of 280 ha and 80 ha area at Hayathnagar and Gunegal respectively nearby Hyderabad are with the institute. Farms have facilities for demonstration of water harvesting and utilization systems, bio resource center, CRIDA KVK, livelihood demonstration units, farm implements center, class room/seminar halls with multi-media presentations.

For further information

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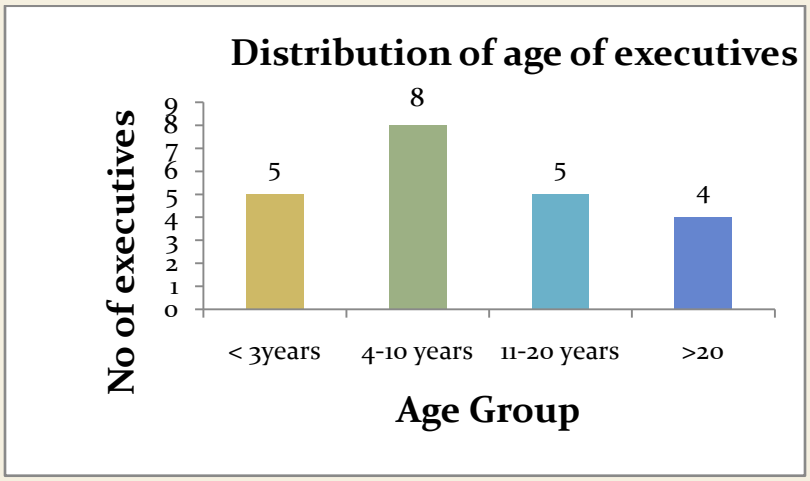
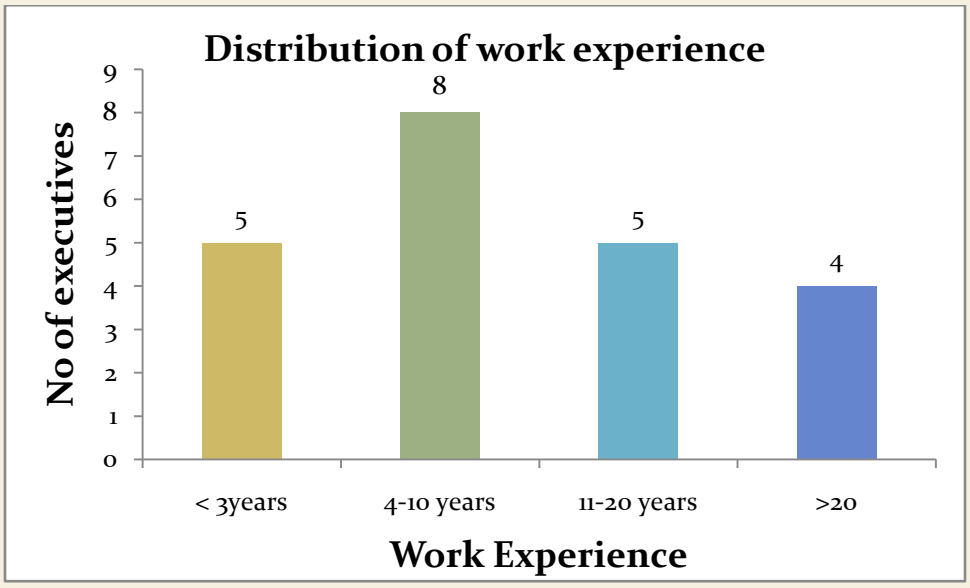
1.6 Profiles of the Executives

The selected executives belonged to seven African countries (namely Kenya, Malawi, Liberia, Congo, Sudan, Uganda and Ghana) and three Asian countries (Namely Afghanistan, Myanmar and Cambodia). There was 6 female and 16 male participants in the training program. The median age of the group was 38 years with minimum and maximum age of 26 and 57 years respectively. The age distribution is presented in figure 1.



The median work experience of the group was 9 years with minimum and maximum of 1 and 29 years respectively (Figure 2).



These executives are working in various field of agriculture including livestock, fisheries, extension and resource management. The profiles of trainee executives are presented in table 1.

Table 1. Brief profile of the trainee executive

S No	Name of executive	Age	Gender	Experience (Years)	Subject area
GHANA					
1	Mr. Romeo Owusu Kankam	40	Male	14	Crop production
2	Mr. Emmanuel Ayimbire Anaba	35	Male	10	Watershed management
KENYA					
3	Mr. Stanley NGOJU Humaiya	54	Male	30	Livestock
4	Mr. Dishon Mwawasi Mkaya	54	Male	30	Watershed management
5	Ms. Grace Wanjiru Njagi	33	Female	9	Fisheries
MYANMAR					
6	Mr. Kyi Myint	57	Male	24	Conservation agriculture
7	Mr. Thant Sin Kyaw	40	Male	15	Water management
MALAWI					
8	Mr. Edward Daniel Mjojo	33	Male	11	Watershed management
9	Ms. Yatipa Nangoma	29	Female	3	Conservation agriculture
10	Ms. Eliza Chinula	32	Female	5	Conservation

					agriculture
UGANDA					
11	Mr. Emuron Joseph	39	Male	12	Livestock
12	Mr. Emmanuel Ogwal	42	Male	7	Livestock
CAMBODIA					
13	Mr.Sokhet OUK	48	Male	29	Extension
14	Mr.Vanthy Vong	37	Male	9	Extension
DEMOCRATIC REPUBLIC OF CONGO					
15	Miss. Ifua Basele Celestine Marie-Robert	34	Female	3	Agriculture
SUDAN					
16	Ms. Fatima Jumaa Tawor Halowf	43	Female	11	Climate change
17	Ms. Rwan Mohamed Elhassan Osman	30	Female	3	Watershed manageemnt
LIBERIA					
18	Mr. Romeo Belley Kiaoh	33	Male	6	Crop Production
19	Mr. Augustine Binda Flomo	43	Male	6	Crop Production
AFGHANISTAN					
20	Mr. Rohullah Qayoumi	47	Male	1	Water management
21	Mr. Mohammad Kabir Sharifi	30	Male	5	Water management
22	Mr. Sharifullah Rahimi	26	Male	2	Watershed management

1.7 Inauguration of Training program

The 15 days International Training Program on "**Strategies for Enhancement of Farmers Income in Dryland Agriculture**" was scheduled during 16-30th January, 2018 at ICAR-CRIDA. The training was attended by 22 participants representing three Asian and seven African countries. The training program was inaugurated by Shri Chhabilendra Roul, Special secretary (DARE) and Secretary (ICAR) in the gracious presence of Mrs. V Usha Rani, IAS, Director General, MANAGE, Director, CRIDA and Directors of various ICAR institutes located in Hyderabad. Participants were formally introduced to Special secretary (DARE) and Secretary (ICAR), Director General (MANAGE), Director (CRIDA), Directors of different ICAR Institutes and Scientists (in-house faculty) of CRIDA.


USAID
Triangular Training (FTF-ITT)
Enhancement of Farmers Income in
Agriculture"


USAID
Triangular Training (FTF-ITT)
Enhancement of Farmers Income in
Dryland Agriculture"


USAID
Feed The Future - India Triangular Training (FTF-ITT)
"Strategies for Enhancement of Farmers Income in
Dryland Agriculture"


USAID
Feed The Future - India Triangular Training (FTF-ITT)
"Strategies for Enhancement of Farmers Income in
Dryland Agriculture"

In the afternoon of 16th January, 2018 post inauguration ceremony, the course director with the team of course coordinators welcomed all the participants with traditional pattu inscribing institute and ICAR logo. Pre course evaluation exam was conducted for the participants which comprised of 50 objective questions on various topics related to Strategies for Enhancement of Farmers Income in Dryland Agriculture. Course Director initiated the introductory session with all the participants and briefly explained the objective and significance of the training programme and also explained about various activities of CRIDA and its divisions.

2. Methodology

2.1 Training methodology

The training was imparted through various modules covering different aspect of dryland agriculture prevailing in India. These include classroom deliberation, field visits, hands on experience of various equipments, live demonstrations, talk and classroom practical. Six external faculty from different institutes and organization were also invited to interact with the trainees. 15 minutes from one hour classroom lecture were kept for participants to share their ideas and participate group discussion with the individual resource person. A Back at Work Plan was inbuilt with this training program to ensure the realization of learning at their respective workplace. The pre and post test was conducted to evaluate the effectiveness of the training. A mutual communication approach was followed to provide orientation to the participants on the core subject of the training program. The salient feature of the methodology adopted for the program are listed as under:

a. Participatory approach.

b. Lecture followed group discussion.

c. Interactive session with the faculty of Institute and Guest Speakers.

d. Interaction with External faculty of various Organization including IMD, WALAMTARI, WTC, IISWC, IISS and IIWM

d. Field visits to various institutions

e. Special lectures/interactions with eminent personalities from the field were invited.

f. Formulation of back to work program.

h. Regular feedback on the program was collected.

About 50% time was utilized in lecture-cum-interaction sessions, 20% time on hands on practices in laboratories and field demonstrations, 20% time for institutional visits and interaction and remaining 10% time in recreational activities

2.2 Study material

A comprehensive instruction materials and lecture are edited and a compendium of these lectures were published and distributed among the trainees. Various literatures on the dryland agriculture were provided to the trainees to have wider exposure about the theory and practices of dryland agriculture prevailing in India. The table 2 describes the different study material provided to the trainee

Table 2. List of study material supplied to trainees

S.No	Title	Type of publication	Thematic area
1	Annual report 2014-15	Annual report	Overview of research activities at CRIDA detailing various research projects and their intermittent outcome and findings
2	Annual report 2015-16	Annual report	Overview of research activities at CRIDA detailing various research projects and their intermittent outcome and findings
3	Annual report 2016-17	Annual report	Overview of research activities at CRIDA detailing various research projects and their intermittent outcome and findings
4	ABIOTIC AND BIOTIC STRESS IN PLANTS - RECENT ADVANCES AND FUTURE PERSPECTIVES	Book	Recent advances in stress management of drylabnd agriculture
5	ATLAS on Climate Change Impacts on Crop Water Balance of Groundnut Arachis hypogaea) and Pigeon pea (Cajanus cajan) in Rainfed Districts of Andhra Pradesh	Book	Water balance and crop water requirement in climate change scenario for rainfed Ground nut and pigeon pea in Andhra Pradesh state
6	ATLAS on Climate Change Impacts on Crop Water Balance of Cotton *Gossypium herbaceum*) and Maize (*Zea mays L.*) in	Book	Water balance and crop water requirement in climate change scenario for rainfed cotton and maize in Telangana state

	Telangana		
7	Conservation Agriculture and Soil Carbon Sequestration	Book chapter (Conservation agriculture, springer)	Agricultural practices in response to climate change and wide spread soil degradation
8	Livelihood Improvement in Tribal Rainfed Region: Experiences from Participatory On-farm Interventions in Nalgonda District, Andhra Pradesh	Technical report/book	Process of livelihood interventions through farmers' participation
9	Perception of Indian Farmers on Climate Change - An Assessment and Awareness Programme	Technical report	Analysis of climatic data and farmer awareness
10	Reshaping Agriculture and Nutrition Linkages for Food and Nutrition Security	Technical report	Extension methodology
11	National Innovations on Climate Resilient Agriculture (NICRA)	Technical report	Research highlight of Institute flagship research project
12	Technology Demonstrations - Enhancing resilience and adaptive capacity of farmers to climate variability	Technical report	Practices and technologies to foster stability in agriculture production in seasonal variations.
13	Rainfed farming – Compendium of doable technologies	Compendium	Various rainfed technologies that can be adopted in different part of India
14	Farmers' Perceptions and Adaptation Measures towards Changing Climate in South India and Role of Extension in Adaptation and Mitigation to Changing Climate	Extension bulletin	Farmers awareness for adaptation and mitigation to climate change
15	Techniques of Water Conservation & Rainwater Harvesting for Drought Management,	Compendium	Collection of lectures notes for SAARC training program
16	Spatial Vulnerability Assessment using Satellite based NDVI for Rainfed Agriculture in India	Technical report	RS-GIS application in dryland agriculture
17	Atlas on Vulnerability of Indian Agriculture to Climate Change	Book	District level crop planning methodology
18	Potential Evapotranspiration estimation for Indian conditions : Improving accuracy through calibration coefficients	Technical bulletin	Methodology for estimating crop water requirement
19	Assessment of carbon	Manual	Quantification of various

	sequestration in agriculture and agroforestry systems		components of carbon sequestration
20	Climate Resilient Crop Varieties for Sustainable Food Production under Aberrant Weather Conditions	NICRA Bulletin	Crop varieties as mitigation strategies for climate extremes
21	Farm Mechanization in Rainfed Regions: Farm Implements Developed and Commercialized.	Technical bulletin	Research and development in farm mechanization of dryland agriculture
22	District Agriculture Contingency Plans to Address Weather Aberrations and for Sustainable Food Security in India	NICRA bulletin	Contingency planning methodology and practice
23	Vermicomposting for Efficient Crop Residue Recycling, Soil Health Improvement and Imparting Climate Resilience : Experiences from Rainfed Tribal Regions	NICRA bulletin	Technology assessment of vermicomposting at field conditions
24	District Level Crop Weather Calendars of Major Crops in India.	Technical bulletin	Crop calendar and agromet services
25	Compensatory *Rabi* Production Plan-2015	Technical bulletin	Contingency plan for *rabi* season crop
26	District Database of Agricultural Statistics - A Database Management System	Technical bulletin	Computers and software in agriculture
27	El Niño Effect on Climatic Variability and Crop Production : A Case Study for Andhra Pradesh,	Technical bulletin	Weather forecasting and dryland agriculture
28	Enhancing *Rabi* Production Plan-2016: Harnessing Benefits of Southwest Monsoon.	Technical bulletin	Resource conservation in enhancing productivity
29	Farm Ponds: A Climate Resilient Technology for Rainfed Agriculture; Planning, Design and Construction.	Technical bulletin	Water resource development through surface water storage
30	User Manual for Surface Water Yield Model	Technical bulletin	Computers and software in agriculture
31	Organic Farming in Rainfed Agriculture – Opportunities and constraints	Technical Bulletin	Enhancing farmers income in dryland agriculture
32	AICRPAM at a Glance	Institute profile	Salient accomplishment of All India Coordinated Research Project on Agrometeorology

33	AICRPDA at a Glance	Institute profile	Salient accomplishment of All India Coordinated Research Project on Dryland Agriculture
34	CRIDA at a Glance	Institute profile	Brief description of ICAR-CRIDA and its salient achievements

Apart from above listed study material, a compendium of training lecture exclusively printed for present training program were also provided to the trainees. Figure below

2.3 Interactive session and resource person

The formal training was statrted on 17th of January, 2018 with classroom lectures. The datewise training schedule and interaction with resource person are described in subsequent paragraphs. Most of the resource person were from CRIDA. However, six external resporce person having rich experience in various aspect of dryland agriculture were also requested tointeract and share their experience with the executives.

INTERACTIVE LECTURE SESSIONS

Date: 17/01/18 Time: 9:30 Hrs – 4:30 Hrs

Topic and resource person	Brief description
Rehabilitation of Tanks and Field Soils through Desilting and Recycling of Silt for Drought Proofing **Dr. Mohammed Osman,**  (Classroom lecture and discussion)	Dr Osman in his lecture described about the rehabilitation of tanks using desiltation and reapplying the silt to the fields. He suggested that while doing so, a holistic perspective of de-silting and recycling of tank silt and sharing of common pool resources in conjunction with the socio-cultural factors are imperative in designing the tank management policies at landscape level. The tank management and land use policies should consider and incorporate the socio-cultural and economic factors. Further suggested following points to evaluate the existing management strategies and take appropriate decisions. 1. Awareness and creating a good understanding among farmers about the significance of tank silt application. 2. The rate of silt recycling should match as per the soil texture of site to be applied (This can be achieved using tank silt application software developed by CRIDA). 3. The process should begin around October so that the actual silt application work can begin as soon as the tank dries up. 4.Excavation of silt should not weaken the bund, sluice, surplus weir, etc. 5. Silt application in fields must be done at least 2-3 weeks before the onset of monsoon so that it is dried and can be properly mixed in the field. 6. Tank silt may be considered as a substitute to the fertilizer and a part of subsidy given to fertilizers need to be diverted to tank de-silting and recycling of nutrients to farm lands.

Horticulture based farming strategies for augmenting incomes of vulnerable Afro-Asian Dryland communities Dr. N N Reddy  (Classroom lecture and discussion)	Dr Reddy discussed following aspect of dryland horticulture to augment farmers income which may be crucial in unlocking the potential of farmers and their communities • Expand the role of international public goodsProducing penough biomass: this can be achieved through the use of cropping technologies (water harvesting, irrigation, improved crop varieties) and intensive farming. • Introducing compatible and high-value perennial crops; this would generate income for the poor farmers and improve the year-round soil cover. • Implementing an integrated farming approach which would help local communities to better address a number of issues at a time and also facilitate the search for alternative sources for various issues. • Enhancing the knowledge of farmers for better management and efficient use of land and water resources in order to increase crop and livestock productivity. • Increase effectiveness of local and national government actions for poverty reduction
Role of Conservation Agriculture in Improving Soil Health and Mitigating Climate Change- Dr. **K.L. Sharma,**	Dr Sharma shared his experiences of conservation tillage, soil fertility enhancement, and carbon sequestration and conservation agriculture. In his lecture, he elaborated the practice of conservation agriculture and tillage to protect the land from climatic extremes and to restore and improve the

(Classroom lecture and discussion)

quality of soils. Further, conservation tillage, a generic term implying all tillage methods that reduce runoff and soil erosion in comparison with plow-based tillage, is known to increase SOC content of the surface soil layer. Principal mechanisms of carbon sequestration with conservation tillage are increase in micro-aggregation and deep placement of SOC in the sub-soil horizons. Other useful agricultural practices associated with conservation tillage are those that increase biomass production (e.g., soil fertility enhancement, improved crops and species, cover crops and fallowing, improved pastures and deep-rooted crops). He further stressed to adopt appropriate need based soil and crop management systems that accentuate human frication and increase the passive fraction of SOC. Because of the importance of C sequestration, soil quality should be evaluated in terms of its SOC content. Beside this, conservation agricultural practices also play an important role in climate change mitigation by i) reducing the fuel requirement in tillage operations and consequently, the associated emissions due to fuel burning and ii) also by reducing the CO2 fluxes coming from soil by sequestering more C in soil profile an making the soil as net sink and not the emitter. Thus, in the years to come, conservation agricultural practices can play a major role in increasing the organic C content in soil, improving soil productivity and in reducing the CO2 fluxes to the atmosphere.

Planning, Design and Execution of Check dams for Water Harvesting in Rainfed Regions- Dr. **B. Krishna Rao,**  (Classroom lecture and discussion)	Dr. Rao discussed about the rainfed regions of India which is characterized by aberrant behavior of monsoon rainfall, eroded and degraded soils with water and nutrient deficiencies, declining ground water table and poor resource base of the farmers. Additionally, climate variability including extreme weather events that poses serious threat to rainfed agriculture. In global perspective, the rain-fed agriculture will continue to play an important role in food and nutrional security. Rainfed or dryland agriculture is prominent in India, accounting for about 56% of the total cropped area and contributes 87.5% coarse cereals, 87.5% pulses, 77% oilseeds and 65.7% cotton of the country's total production. In rainfed regions, due to the temporal and spatial variability and skewed distribution of rainfall, crops suffer invariably from moisture stress at one or the other stage of crop growth. Rainwater harvesting both *in-situ* and *ex-situ* is the panacea for mitigating the constraints of rainfed farming. The successful production of rainfed crops largely depends on how efficiently soil moisture is conserved (*in-situ)* or the surplus runoff (*ex-situ)* is harvested stored and recycled for Supplemental irrigation as these are inevitable options to sustain rainfed agriculture in changing climatic scenario.

Climate Change and Water Management Strategies in Rainfed Agriculture

Dr. P K Mishra

(Classroom lecture and discussion)

In-situ conservation by means of land configuration, broad-bed furrow, ridge furrow, tied ridges, trenching, contour and graded bonding, V-shaped catchment are good practices to improve farm productivity and farmer's income in rainfed area in Asia and Africa. Decentralized water conservation (green and blue) including harvesting water in embankment and dugout pond, use of low cost plastic check dam, tapping excess spring flow, inter watershed linking, tapping base flow by innovative approach are important towards improving rain fed productivity. Renovating old water harvesting structure should be priority as silt removal from tank and application in agricultural field has double benefit in terms of improved water storage capacity, improved soil health and higher income. Watershed management comprising various water conservation and management intervention in scientific approach, along with promoting social equity has been proved one of the most successful land management options in India, expertise available may be extended to African countries. However, a continuous research is required to utilize contemporary development in tools and technologies to make the programme more inclusive. A considerable portion of rainfed area mainly black soils in India and Africa also suffer from seasonal water logging therefore drainage must be part of rainfed water management strategy. Interlinking of river, coupled with national water grid, taluka level sub grid and farm level pocket water-tank/well capable of utilizing runoff as well as grid water for protective irrigation is the key of evergreen revolution in Asia as well as in Africa.

Issues and Strategies for Enhancing Agricultural Productivity in Coastal Lowlands- **Dr. S.K. Ambast, Director, IIWM, Bhubaneswar**  (Classroom lecture and discussion)	Coastal ecosystem includes estuaries, coastal waters and lands located at the lower end of drainage basins, where streams and river systems meet the sea and are mixed by tides. Functionally, it is broad interface between land and water where production, consumption, recreation and exchange processes occur at high rates of intensity. Ecologically, these areas are dynamic, biological, hydraulic, geological and chemical activities often with considerable but always in limited capacity for supporting various forms of human use. However, such areas are fragile and vulnerable which both nature and man have and will muscle in both constructive and destructive ways. The coastline of India is about 7,516 km, of which the mainland accounts for 5,422 km and Islands extends for 2094 km and has a continental shelf area of 468,000 sq km, spread across 9 coastal States and 3 Union Territories

Date: 18/01/18 Time: 9:30 Hrs – 4:30 Hrs

Topic and resource person	Brief description
In Creasing Atnospheris CO_2 Concentration and Temperature – Impact on Rainfed Crops Productivity **Dr. M. Vanaja,**	The changes in the composition of atmosphere in terms of greenhouse gases, aerosols influence the properties of solar radiation and alter the energy balance of the climate system. Now it is evident from various studies that the human activities are contributing significantly for the change in climate compared to natural variability in climate. The atmospheric concentration of carbon dioxide- the most important anthropogenic greenhouse gas increasing at alarming rates (2.1 ppm per year) in

 (Classroom lecture and discussion)	recent years. Climate model predictions of CO2 induced global warming typically suggest that rising temperatures would be accompanied by increases in rainfall amounts and intensities, as well as enhanced variability. The inter-annual variations in temperature and precipitation were much higher than the predicted changes in temperature and precipitation. The crop losses may increase if the predicted climate change increases the climate variability. Different crops respond differently as the global warming will have a complex impact. The climate sensitivity of agriculture is uncertain, as there is regional variation of rainfall, temperature, crops and cropping system, soils and management practices.
Farming Systems Approach in Rainfed Agriculture- Prospects and Limitations- **Dr. K.A. Gopinath**  (Classroom lecture and discussion)	Rainfed agriculture constitutes 80% of global agriculture, and plays a critical role in achieving global food security. Out of the total population of 7.3 billion, about 1 billion are food-insecure, and 60% of these live in South Asia and Sub-Saharan Africa. Aberrant behavior of monsoon rainfall, eroded and degraded soils with multiple nutrient and water deficiencies, declining ground water table and poor resource base of the farmers are major constraints for low and unstable yields in rainfed areas. In addition, climate variability including extreme weather events resulting from global climate change poses serious threat to rainfed agriculture. Traditionally, farmers in rainfed regions practice crop-livestock mixed farming systems, which provide stability during drought years, minimize their risk and help them to cope with weather aberrations. However, these traditional systems are low productive and cannot ensure immediate livelihood security. The farming systems approach is considered important and

	relevant especially for the small and marginal farmers as location-specific integrated farming systems (IFS) will be more resilient and adaptive to climate variability. The IFS approach also has the potential to overcome multifarious problems of farmers including resource degradation, declining resource use efficiency, farm productivity and profitability and also meet the multiple objectives of poverty reduction, food security, competitiveness and sustainability.
Agroforestry in Dryland Areas for Boosting Farmers Income and Environment Amelioration Dr. **G. Rajeshwar Rao,**  Classroom lecture and discussion)	In a vast country like India, with a high unemployment rate, scarcity of land and capital, deforestation, and a growing population, agro forestry systems are ideal land use options to use the available natural resources in the fragile rainfed ecosystem for generating assured income with minimum risk. Harnessing agro forestry enterprise in rainfed areas has lots of scope to enhance livelihood security. In view of the growing importance of agro forestry for rainfed agriculture, there is an urgent need for further research to continuously refine and improve the system. To meet both present and future demands, infrastructure and policies need to be supportive for the development and adoption of traditional and improved agro forestry systems based on synergy with nature. There is also a potential to utilize agro forestry in rainfed areas to solve problems like global warming (through increased carbon sequestration), and for biodiversity conservation, which will require that greater policy support for agro forestry in rainfed areas.
Microbial Products as Farm Inputs for Enhanced Farm-Productivity and Profitability-	With the growing concern for our immediate environment, there has been a renewed interest in exploring the micro biota for their beneficial traits. It has

Dr. **Suseelendra Desai,**  (Classroom lecture and discussion)	been proved beyond doubt that microorganisms are an essential component of plant growth and productivity. Their association with plant system continues to play a predominant role in deciding the establishment and yielding of a particular crop species in a given agro-ecosystem. Several examples have proved that microbes help in cycling of nutrients in soil environment and thereby promoting plant growth. They protect crops from pathogenic organisms and insect pests that cause severe yield losses. They produce various growth promoting substances that help in establishment of plants. Harnessing their beneficial effects could help in Development of microbial products as inputs and thus save on escalating input costs and thereby increase farm profitability esp. for resource-poor small- and marginal-farmers of rainfed regions of India.
Agriculture Contingency Plans towards Adaptation of Indian Agriculture Dr. K V Rao  	In order to address the climate variability/ change, a coordinated effort by Ministry of Agriculture, Indian Council of Agriculture Research through NARES along with state department of agriculture was started on a continuous basis to provide suitable contingency plans. The preparation and implementation of contingency plans is the way chosen by both federal and state governments as an important adaptation measure to make the agriculture sector more resilient in the country. Anticipatory research is needed to cope with such weather abnormalities as dry spells, high rainfall, hailstorms etc. With time, thorough protocols would have to be put in place where by meteorological division and agricultural research systems provide valuable inputs through advisories to farmers through real-time collection and

	analysis of weather data at micro level and the support for implementation of advisories would be ensured by extension agencies.
How ICT Enhance Farmer's Income in Dryland Agriculture Dr. **N. Ravi Kumar,**  (Classroom lecture and discussion)	The overarching benefits of ICT in agriculture are that it reduces transportation, transactional and corruption waste. It can bring about product traceability, disease and pest tracking, and storage. The ICT development has made the rural people better informed about the market and the many Indian farmers are benefitted with the reach of ICT in the form of mobile phone or Internet in the remote villages. Only through strong linkages from diverse stakeholders can create the conditions needed for unlocking the entrepreneurship of smallholder farmers and ultimately boosting their income.

Date: 19/01/18 Time: 9:30 Hrs – 4:30 Hrs

Topic and resource person	Brief description
Field visit to Gunegal Research Farm and Watershed **S.S. Balloli and Manoranjan Kumar** **(Field visit)**	Dr SS Balloli, Officer in charge of guunegal research farm (GRF) presented the overview of the research farm including various research project being implemented. GRF located at 78^{o} 39', 17^{o}05' 650 m (lat, long and elevation respectively) spread over 80 ha area and represents agro-ecological zone -7 of India, which is characterized by hot semi-arid eco-region with red and black soil and receives average annual rainfall between 600-1000 mm.

GRF experiences potential evapotranspiration as high as 1600-1700 mm during the length of growing period which is typically varies between 90-150 days. Nearly half of the area in GRF is maintain as forest for ecological research. The activities include field experiments, demonstration of rainfed technologies, seed production and training/exposure visits.

The trainees visited the field experiments of fodder based cropping system and were explained about the enhancement of the production potential of such system, its sustainability in respect of soil health and economics.

The conservation agriculture for maize-pigeonpea crop rotation, potential of organic crop production as a measure to climate change adaptation and mitigation strategies as well as resource conservation and carbon sequestration were also explained to the trainees. Also, the trainees were exposed to the field experimental framework for crop simulation modelling. The trainees further visited the field and had exposure to the adaptation strategies for climate resilience in horticultural crops specifically in custard apple and guava. The genetic improvement Jataropha for dryland adaptation were also shown.

The trainess were further taken to the demonstration site which include draught management through mulching, mitigation through runoff water harvesting, reuse using irrigation system, conservation furrow, contour

strips and contour sowing, compartmental bunding and use of potassium chloride as draught mitigation. On-farm organic recycling strategies including machinery such as chipper shredder were also explained to the trainees.

Some other techniques such as composting of farm residues, subabul plantation, intercropping system and agri-horti system were shown to the trainees.

However. the USP of research and development at GRF remains in rainwater harvesting in farm ponds and its use during dryspells. Dr Manoranjan Kumar elaborated these techniques in details to the trainess including various aspects of farm pond design and construction. Several farm ponds of various size, shape and lining material at the field were shown to the trainees and relative advantages and disadvantages were discussed considering the prevailing conditions of the native country of the trainees.

Date:20/01/18 Time: 9:30 Hrs – 4:30 Hrs

Topic and resource person	Brief description
National Innovations in Climate Resilient Agriculture: A Multi Sectorial Approach to Enhance Farm Income Under Changing Climate in India Dr. **M. Prabhakar,**  	Dr Prabhakar, Principal Investigator of NICRA presented the salient features of the CRIDA flagship project on climate change. NICRA is a unique project, which brings all sectors of agriculture viz. crops, horticulture, livestock, fisheries, NRM and extension scientists on one platform for addressing climate concerns. Over the past five years, several the state of the art infrastructure facilities have been developed established, standardized and put in to function in core institutes of ICAR to undertake the climate change research. Manpower (Scientists, Research Associates, Research Fellows, Technical Officers etc.) have been trained to handle and operate these facilities. Efforts made under this project, in some cases resulted in development of varieties/hybrids ready for large-scale cultivation. Standardization of minimum data sets and compilation of data from different sources have shown good progress and provide ample scope for crop simulation and modelling in Indian context Though there are some positive lessons and experiences emerging out of technology demonstration component, there is still considerable need to continue this activity to identify and demonstrate technologies that help deal with climate

(Classroom lecture and discussion)	change. In fact, the technologies found to be performing well are getting fed into programs such as National Mission on Sustainable Agriculture (NMSA). The commitments of the country to emission reductions require generate appropriate information and data on emissions as well as options that help reduce emissions. Techniques standardized so far under NICRA for estimation of GHG emissions from different management practices can be used for further reducing the carbon footprint of production systems in the country. The efforts in this direction, which have begun, recently have to be taken through their logical course to identify and prioritize various adaptation options.
Climate Resilient Agriculture for Sustainable Crop Production **Dr. K. Sammi Reddy,**  (Classroom lecture and discussion)	Indian agriculture, predominantly rainfed, is vulnerable to the vagaries of monsoon. International Panel on Climate Change (IPCC) in its Fifth Assessment Report observed that 'Warming of climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and oceans have warmed, the amount of snow and ice have diminished, and sea levels risen. Climate change projections for Indian sub continent up to 2100 indicate an increase in temperature by 2-40C, with different regions expected to experience differential change in the amount of rainfall. It is evident from the shifting weather patterns in recent years, causing increased rainfall variability (8 out of

	15 years drought), heat and cold waves, hail storms, rising sea levels contaminating coastal freshwater reserves and increased frequency of flooding affecting many areas. To meet the challenges of sustaining domestic food production in the face of changing climate and to generate information on adaptation and mitigation in agriculture to contribute to global fora like UNFCC, the Indian Council of Agricultural Research (ICAR) launched a flagship network project 'National Initiative on Climate Resilient Agriculture' (NICRA) during XI Plan in February 2011, and during XII Plan it is referred as 'National Innovations in Climate Resilient Agriculture' (NICRA).
Water Use Efficiency in Livestock Production Management: A Key Area for Improving Farmers' Income in Drylands Dr. **Prabhat Kumar Pankaj** 	Demand for meat and milk is projected to be more than double over the next two decades in developing countries. The major factors driving this rising demand are population growth, increased awareness towards balanced diet, increased urbanization and higher incomes. If livestock production is to keep pace with demand, the imperative is to enhance productivity per animal with minimal resource use and reduced wastage. Livestock contribute to livelihood of poor and food insecurity in dryland in many ways. They are an important source of cash income, and offer risk management options to reduce vulnerability, social networking instruments and social security capital. They provide major benefits in term of manure and draft power to enhance soil fertility and facilitate facility to sustainable intensification of farming systems;

 (Classroom lecture and discussion)	transport to markets and power for post-harvest operations; usage of common property grazing lands, which are especially vital to the welfare of the landless; source of income diversification; and high-quality protein and energy to the diets of food and nutrition insecure, as well as Essential micronutrients such as calcium, iron, zinc, retinal, thiamine, and vitamins A, B6 and B12, often lacking in cereal-based diets. Livestock products provide one third of the human protein intake, but also consume almost one third of the water used in agriculture globally. Most of the world's animal production comes from rainfed mixed crop-livestock systems in developing countries and from intensive industrialized production in developed countries. Livestock production systems are rapidly changing in response to various potential drivers, mainly in terms of policy adaptation, investment and technology options. With increasing demands for animal products, along with increasing global water scarcity and competition for water, improving livestock water productivity(LWP) has become essential.
Crops and Cropping Systems for Soil and Water Management **Dr. V. Maruthi,**	Soil and water management is gaining lot of importance worldwide not just because of soil losses occurring in different regions that lead to low yields and poor income, but also due to changing climate observed in terms of unseasonal, ill distributed rainfall as well as extreme rainfall events. As efforts are on globally to make dryland agriculture

 (Classroom lecture and discussion)	competitive, plugging the losses (soil and water) issue becomes prime concern. Unless the soil is productive, manipulating crop sowings and other operations matching the weather variations is not possible. Matching suitable measures with the required site/soil management is critical, therefore soil and water management measures to improve productivity of the soil and thereby farmers' income may be focused upon. Most engineering management measures like check dams, gabions *etc*. are matched to the specific land requirement while the measures on crop lands must be mostly agronomic which is mostly a non monetary input. Agronomic measures include crops which grow close to the soil reduce the raindrop impact on soil dislodging the soil grains while cropping systems like intercropping and sequence cropping systems are for slowing down the runoff and thereby reducing the soil carrying away by runoff water.
Agriculture Insurance as a Risk Management Strategy- Dr. **P. Vijaya Kumar,**  (Classroom lecture and discussion)	Weather risk is assuming importance in agriculture due to climate change. Agriculture insurance has been identified as one of the risk management strategy for adapting to the climate change. In contrast to the traditional crop insurance scheme, weather index based insurance is gaining prominence because of its transparency, low operational costs and fast pay out mechanism. Yet, there are major constraints associated with weather index products that need to be successfully addressed. Foremost among the constraints is high basis risk. There is an urgent need to bring down

	basis risk arising from insufficient network and spread of weather stations besides improving relationships between the weather triggers and yield loss. Finally, there should be an in-depth research (on a continuous basis) of the associated weather risks for various crops grown in the country

Date: 21/01/18 (Wekend off), time 8:30 – 17:00 Hrs, Executives were visited to Ramoji Film City, Hyderabad

Date: 22/01/18

Topic and resource person	Brief description
Crop Interventions for Climate Resilient Agriculture: Dr. **J.V.N.S Prasad**  (Classroom lecture and discussion)	As rainfed agriculture is risky due to weather aberrations and frequent droughts, selection of appropriate crops and cultivars based on the bio-physical and climatic constraints of an area are essential pre-requisites for successful crop production and for maximizing productivity and profi tability. Many criteria have been set out for selecting appropriate crop varieties for rainfed areas and some of them are of short duration, drought tolerance and the capacity to produce reasonable yields under limited soil moisture conditions. Selection of appropriate crops, varieties, systems such as mono cropping, inter cropping, sequence cropping, etc. for a location can be effectively made based on the analysis of long-term climatic data in terms of probability of the onset of monsoon, withdrawal of monsoon, and occurrence of dry spells and the soil moisture supplying capacity.

	Short duration and improved crop varieties play an important role in addressing the, shortened growing season and early withdrawal of the monsoon. Similarly the flood tolerant, paddy cultivars can impart resilience in frequently flood prone regions. Intercropping and integrated farming systems can minimize the risk due to climatic vagaries and enhance resilience during variable rainfall situations.
Use of Geomatic Tools for Monitoring & Evaluation of Watershed Projects to Increase Farmers' Income- Dr. **Kaushalya Ramachandran,**  (Classroom lecture and discussion)	In order to evaluate sustainability of WDP, it is essential to undertake a multidisciplinary approach using the tools indicated in this document. Soil fertility status was evaluated in conjunction with socio-economic conditions prevalent in the selected watersheds. Application of GIS & Remote Sensing was found to be useful to geo-reference sustainability indicators and in construction of baseline information for pre- watershed development period so as to facilitate a comparison of progress made. Study of ten micro-watersheds in the five villages in AESR 7.2 undertaken during 2005-2015 indicated that watershed development program has positively impacted rainfed agriculture although marginally. It was seen that most villages are predominantly peopled by marginal and small farmers and any rural development programs including WDP must be fi ne–tuned for them, if agricultural sustainability has to be achieved. Automation of technology like Jal-DSS could help in implementing interventions in a short period of

	time which was not possible earlier. GIS and Remote Sensing tools and techniques facilitate robust and objective evaluation of impact of NRM interventions like watershed projects.
Livestock Integrated Farming Systems: A Boon to Dryland Farmers Dr. **D.B.V. Ramana,**  (Classroom lecture and discussion)	Integrated farming system models suitable to the agro-climatic zones will vary with location depending on natural resources (grazing lands, water, rainfall and other climatic factors, soil types) and crop residues, byproducts and forage availability and market demand for the produce. Integrated farming system with livestock absolutely helps in recycling and improving utilization of organic wastes and crop residues and lowers external input requirements, minimizes risk, increases total production and profit. Livestock based integrated farming systems interact eco-biologically, in space and time, are mutually accommodative and depend on each other in additive fashion and results in more efficient use of their marginal small holdings with less external inputs, improve their economic gains substantially and pays path towards achieving a more sustainable agricultural food production systems in dryland.
Agromet Advisories and their Role in the Risk Management- Dr. **A.V.M. Subba Rao,** (Classroom lecture and discussion)	Agriculture in India depends heavily on weather and climatic conditions. Weather forecasts are useful for taking decisions like choice of crop / crop variety, planting/harvesting dates, irrigation, fertilizer, pesticide, herbicide application etc. Hence, improved weather forecast based Agro met advisory services greatly help farmers to take advantage of beneficial weather and mitigate the

 	impacts of malevolent weather conditions. Government of India established the National Centre for Medium Range Weather Forecasting (NCMRWF) under Department of Science & Technology (DST) in early 1988 in mission mode with the following mandate Development of global and regional scale numerical weather prediction (NWP) models for forecasting weather in medium range (3-10 days) time scale taking full advantage of existing and concurrent developments both in India and abroad in the fi eld of atmospheric science. • Set-up a state-of-the-art supercomputing infrastructure to develop suitable NWP Models to issue medium range weather forecasts. • To inform and guide the farmers in advance to undertake various farming activities Based on the expected weather. • Set-up agro meteorological advisory service (AAS) units, each unit representing one of the 127 agro climatic zones spread all over India, to prepare/ issue/ Disseminate AAS Bulletins based on weather forecasts and to provide user Feedback as well. • Set-up a stable/fast dedicated communication network with AAS units.
Dr. Recent trends in Agricultural Water Management Dr T B S Rajput	Dr Rajput in his interaction with the trainees explained about the recent trends prevailing in water management. He elaborated the need for water saving technology including water

	conservation, water harvesting and recycling with special emphasis to small scale structures, conjunctive use of surface and ground water. The scope for improvement in canal water management was discussed in details and suggested following measures to be adopted • Inter and intra seasonal modifications in the rotational warabandi schedules. • Introduction of auxiliary storage or service reservoir both at outlet and/or farm level. • Allocation of canal water in conjunction with groundwater. • Modification in the canal capacity factors. • Appropriate sizing of watercourse or unit command area. • Variable time warabandi schedule. If these interventions are implemented earnestly canal management would be greatly improved.
Soil and Nutrient Management Innovations for Enhancing Soil Health and Farmers' Income Dr. A K Patra 	The experience on various soil and nutrient management innovation prevailing in Indian agriculture was shared with the trainees. The reduction in cost of cultivation was emphasized and to this effect tillage practices and crop residue management as a system approach were suggested. It was also suggested to adopt integrated farming system, crop diversification and use of microbial resources for enhancing income in dryland farming. The methodology for sustainable soil health through conservation agriculture and organic waste management were also discussed.

Date 23/01/18; 08:00 Hrs – 16:45 Hrs; Visit to Water and Land Management Training and Research Institute (WALANTARI), Hyderabad and other ICAR institutes namely Indian Institute of Rice Research, Indian Institute of Millet Research, Indian Institute of Oilseed Research situated at in and around Hyderabad.

Date 24/01/18

Topic and resource person	Brief description
Visit to Hayathnagar Research Farm (Farm Implements and Machinery **Dr.B. Sanjeeva Reddy,** Research facilities by **K. Srinivas,** OIC (FARM), Drs. **Manoranjan Kumar and Pushpanjali)** **(Field visit)** 	Dr K Srinivas, Officer in charge of Hayathnagarl research farm (HRF) presented the overview of the research farm including various research project being implemented. HRF located at 78^{o} 35', 17^{o}21' 521 m (lat, long and elevation respectively) spread over 280 ha area and represents agro-ecological zone -7 of India, which is characterized by hot semi-arid eco-region with red and black soil and receives average annual rainfall between 600-1000 mm. Like GRF, HRF also experiences potential evapotranspiration as high as 1600-1700 mm during the length of growing period which is typically varies between 90-150 days. Nearly half of the area in HRF is under dryland plantation. The facility include Climate change research complex, workshop for farm mechanization, Farm science centre, field soil testing laboratory. Dr B Sanjeeva reddy, principal scientist, facilitated the visit of trainees to the farm mechanization workshop. Various farm equipments developed and commercialized by

 	CRIDA were explained. These includes Drill plough, plough planter, row planter, herbicide applicator, Broad base furrow planter, ridger planter, manual, bullock and tractor drawn weeder, Orchard sprayer, castor sheller, ground nut stripper, vegetable preservator, herbal dryer and mini dal mill. Functioning of custom hiring centre and its management were also explained. The climate change research complex housing state-of-art facility such as FATE (Free air temperature elevation), CTGC (CO_2, Temperature gradient chamber) and SCADA (Supervisory control and data acquisition) based rainfall simulator and lysimeter. Exposure to these facilities was provided to the trainees. The trainess were also explained about various field experiments pertaining to dryland agriculture such as resource characterization, rainwater management, crops and cropping system, soil health and nutrient management, management of livestock and energy. Various irrigation system (Drip and raingun) and its components were also explained to the trainees.
Visit to India meteorological Department (IMD) Dr. Y K Reddy, Scientist – F and In-charge Director	Dr Reddy explained about the weather forecasting methodology and respective equipment in details. The trainees were let to have hand on experience of various equipment of standard observatory.


DOPPLER WEATHER RADAR

Date 25/01/18 8:00 hrs to 17:00 hrs

Topic and resource person	Brief description
Visit to MANAGE (National Institute of Agricultural Extension Management) **Dr. Manoranjan Kumar,** Various facilities of MANAGE by Dr. P Chandra Shekara, Ms Shakera Parveen and Mr. Ravi Nandi.  	The overview of MANAGE regarding its functioning and clientele were briefed by Dr. P Chandra Shekara. Mr Ravi Nandi described about the facility of information and communication technology for data assimilation. Analysis and distribution to the stakeholders. Ms Shakera facilitate visit to different learning centre including startup incubation centre. Dr. Yella Reddy, Director (A&R), interacted with the trainees on water footprint of different agricultural activities and commodity. He stressed that there is an urgent need to improve water resource management and water productivity not only in crop land but also in various other sectors. To accomplish this, state specific action plan are required to be developed in line with national water policy and vision documents. In order to reduce water withdrawals for irrigation, upgrading of irrigation infrastructure through rehabilitation and modernization should be given priority. Other aspects like timely maintenance of irrigation and drainage infrastructure, investment in water storage and water saving technologies, combating the twin menace of water logging and salinity through drainage are required.

Date:26.01.18 Holiday – Trainees were allowed to spend leisure time and facilitated to shopping etc.

Date 27.01.18;

Topic and resource person	Brief description
Agro-Ecology Specific Rainwater Management Interventions for Higher Productivity and Income in Rainfed Areas- Dr. **G. Ravindra Chary**   (Classroom lecture and discussion)	Rainfed agriculture constitutes 80% of global agriculture, and plays a critical role in achieving global food security. Out of the total population of 7.3 billion, about 1 billion are food-insecure, and 60% of these live in South Asia and Sub-Saharan Africa. The importance of rainfed agriculture varies regionally, but it produces most food for poor communities in developing countries. Aberrant behavior of monsoon rainfall, eroded and degraded soils with multiple nutrient and water deficiencies, declining ground water table and poor resource base of the farmers are major constraints for low and unstable yields in rainfed areas. In addition, climate variability including extreme weather events resulting from global climate change poses serious threat to rainfed agriculture. Traditionally, farmers in rainfed regions practice crop-livestock mixed farming systems, which provide stability during drought years, minimize their risk and help them to cope with weather aberrations. However, these traditional systems are low productive and cannot ensure immediate livelihood security. The farming systems approach is considered important and relevant especially for the small and marginal farmers as location-specifi c integrated farming systems (IFS) will be more resilient and adaptive to climate variability. The IFS approach also has

	the potential to overcome multifarious problems of farmers including resource degradation, declining resource use efficiency, farm productivity and profitability. To meet the multiple objectives of poverty reduction, food security, competitiveness and sustainability, several researchers have recommended a farming systems approach.
Addressing Malnutrition with Biofortified Crops- Dr. **Sushil Kumar Yadav,**  (Classroom lecture and discussion)	Biofortified crops are bred to have higher amounts of micronutrients and can help provide essential vitamins and minerals. They provide a low cost, sustainable and permanent solution to problems related to malnutrition. Transgenic approaches are in some cases necessary and, in some cases, potentially advantageous compared with conventional breeding. One such example is Golden Rice which contains higher amounts of beta-carotene, with potential benefits for 250 million children who risk blindness due to vitamin A deficiency. Similarly, rice with higher amounts of iron could offer significant benefits to 1.4 billion women who suffer from anemia. Biofortification is yet to be fully scaled-up in a single country, but much evidence and experience has been assembled to support its eventual effectiveness. Policies to support cross-sectoral implementation at all levels, as well as increasing the evidence base, will contribute to ensure that biofortification is a cost-effective investment in community nutrition. Dr Yadav suggested some action points to make it

	effective to deal with widely prevalent malnutrition which includes • Make enhanced mineral and vitamin content of the edible portions of new cropvarieties core breeding objectives at agricultural research centers, in addition toyield and other agronomic characteristics Invest in developing cultivars with multiple micronutrients to capitalize on thesynergistic effects between micronutrients. • Develop further efficacy trial evidence for biofortified crops, in particular withrespect to the nutritional status of mothers going into pregnancy and for youngchildren.
GIS for water harvesting structures planning and management- Dr. **R. Rejani, Senior Scientist,**  (Classroom lecture and discussion)	GIS is very useful for estimating runoff and soil loss spatially from watersheds or large catchments. For finding the suitable locations for different *in-situ* and *ex-situ* interventions, different thematic layers were integrated in GIS and the set of criteria was applied in three stages. The specific locations and number of structures was determined based on preliminary criteria, slope of the land, vertical interval and horizontal interval required between structures. Since, semi-arid rainfed regions have limitations in the runoff potential availability; these locations were further optimized based on the surplus runoff available after *in-situ* water conservation. This methodology is less time consuming, more precise and can be utilized for the planning of watersheds or even large catchments
Establishment of Farm Machinery Custom	The custom hiring sentres (CHCs) are very useful

Hiring Centres Dr. **I. Srinivas**  (Classroom lecture and discussion)	to farming community particularly for small, marginal, semi-medium farmers. In almost all cases, the generated funds not sufficient to successfully run the CHCs on long-term basis. In some cases, there was no demand for some implements which can be replaced by need based high cost machinery such as combine harvesters, multi crop threshers etc. Some of the CHCS supported by the government with signifi cant subsidy backup are working with marginal profits but the long term sustainability will be depend on the future business volume. Apart from meeting the operational requirements, CHCs are much useful to the farmers for creating awareness on new implements. Increase in cropping intensity resulted in employment generation. Therefore, the government should extend the fi nancial support to the extent of 50 to 90 % of total capital cost including the shed and other infrastructure facilities. At the same time an input subsidy of 50 % on rental cost should be extended to the small and marginal farmers who ever utilizes the services of CHCs which will boost the productivity and reduce the cultivation cost.
Extension Tools and Techniques for Technology Dissemination in Dryland Agriculture- **K. Nagasree,**	Most of the time, agricultural productivity has increased at the expense of deterioration in the natural resource base on which farming systems depend. It is need of the hour that this trend should be controlled by encouraging farmers to adopt more sustainable methods of farming that will have long-term benefits in environmental

 (Classroom lecture and discussion)	conservation and development of sustainable livelihoods. Specific objectives for sustainable natural resource management (NRM) include improving agro-ecosystem productivity, conserving biodiversity, reducing land degradation, improving water management, ensuring the sustainability of forests, managing the sustainability of wildlife and fisheries and mitigating the effects of global climate change. NRM refers to the processes and practices relating to the allocation and use of natural resources while, sustainable NRM optimizes the use of resources to meet current livelihood needs, while maintaining and improving the stock and quality of resources so that future generations will be able to meet their needs. NRM decisions are made at various levels such as household, farm, community, national and global. Sustainable NRM is critical to reducing poverty. If productive capacity of natural resources continues to erode, the potential to satisfy future food needs will be seriously compromised. The poorest will suffer the most, through increased food costs and greater vulnerability to their livelihood. Further, increased agricultural production and productivity and increased incomes provide more resources in the long run for addressing environmental problems.
Design Options of Portable Pumpset for Effective Utilization of Harvested Water From Farm Pond	Water harvesting through farm pond is a viable technology but appropriate lifting mechanism is required for effective use of pond water in

Dr. **Ravikant V. Adake**  (Classroom lecture and discussion)	agriculture. A portable pump set of 1.5 hp was tested for lifting of pond water and pressurized irrigation showed satisfactory performance in terms of both cost and energy. The utilization of harvested water using portable pump set added signify cant contribution to farmer's income. The payback period of portable pump set is just one year. Portable technology inspired the farmers to make effective use of harvested water.

Date: 28.01.18 weekend off, visit to nearby sites for shopping etc

Date 29.01.18

Topic and resource person	Brief description
Potential of Rain Water Harvesting Farm Ponds for Raising Farm Incomes in Rainfed Regions of Andhra Pradesh and Telangana- Dr. **C.A. Rama Rao**  	Improving the productivity of and income from rainfed agriculture should form an important element of any strategy for a more inclusive growth and doubling incomes of farmer households. In the context of rainfed agriculture, harvesting and use of rainwater for protective and/or productive irrigation assumes importance. The experience gained from 300 farm ponds from three districts with varying rainfall, soil types and cropping pattern showed that rainwater harvesting through farm ponds was effective in enhancing farm incomes considerably across locations. The findings imply that design of farm ponds should be location specific taking into

 (Classroom lecture and discussion)	consideration the rainfall and run off possibilities. Further, the plot where the pond is located should be reasonably large in size so that the harvested water can be gainfully utilized. Interactions with farmers also brought out that during the years of normal/ above normal Rainfall, the benefits from pond seem to be moderated. The farm ponds are also found to impact ground water recharge and access to irrigation. Though there is clear evidence of benefits from ponds still its adoption is less than what is possible. Unawareness and small farm size were major reasons for non-adoption. Therefore, the policy focus must be for the construction of water harvesting structures particularly farm ponds wherever feasible and public and private investment may be focused to expand its adoption especially in rainfed regions of our country. Designing and making available low cost and more efficient pumping devices suitable to lift water from shallow depth may also help popularize farm ponds.
International Practices followed for Efficient Natural Resource Management for Sustainable Livelihood of Farmers- **Ms. Jagriti Rohit & Ms. C.N. Anshida Beevi,**	In rainfed areas, technology transfer should not only be input based but also cover soil testing contingency cropping, water conservation and livestock production. Since agriculture is becoming more knowledge-intensive, technology led, market oriented and more demand driven extension is required in a systems' perspective from production to consumption in a value chain mode. Participatory approaches in a collaborative and consortia approach in dryland alone can

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(Classroom lecture and discussion)</td>
<td>realize the goals towards achieving market led extension in the future. Knowledge transformation alone can bring about changes in the extension strategies in the future with application of information and communication technologies. Multi-stake holder participation through coordination and resource sharing can only shift farming into business and farmers into entrepreneurs

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<td>Pulses for Nutritional Security: Constraints and Opportunities-
Dr. Basudeb Sarkar,

(Classroom lecture and discussion)</td>
<td>Pulses are important natural foods for meeting the daily requirements of proteins. Presently about 25 million hectares of land is under pulses cultivation in India producing about 16.5 million tones of pulses. It is a challenge to ensure supply of sufficient quantity of pulses in the era of climate change where pulses are subject to various biotic and biotic stresses. Intensive effort is needed to breed for new improved varieties those fits well into different cropping systems. Besides varietal improvement, emphasis is needed for development appropriate crop production and protection technologies to make it profitable for farmers to cultivate pulses. Use of drip irrigation in case of pigeon pea and</td>
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	agronomic practices like transplantation and nipping of branches are showing encouraging results. With better yields, development of pest resistant varieties and increased MSP support, farmer will adopt pulse based cropping systems to produce more pulses with increased acreages. Given the important role that pulses play in the human diet, there is also a possibility of increasing production and productivity using available varieties through adoption of appropriate package of practices. The intervention of different stake holders and supply of inputs at proper time along with policy support will help in breaking yield gaps and increasing national production of pulses to ensure nutritional security for the country
Cost cutting techniques for insect pest management- Dr. **M. Srinivasa Rao** 	The challenge in natural crop protection is to have simple and low-cost technologies that are able to regulate pests and diseases and to reduce or completely avoid the problem of contamination by agrochemicals. One such natural crop protection approach is based on the use of plants with biological control properties. These options were found to be cost effective. The efficacy of individual components was well known and documented by several authors. Intercropping offers farmers the opportunity to engage nature's principle of diversity on their farms. Spatial arrangements of plants, planting rates, and maturity dates are to be considered when planning intercrops. Intercrops can be more

 (Classroom lecture and discussion)	productive than growing pure stands. Many different intercrop systems are known and including mixed intercropping, strip cropping, and traditional intercropping arrangements. Pest management benefits can also be realized from intercropping due to increased diversity. The efficacy of these botanical extracts in a combination of bird perches and mechanical collection of larvae on a diversified cropping system in an integrated manner with a specified sequential way in the form of Low external input IPM was not available. These modules also facilitated the multiplication of predators also as *in situ* culturing of natural enemies is possible in case of diver's field crops and the other adopted pest control options are eco friendly in nature.
Conservation Agriculture in Rainfed Systems **Dr. G. Prathiba**  (Classroom lecture and discussion)	The yield in zero tillage was lower in rainfed conditions mainly due to lack of residues and poor soil moisture content. Hence under rainfed regions the yield under CA can be improved with integration of in situ soil moisture as fourth principle. Incentives for abandoning the plough still exist through savings in fuel, labour, and wear and tear of farm implements; low energy input and carbon foot print. In spite of positive socio-economic and environmental impacts of conservation tillage, adoption of conservation tillage is still limited. The main reason for this low adoption is initial higher investment in new machinery and lack of knowledge about crop rotation. Interactions between the components of

	conservation agriculture and their effects on crop yields are complex and often site-specific and long-term experiments are necessary to provide a better understanding.

Date 30.01.18

Topic and resource person	Brief description
Gender Mainstreaming in Natural Resources Management- Dr. **G. Nirmala**  (Classroom lecture and discussion)	Incorporating gender concerns into agriculture through mechanization can reduce drudgery and increases efficiency of work. This will affect the productivity of crop and overall performance and agricultural growth. Women role in agriculture need to be made more visible as 60 -70 % contribution in terms labor is from women work force. Reducing drudgery and saving of time has to be utmost concern of any agricultural project involving women. Empowerment by participation in decision- making from evidence so far suggests that a mixed- gender or joint decision making leads to better outcomes for environmental sustainability and food security, managing the multiple tradeoffs in landscape multi functionality

Watershed Modeling and Management in Sustainable Dryland Farming – Indian Outlook- Dr. **Manoranjan Kumar**  (Classroom lecture and discussion)	Earlier studies showed that unsustainable watershed planning and management can result in environmental disasters as well as socioeconomic problems. Watershed modeling has become a reliable tool for water resources system design, planning, and management at an affordable cost within a reasonable time. The continuous growth in computational capacities, along with other advances in data collection and management, has allowed watershed models to evolve from lumped mode models to physical process models and ultimately to integrated models comprising of hydrological, social, economic, cultural and environmental models with the objective of giving support for decision making. The improvement of the simulation models into integrated models have made promising changes in the watershed modeling
Formulation of Back to work Plan Dr. K Nagasri  (Group discussion)	The group discussion was held to finalize back to work plan in respect of all trainees. Dr. K Nagasri facilitated the proceedings. The various of back to work program are briefly presented in Annexure. 

FIELD VISITS

2.4 Field visits

The executives were exposed to various field visits i.e IIRR (Indian Institute of Rice Research), IIMR (Indian Institute of Millets Research),Water and Land Management Training and Research Institute (WALAMTARI), CRIDA (Farm Machinery Workshop), CRIDA **(**Gunegal Research Farm and Watershed), National Institute of Agricultural Extension Management **(**MANAGE**)**, India Meteorological Institute (IMD).

Indian Institute of Rice Research:

All the participants under leadership of Dr. O. P. Sharma, Course Coordinator have visited Indian Institute of Rice Research (IIRR) Rajendranagar, Hyderabad. During the visit participants were received by Dr. Seikh Meera, Sr Scientist and taken to Rice Museum. Participants were exposed to various research achievement of the institute by displaying pictorial charts and models Dr. Anand Kumar, Director, IIRR also interacted with participants and replied the queries. Dr. Brajendra, Soil Scientist, displayed a low cost soil testing kit developed by IIRR. Participants have liked the kit and desired to use such kit in their country. Later, participants have also visited entomology glass house, pathology lab, etc. facilities at IIRR. Many of the participants have desired to take up the technologies developed by IIRR to their country through MoUs at high level.

Indian Institute of Millets Research:

Participants were visited Indian Institute of Millets Research, Rajendrangar, Hyderabad wherein they were exposed to different millets grown in India.

Dr. Rajendra R Chapke, Principal Scientist, Agricultural Extension gave a brief introduction of millets, their ecological conditions, edaphic factors, climatic conditions suitable for millets, nutritional content, varieties, different food products etc.

Dr. Venkatesh Bhat Principal Scientist, Breeding highlighted the importance of different millets grown in India *viz.*, sorghum, pearl millet, fox tail millet, finger millet, kodo millet, small millet, proso millet, tef and fonia. Under low rain fall conditions, high temperature conditions and erratic climatic conditions millets can be grown judiciously. He gave information about production and productivity of these millets, nutritional content especially the dietary fiber, protein contents and their role in diabetic patients. He described the methodology of testing of varieties and hybrids of millets through All India Coordinated Millet Improvement Programmes of the Country involving different State Agricultural Universities. He also stressed the importance of health benefit and called them as nutraceutical millets. He highlighted the bio fortification of Iron and zinc to ameliorate the malnutrition in the world, he also stressed on fortified food products, ready to eat and ready to cook products from sorghum and other millets, farm mechanization, breeding strategies including apomixes and mutagenic techniques to improve yield and resistance to herbicides. He dealt with biotic and abiotic stress management in millets, Agribusiness incubation. He highlighted the important research activities of the Centre including germplasm conservation, utilization, crop improvement programmes including development of hybrids, and varieties in millets, crop production technologies, management of various biotic stresses including pests and diseases of millets, various abiotic stresses like salinity, drought etc.

Discussions:

How to increase amount of biomass in dual purpose sorghums, finger millet and small millets?

VB: A separate program is there for high biomass increase in the case of sorghum, but in other millets this program is not there as it is not a major problem.

How to reduce aflatoxin problems in finger millet sprouts?

VB: It is very difficult as many fungi are associated with grains of finger millet, kodo millet and sorghum grains which produce aflatoxins. Removal of these aflatoxins is very difficult.

In Africa millets are grown in small areas, can the small cottage industry be developed with women who look after crop?

VB: Yes it can be done as it is grown in smaller areas in Africa, women entrepreneurs can be developed.

Dr. T. G. Nageshwar Rao proposed vote of thanks to the speakers for their excellent presentation.

National Institute of Agricultural Extension Management:

The executives have visited the National Institute of Agricultural Extension Management (MANAGE) campus on 25.01.2018 and interacted with Smt. V. Usha Rani, Director General and Dr. P. Chandrashekara, Director (Agri. Extn.) MANAGE.

Water and Land Management Training and Research Institute

The executives visited Indian Institute of Oilseed Research (IIOR), Hyderabad on 18th September, 2017 and interacted with scientists of institute to know about the oil seed crops. The executives visited the Oil seed crop museum and also fields of groundnut, sunflower, castor and safflower. Dr. S.N. Sudhakara Babu, Principal Scientist, Agronomy explained about oil seed crops related to cultivation of different varieties and crop protection measures. Dr. A. Vishnuvardhan Reddy, Director of IIOR interacted with executives and asked about oil seed crops growing in their countries and also encouraged the executives to promote these technologies in their countries

India Meteorological Department

CRIDA Farm Machinery Workshop:

Farm Machinery Workshop:

The executives visited farm machinery workshop located at, Hayathnagar Research Farm (CRIDA) on 23th January 2018 and interacted with. Dr. B. Sanjeeva Reddy research facilities by K. Srinivas**,** OIC (FARM), Dr. **B**. Krishna Rao and Pushpanjali). He explained about various farm machineries and their working principle.

Field visit to Gunegal Research Farm and Watershed- S.S. Balloli, M.A. Sarath Chandran and Dr. Manoranjan Kumar, Er. B. Srinivas

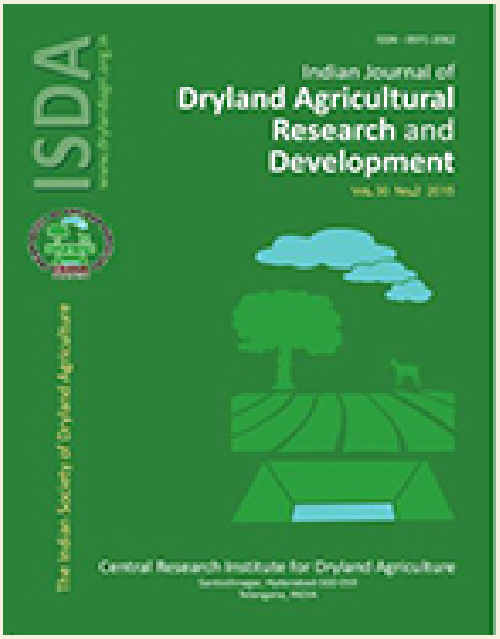



2.5 Collective action and participatory learning

All the executives were divided in to groups to enhance learning in small groups throughout the training program including field/ Institutional visits and prepare for cultural programme. The groups were given responsibility for learning from interactions, collection of literature, photographs, contact details, use of library and identify useful technology to their respective countries. The group also participated and managed cultural programme successfully.

2.6 Life Membership to professional bodies and journals

All the executives were made life members of Indian Society of Dryland Agriculture (ISDA) based at CRIDA, Hyderabad which publish the bi-annual Journal "Indian Journal of Dryland Agricultural Research and Development", a repository of information on latest advances on research and development of dryland agriculture. As a life member to ISDA,the journal is automatically subscribed to the executives and they will receive the journal in PDF form from next publication issue. The executive not only can receive the journal but also can submit their future work for publication in this journal. The executive can access the archive of the journal by visiting http://www.drylandagri.org.in/ .



2.7 **Back-at-work-plans**

The present program aimed at strategies for income enhancement. Hence, the expected outcome would be a professional commitment by each executive to try new initiatives learnt during the training programs at their work place after the training program. In the backdrop of orientation, inputs, interactions, study material and experiences received during the program, the executives prepared and presented individual "Back-at-work-plans" which would help operationalize the relevant concepts learned during the program in their respective countries. Back at work -plan also trace the connectivity between Indian experience and back home extension issues. Details of individual Back-at-work-plans are given at Annexure-IV

3. TRAINING EVALUATION

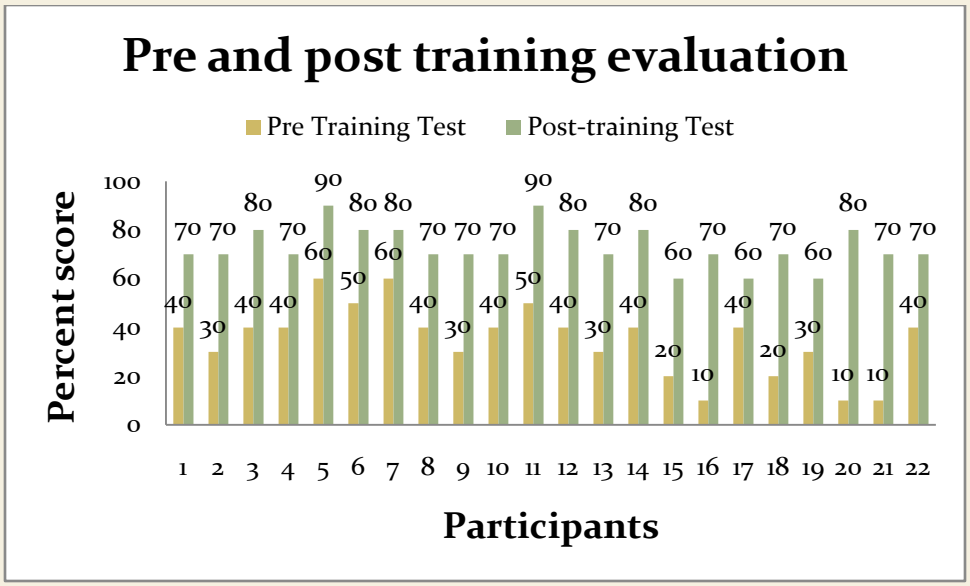
3.1 Evaluation of Technical sessions

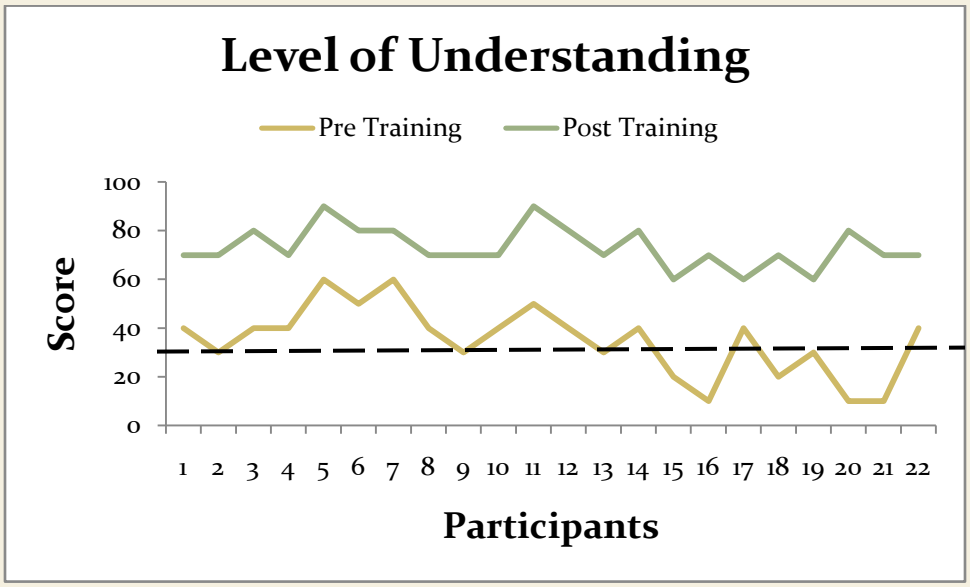
Feedback of Executives was collected on all technical sessions taken by resources persons, and field visits on a scale of 0 to10 *i.e.* '1 being the least and 10 being highest. In addition, their suggestions on other areas such as boarding and lodging were obtained in order to bring necessary changes. The executives expressed their satisfaction level by rating the program on an average score of 8.22 on a 10 point. The executives rated lowest to the visit of Hyderabad culture and heritage site including Ramoji film city (RFC). The feedbacks received from executives are tabulated and presented in annexure V

Executives were asked to rate the lodging, boarding and transport facility on head of fully satisfied, satisfied to a limited extend and not at all satisfied. The score of 10, 5 and 0 were assigned accordingly and thus overall score was 8.86, 9.32 and 9.32 respectively for food, accommodation and transport facility. The final outcome including all aspects was **8.30**. The overall grading from individual executive is presented in annexure VI

3.2 Pre and post-training test

Pre and Post Training test were conducted for the executives at the beginning and at the end of the training respectively. Ten thematic questions on different aspects of dryland agriculture were asked for pre and post-training test and obtained answers of the executives to assess their change of knowledge levels and effectiveness of the training programme. The average score of executives in the pre-training test was 35%, whereas the average score of post-training was 73%. Thus, it was found that the level of knowledge of executives was increased by 38 percent after the training programme. Details of pre and post-training test are given at Annexure-VII.





4. VALEDICTORY

Valedictory session was conducted on 30th January, 2018. Dr S Bhaskar, Assisstant Director General (Agroforestry and climate change) had graced the occasion of valedictory session as chief guest in the presence of Dr. K Sammi Reddy, Director, CRIDA. Dr. Manoranjan Kumar, course director briefed about the training program outcomes. The chief guest , in his address to the executives suggested to replicate the knowhow learned during the training at their respective place of work. The executives were presented with the course certificate, memeto and souvenir.

The executive were also awarded for various activities. A compendium of lecture notes was released by the chief guest and the same was distributed to the executives. The executives were asked to give their valuable feedback on the training program. The valedictory dinner for informal coordination among scientist of CRIDA and executives was hosted after the program.

5 Cultural Evening (16th January 2018)

The evening was made more colorful at CRIDA. The main objective was to expose Indian culture to partner countries, at the same time each country executives were encouraged to present their cultural heritage to other partner countries including India. Organizing committee of CRIDA informed all executives well in advance about cultural evening and facilitated them with required items and preparation. Official Dinner was hosted by Director, CRIDA. The cultural evening was followed by inaugural dinner among executives and CRIDA staff.


FEED THE FUTURE
USAID
Feed The Future - India Triangular Training (FTF-ITT)


FEED THE FUTURE
USAID
Feed The Future - India Triangular Training (FTF-ITT)
International Training Programme
"Strategies for Enhancement of Farmers Income in Dryland Agriculture"

Annexure - I

Feed The Future India Triangular Training (FTF-ITT) International Training Program on "Strategies for Enhancement of Farmers Income in Dryland Agriculture" for Extension Practitioners of Asian and African Countries
16-30th January, 2018 at ICAR-Central Research Institute for Dryland Agriculture, Santoshnagar, Hyderabad, India

Training Schedule (16th January 2018 to 30th January 2018)

16/01/2018 (Tuesday) Venue: Conference Hall-II	
09:30 Hr – 11:30 Hr	Registration and Inaugural Session
11:30 Hr– 11:45 Hr	High Tea
11:45 Hr – 12:45 Hr	Ice-breaking session **(All Coordinators)**
12:45 Hr – 13:30 Hr	Lunch
13:30 Hr – 15:30 Hr	Interaction with Institute scientists and visit to laboratories
15:30 Hr – 15:45Hr	Tea break/Interaction with resource person
15:45 Hr – 16:45 Hr	Pre-Training Evaluation **(K. Nagasree and R. Rejani)**
18:00 Hr – 21:00 Hr	Cultural Night followed by Dinner (Trainees and CRIDA Scientists and Senior officers)
17/01/2018 (Wednesday) Venue: Conference Hall-I	
09:30 Hr – 10:30 Hr	Rehabilitation of Tanks and Field Soils through Desilting and Recycling of Silt for Drought Proofing- **Mohammed Osman, Head (PME Cell) & Principal Scientist, ICAR-CRIDA, Hyderabad**
10:30 Hr – 11:30 Hr	Horticulture based farming strategies for augmenting incomes of vulnerable Afro- Asian Dryland communities- N.N. Reddy, **Principal Scientist, ICAR-CRIDA, Hyderabad**
11:30 Hr – 11:45 Hr	Tea break/Interaction with resource person
11:45 Hr – 12:45 Hr	Role of Conservation Agriculture in Improving Soil Health and Mitigating Climate Change- **K.L. Sharma, Principal Scientist & Former National Fellow, ICAR-CRIDA, Hyderabad**

12:45 Hr – 13:30 Hr	Lunch
13:30 Hr – 14:30 Hr	Planning, Design and Execution of Check dams for Water Harvesting in Rainfed Regions- **B. Krishna Rao, Principal Scientist, ICAR-CRIDA, Hyderabad**
14:30 Hr – 15:30 Hr	Climate Change and Water Management Strategies in Rainfed Agriculture- **P.K. Mishra, Director, IISWC, Dehradun**
15:30 Hr – 15:45 Hr	Tea break/Interaction with resource person
15:45 Hr – 16:45 Hr	Issues and Strategies for Enhancing Agricultural Productivity in Coastal Lowlands- **S.K. Ambast, Director, IIWM, Bhubaneswar**
18/01/2018 (Thursday) Venue: Conference Hall-I	
09:30 Hr – 10:30 Hr	Increasing Atomospheric CO2 Concentration and Temperature – Impact on Rainfed Crops Productivity **– M Vanaja, Principal Scientist, ICAR-CRIDA, Hyderabad**
10:30 Hr – 11:30 Hr	Farming Systems Approach in Rainfed Agriculture-Prospects and Limitations- **K.A. Gopinath, Principal Scientist, ICAR-CRIDA, Hyderabad**
11:30 Hr – 11:45 Hr	Tea break/Interaction with resource person
11:45 Hr – 12:45 Hr	Agroforestry in Dryland Areas for Boosting Farmers Income and Environment Amelioration- **G. Rajeshwar Rao, Principal Scientist, ICAR-CRIDA, Hyderabad**
12:45 Hr – 13:30 Hr	Lunch
13:30 Hr – 14:30 Hr	Microbial Products as Farm Inputs for Enhanced Farm-Productivity and Profitability- **Suseelendra Desai, Principal Scientist, ICAR-CRIDA, Hyderabad**
14:30 Hr – 15:30 Hr	Agriculture Contingency Plans towards Adaptation of Indian Agriculture – K. **V. Rao, Principal Scientist, ICAR-CRIDA, Hyderabad**

15:30 Hr – 15:45 Hr	Tea break/Interaction with resource person
15:45 Hr – 16:45 Hr	How ICT Enhance Farmer's Income in Dryland Agriculture- **N. Ravi Kumar, Principal Scientist, ICAR-CRIDA, Hyderabad**
19/01/2018 (Friday)	
08:00 Hr – 16:45 Hr	Field visit to Gunegal Research Farm and Watershed- **S.S. Balloli, M.A. Sarath Chandran and Manoranjan Kumar**
20/01/2018 (Saturday) Venue: Conference Hall-I	
09:30 Hr – 10:30 Hr	National Innovations in Climate Resilient Agriculture: A Multi Sectorial Approach to Enhance Farm Income Under Changing Climate in India- **M. Prabhakar, PI-NICRA, ICAR-CRIDA, Hyderabad**
10:30 Hr – 11:30 Hr	Farm Ponds for Providing Life Saving Irrigations for enhancing Production and Profitability in Drylands- **K. Srinivasa Reddy, Principal Scientist, ICAR-CRIDA, Hyderabad**
11:30 Hr – 11:45 Hr	Tea break/Interaction with resource person
11:45 Hr – 12:45 Hr	Climate Resilient Agriculture for Sustainable Crop Production- **K. Sammi Reddy, Acting-Director, ICAR-CRIDA, Hyderabad**
12:45 Hr – 13:30 Hr	Lunch
13:30 Hr – 14:30 Hr	Water Use Efficiency in Livestock Production Management: A Key Area for Improving Farmers' Income in Drylands- **Prabhat Kumar Pankaj, Senior Scientist, ICAR-CRIDA, Hyderabad**
14:30 Hr – 15:30 Hr	Crops and Cropping Systems for Soil and Water Management- **V. Maruthi, Head (KVK) & Principal Scientist, ICAR-CRIDA, Hyderabad**
15:30 Hr – 15:45 Hr	Tea break/Interaction with resource person
15:45 Hr – 16:45 Hr	Agriculture Insurance as a Risk Management Strategy- **P. Vijaya Kumar, Project Coordinator AICRPAM, ICAR-**

	CRIDA, Hyderabad
21/01/2018 (Sunday)	**Weekend off**
22/01/2018 (Monday) Venue: Conference Hall-I	
09:30 Hr – 10:30 Hr	Crop Interventions for Climate Resilient Agriculture- **J.V.N.S Prasad, Principal Scientist, ICAR-CRIDA, Hyderabad**
10:30 Hr – 11:30 Hr	Use of Geomatic Tools for Monitoring & Evaluation of Watershed Projects to Increase Farmers' Income- **Kaushalya Ramachandran, Principal Scientist & National Fellow, ICAR-CRIDA, Hyderabad**
11:30 Hr – 11:45 Hr	Tea break/Interaction with resource person
11:45 Hr – 12:45 Hr	Livestock Integrated Farming Systems: A Boon to Dryland Farmers- **D.B.V. Ramana, Principal Scientist, ICAR-CRIDA, Hyderabad**
12:45 Hr – 13:30 Hr	Lunch
13:30 Hr – 14:30 Hr	Agromet Advisories and their Role in the Risk Management- **A.V.M. Subba Rao, Senior Scientist, ICAR-CRIDA, Hyderabad**
14:30 Hr – 15:30 Hr	Recent Trends in Agricultural Water Management- **T.B.S. Rajput, Emeritus Scientist, WTC, New Delhi**
15:30 Hr – 15:45 Hr	Tea break/Interaction with resource person
15:45 Hr – 16:45 Hr	Soil and Nutrient Management Innovations for Enhancing Soil Health and Farmers Income- **A.K. Patra, Director, IISS, Bhopal**
23/01/2018 (Tuesday)	
08:00 Hrs – 16:45 Hrs	Visit to other **ICAR institutes (IIRR, IIMR and IIOR), Water technology centre, PJTSAU, Hyderabad** and **WALAMTARI, Hyderabad**
24/01/2018 (Wednesday)	

09:30 Hrs – 16:45 Hrs	Visit to Hayathnagar Research Farm (Farm Implements and Machinery by **B. Sanjeeva Reddy,** research facilities by **K. Srinivas,** OIC (FARM), **B. Krishna Rao and Pushpanjali)**
25/01/2018 (Thursday)	
09:30 Hrs – 16:45 Hrs	Visit to **MANAGE (Manoranjan Kumar)** Water Management is Key for Sustainable Development- **K. Yella Reddy, Director, WALAMTARI, Hyderabad**
26/01/2018 (Friday)	
09:30 Hrs – 16:45 Hrs	Exposure to **Hyderabad Culture** and **Heritage**
27/01/2018 (Saturday) Venue: Conference Hall-I	
09:30 Hr – 10:30 Hr	Agro-Ecology Specific Rainwater Management Interventions for Higher Productivity and Income in Rainfed Areas- **G. Ravindra Chary, Project Coordinator AICRPDA, Hyderabad**
10:30 Hr – 11:30 Hr	Addressing Malnutrition with Biofortified Crops- **Sushil Kumar Yadav, Principal Scientist, ICAR-CRIDA, Hyderabad**
11:30 Hr – 11:45 Hr	Tea break/Interaction with resource person
11:45 Hr – 12:45 Hr	GIS for water harvesting structures planning and management- **R. Rejani, Senior Scientist, ICAR-CRIDA, Hyderabad**
12:45 Hr – 13:30 Hr	Lunch
13:30 Hr – 14:30 Hr	Establishment of Farm Machinery Custom Hiring Centres - **I. Srinivas, Principal Scientist, ICAR-CRIDA, Hyderabad**
14:30 Hr – 15:30 Hr	Extension Tools and Techniques for Technology Dissemination in Dryland Agriculture- **K. Nagasree, Principal Scientist, ICAR-CRIDA, Hyderabad**
15:30 Hr – 15:45 Hr	Tea break/Interaction with resource person

15:45 Hr – 16:45 Hr	Design Options of Portable Pumpset for Effective Utilization of Harvested Water From Farm Pond - **Ravikant V. Adake, Principal Scientist, ICAR-CRIDA, Hyderabad**
28/01/2018 (Sunday)	**Weekend off**
29/01/2018 (Monday)	
09:30 Hr – 10:30 Hr	Potential of Rain Water Harvesting Farm Ponds for Raising Farm Incomes in Rainfed Regions of Andhra Pradesh and Telangana- **C.A. Rama Rao, Head (SDA) ICAR-CRIDA, Hyderabad**
10:30 Hr – 11:30 Hr	International Practices followed for Efficient Natural Resource Management for Sustainable Livelihood of Farmers- **Jagriti Rohit & C.N. Anshida Beevi, Scientist, ICAR-CRIDA, Hyderabad**
11:30 Hr – 11:45 Hr	Tea break/Interaction with resource person
11:45 Hr – 12:45 Hr	Enhancing tolerance to climate stresses in rainfed crops: The road ahead- **M. Maheswari, Head (DCS), ICAR-CRIDA, Hyderabad**
12:45 Hr – 13:30 Hr	Lunch
13:30 Hr – 14:30 Hr	Pulses for Nutritional Security: Constraints and Opportunities- **Basudeb Sarkar, Principal Scientist, ICAR-CRIDA, Hyderabad**
14:30 Hr – 15:30 Hr	Cost cutting techniques for insect pest management- **M. Srinivasa Rao, Principal Scientist, ICAR-CRIDA, Hyderabad**
15:30 Hr – 15:45 Hr	Tea break/Interaction with resource person
15:45 Hr – 16:45 Hr	Conservation Agriculture in Rainfed Systems **G. Prathiba, Principal Scientist, ICAR-CRIDA, Hyderabad**

30/01/2018 (Tuesday) Venue: Conference Hall-I	
09:30 Hr – 10:30 Hr	Gender Mainstreaming in Natural Resources Management- **G. Nirmala, Head (TOT), ICAR-CRIDA, Hyderabad**
10:30 Hr – 11:30 Hr	Watershed Modeling and Management in Sustainable Dryland Farming – Indian Outlook- **Manoranjan Kumar, Principal Scientist, ICAR-CRIDA, Hyderabad**
11:30 Hr – 11:45 Hr	Tea break/Interaction with resource person
11:45 Hr – 12:45 Hr	**Interaction with resource persons and Coordinators**
12:45 Hr – 13:45 Hr	Lunch
Venue: Conference Hall-II	
13:45 Hr – 14:45 Hr	**Panel discussion, Feedback and evaluation**
14:45 Hr – 16:00 Hr	**Valediction and certificate distribution**
16:00 Hr – 16:15 Hr	Tea break/Interaction with resource person
16:15 Hr – 16:45 Hr	Post-Training Evaluation **(All Coordinators)**
16:45 Hr – 21:00 Hr	**Cultural program presented by trainees** showcasing cultural heritage and tradition of respective country followed by dinner (Trainees and CRIDA Scientist and Senior officers).
31/01/2018 (Wednesday)	Departure

Annexure - II

Feed The Future India Triangular Training (FTF-ITT) International Training Program on "Strategies for Enhancement of Farmers Income in Dryland Agriculture" for Extension Practitioners of Asian and African Countries
16-30th January, 2018 at ICAR-Central Research Institute for Dryland Agriculture, Santoshnagar, Hyderabad, India

ORGANIZING COMMITTEE

Overall Training program Dr. Manoranjan Kumar, Course director Dr. B K Rao, Course coordinator Dr. K Nagasri, Course coordinator Dr. R Rejani, Course coordinator	**Classroom coordination** 1. Dr. R Rejani 2. Mr Sattiah 3. Mr Yadagiri 4. Mr. D. Kalyana Srinivas 5. Mr B Srinivas 6. Ms Deepika
Registration 1. Dr K Nagasri 2. Mr Ashish Dhimate 3. Mr B Srinivas 4. Mr. D. Kalyana Srinivas	**Procurement** 1. Dr G Pratibha 2. Dr R V Adake 3 Mr C V K N Rao 4. Mr D. Kalyana Srinivas
Inaugural and valediction Dr. Manoranjan Kumar Dr. K Nagasri Ms Savitri 3. Ms Geetika Chaitanya 4. Ms M Divya Mr Khaled	**Lodging and boarding** Dr Manoranjan Kumar Dr K Nagasri Dr B Krishna Rao Mr CVKN Rao
Transport Dr R V Adake Mr Ganesh	**Publication** Dr Manoranjan Kumar Dr R Rejani Dr K Nagasri Dr.B.Krishna Rao Mr. D. Kalyana Srinivas

Annexure - III

Feed The Future India Triangular Training (FTF-ITT) International Training Program on "Strategies for Enhancement of Farmers Income in Dryland Agriculture" for Extension Practitioners of Asian and African Countries

16-30th January, 2018 at ICAR-Central Research Institute for Dryland Agriculture, Santoshnagar, Hyderabad, India

LIST OF EXECUTIVES

	**Ms. Eliza Chinula** Agriculture Extension Development Officer Ministry of Agriculture and Food safety, Malawi Tel: +265996033375 Email: chinulaelie@gmail.com
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	**Mr. Emmanuel Ogwal** Agricultural Officer Otuke District Local Government/ Production P.O.Box 617, Lira District, Uganda Tel: +256 772871650 Email: ogwalemmanuel22000@gmail.com
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	**Ms. Rwan Mohamed Elhassan Osman** Ministry of Agriculture and Forestry General Administration of Planning & Agriculture Economies Khartoum, Sudan Tel: +249123334261, +249918073153, +249114413284 Email: moafuso@yahoo.com, rawan.m.hassan22@gmail.com
	**Mr. Augustine Binda Flomo** **Extension Technician, Ministry of Agriculture** **P.O. Box 10-9010 1000 Monrovia 10. Liberia** **Tel: 0886-485-992/0775-519-941** **Email: flomoaugustine@yahoo.com**
	**Mr. Romeo Belley Kaioh** **Assistant Administrator, Ministry of Agriculture** **P.O. Box - 10-9010 1000 Monrovia 10. Liberia** **Tel – 8867638082/31777008770**

Annexure - IV

Feed The Future India Triangular Training (FTF-ITT) International Training Program on

"Strategies for Enhancement of Farmers Income in Dryland Agriculture" for Extension Practitioners of Asian and African Countries

16-30th January, 2018 at ICAR-Central Research Institute for Dryland Agriculture, Santoshnagar, Hyderabad, India

BACK TO WORK PLAN

S No	Name of executive	Proposed Activity	Proposed Place of activity	Duration	Expected Outcome
1	**Mr. Romeo Owusu Kankam**	Integrated farming system for maize and poultry production	Dwease operational area, Ghana	8 months	Increase in farmers production and double their income and welfare
2	**Mr. Emmanuel Ayimbire Anaba**	In-situ moisture conservation using bund and furrow	West Mamprusi district, Ghana	6 months	Increase in crop yield using improved soil moisture retention
3	**Mr. Stanley NGOJU Humaiya**	Fodder production	Machekos county, Kenya	6 months	Increase in milk production by improved quality of livestock food
4	**Mr. Dishon Mwawasi Mkaya**	Farm pond and greenhouse technology	Counties, Kenya	6 months	Increase in yield and income of farmers
5	**Ms. Grace Wanjiru Njagi**	Dissemination of technology on Rainwater	Linnyaga county, Kenya	6 months	Increased area under fish farming

		harvesting in Farm pond for fish farming			
6	**Mr. Kyi Myint**	Composting	Netmauk township, Magwe region, Myanmar	3 months	15000 tons of compost
7	**Mr. Thant Sin Kyaw**	Water management using mulching	Loikaw township, Kayah state, Myanmar	3 months	Mulching in 1000 acres for growing garlic and onions
8	**Mr. Edward Daniel Mjojo**	Bango soil and water conservation	Mphangula section, Malawi	6 months	Implementation of various soil and water conservation techniques
9	**Ms. Yatipa Nangoma**	Conservation agriculture	Nkhstakota, Linga LPA, Malawi	6 months	Enhancing household income by increasing yield
10	**Ms. Eliza Chinula**	Manure making, mulching and introduction of early maturity varieties	Malawi	4 months	High yield and water productivity
11	**Mr. Emuron Joseph**	Fodder development for livestock production	Katalawi district, Uganda	6 months	Enhancement in farmers income through increase in livestock and dairy production
12	**Mr. Emmanuel Ogwal**	Production of cactus fodder for livestock feedings	Otuece district and lira district, Uganda	6 months	Demo plot establishment and adoption by the farmers
13	**Mr.Sokhet OUK**	Training on integrated farming management	Prey vang and Kandal province	6 months	Enhancement in knowledge level among the agricultural and cooperative members
14	**Mr.Vanthy Vong**	Training on integrated farming management	Prey vang and Kandal province	6 months	Enhancement in knowledge level among the agricultural and cooperative members
15	**Miss. Ifua Basele**				

	Celestine Marie-Robert				
16	**Ms. Fatima Jumaa Tawor Halowf**	Awareness on climate change impact on farmers income	Red Sea state	6 months	Enhancing knowledge on impact of climate change on farmers income in red sea state
17	**Ms. Rwan Mohamed Elhassan Osman**	Awareness on rainwater management	Khartoum state, Sudan	6 months	Enhancement in farmers income through yield and productivity enhancement
18	**Mr. Romeo Belley Kaioh**	Cassava production in farm	Juarzon district, sinoe county, Liberia	One year	More cassava production
19	**Mr. Augustine Binda Flomo**	Maize production	Liberia	One year	Income enhancement through increase in yield
20	**Mr. Rohullah Qayoumi**	Farm pond	Farmers land, Afganistan	6 months	Increasing yield through irrigation using farm pond
21	**Mr. Mohammad Kabir Sharifi**	Mulching in melon crop	Samangan province, Afganistan	6 months	
22	**Mr. Sharifullah Rahimi**	Conservation furrow	Farmers farm, Afganistan	6 months	Enhancement in farmers income

Annexure - V

Feed The Future India Triangular Training (FTF-ITT) International Training Program on "Strategies for Enhancement of Farmers Income in Dryland Agriculture" for Extension Practitioners of Asian and African Countries
16-30th January, 2018 at ICAR-Central Research Institute for Dryland Agriculture, Santoshnagar, Hyderabad, India

Executives overall Feed Back

1	Climate Resilient Agriculture for Sustainable Crop Production **(Dr. K. Sammi Reddy)**	**8.27**
2	Climate Change and Water Management Strategies in Rainfed Agriculture **(Dr. Prasanta Kumar Mishra)**	**8.14**
3	Issues and Strategies for Enhancing Agricultural Productivity in Coastal Lowlands **(Dr. S. K. Ambast)**	**7.77**
4	Recent Trends in Agricultural Water Management **(Dr. T. B. S. Rajput)**	**8.00**
5	Water Management is Key for Sustainable Development **(Dr. K. Yella Reddy)**	**8.59**
6	Role of Conservation Agriculture in Improving Soil Health and Mitigating Climate Change **(Dr. K. L. Sharma)**	**8.09**
7	National Innovations in Climate Resilient Agriculture: A Multi Sectorial Approach to Enhance Farm Income Under Changing Climate in India **(Dr. M. Prabhakar)**	**8.18**
8	Use of Geomatic Tools for Monitoring & Evaluation of Watershed Projects to Increase Farmers' Income **(Dr. Kaushalya Ramachandran)**	**8.00**
9	Agriculture Insurance as a Risk Management Strategy **(Dr. P. Vijaya Kumar)**	**7.64**
10	Agroforestry in Dryland Areas for Boosting Farmers Income and Environment Amelioration **(Dr. G. Rajeshwar Rao)**	**8.05**
11	Microbial Products as Farm Inputs for Enhanced Farm-Productivity and Profitability **(Dr. Suseelendra Desai)**	**8.09**
12	Mechanization of Dryland Agriculture **(Dr. B. Sanjeeva Reddy)**	**8.00**

13	Rehabilitation of Tanks and Field Soils through Desilting and Recycling of Silt for Drought Proofing **(Dr. Mohammed Osman)**	**8.00**
14	Farming Systems Approach in Rainfed Agriculture - Prospects and Limitations **(Dr. K. A. Gopinath)**	**8.18**
15	International Practices followed for Efficient Natural Resource Management for Sustainable Livelihood of Farmers **(Dr. Jagriti Rohit)**	**8.14**
16	Crop Interventions for Climate Resilient Agriculture **(Dr. J.V.N.S Prasad)**	**8.32**
17	Agriculture Contingency Plans towards Adaptation of Indian Agriculture **(Dr. K. V. Rao)**	**7.68**
18	Cost cutting techniques for insect pest management **(Dr. M. Srinivasa Rao)**	**8.18**
19	GIS for water harvesting structures planning and management **(Dr. R. Rejani)**	**8.14**
20	Watershed Modeling and Management in Sustainable Dryland Farming – Indian Outlook **(Dr. Manoranjan Kumar)**	**8.82**
21	Gender Mainstreaming in Natural Resources Management **(Dr. G. Nirmala)**	**8.59**
22	Agro-Ecology Specific Rainwater Management Interventions for Higher Productivity and Income in Rainfed Area **(Dr. G. Ravindra Chary)**	**7.91**
23	Water Use Efficiency in Livestock Production Management: A Key Area for Improving Farmers' Income in Drylands **(Dr. Prabhat Kumar Pankaj)**	**8.27**
24	Livestock Integrated Farming Systems: A Boon to Dryland Farmers **(Dr. D. B. V. Ramana)**	**8.50**
25	Potential of Rain Water Harvesting Farm Ponds for Raising Farm Incomes in Rainfed Regions of Andhra Pradesh and Telangana **(Dr. C. A. Rama Rao)**	**8.59**
26	Agromet Advisories and their Role in the Risk Management **(Dr. A. V. M Subba Rao)**	**8.45**
27	Increasing Atmospheric CO2 Concentration and Temperature - Impact on Rainfed Crops Productivity **(Dr. M. Vanaja)**	**8.00**
28	Extension Tools and Techniques for Technology Dissemination in Dryland Agriculture **(Dr. K. Nagasree)**	**8.68**
29	Design Options of Portable Pumpset for Effective Utilization of Harvested Water From Farm Pond **(Dr. Ravikant V. Adake)**	**7.86**
30	Conservation Agriculture in Rainfed Systems **(Dr. G. Pratibha)**	**8.18**
31	How ICT Enhance Farmer's Income in Dryland Agriculture **(Dr. N. Ravi Kumar)**	**8.36**

32	Pulses for Nutritional Security: Constraints and Opportunities **(Dr. Basudeb Sarkar)**	**8.32**
33	Establishment of Farm Machinery Custom Hiring Centers **(Dr. I. Srinivas)**	**7.55**
34	Crops and Cropping Systems for Soil and Water Management **(Dr. V. Maruthi)**	**8.50**
35	Horticulture based Farming Strategies for Augmenting Incomes of Vulnerable Afro- Asian Dryland Communities **(Dr. N.N. Reddy)**	**8.27**
36	Water Harvesting Check dams for Climate Resilient Agriculture in Rainfed Regions **(Dr. B. Krishna Rao)**	**8.18**
37	Addressing Malnutrition with Bio-fortified Crops **(Dr. Sushil Kumar Yadav)**	**8.14**
38	**Field visit to Gunegal Research Farm & Watershed**	**8.73**
39	**Field visit to Hayathnagar Research Farm**	**8.59**
40	**Visit to MANAGE, Hyderabad**	**9.05**
41	**Visit to ICAR Institutes, Hyderabad**	**8.77**
42	**Exposure to Hyderabad Culture & Heritage sites (RFC)**	**7.59**
	Average	**8.22**
I	**Food facility**	**8.86**
II	**Accommodation facility**	**9.32**
III	**Transport facility**	**9.32**
IV	**Overall impression about Training Program**	**Excellent**

Annexure - VI

Feed The Future India Triangular Training (FTF-ITT) International Training Program on "Strategies for Enhancement of Farmers Income in Dryland Agriculture" for Extension Practitioners of Asian and African Countries
16-30th January, 2018 at ICAR-Central Research Institute for Dryland Agriculture, Santoshnagar, Hyderabad, India

Executives Feed Back

S. No	Name	Country	Overall grading of the Course
1	Mr. Rohullah Qayoumi	Afghanistan	Excellent
2	Mr. Mohammad Kabir Sharifi	Afghanistan	Excellent
3	Mr. Sharifullah Rahimi	Afghanistan	Excellent
4	Mr. Emmanuel Ayimbire Anaba	Ghana	Excellent
5	Mr. Romeo Owusu Kankam	Ghana	Excellent
6	Mr. Edward Daniel Mjojo	Malawi	Excellent
7	Ms. Eliza Chinula	Malawi	Excellent
8	Mr. Kyi Myint	Myanmar	Excellent
9	Mr. Thant Sin Kyaw	Myanmar	Excellent
10	Ms. Rwan Mohamed Elhassan Osman	Sudan	Excellent
11	Mr. Emuron Joseph	Uganda	Excellent
12	Miss. Ifua Basele Celestine Marie-Robert	Congo	Good
13	Ms. Yatipa Nangoma	Malawi	Good
14	Mr. Ouk Sokhet	Cambodia	Very good
15	Mr. Vong Vanthy	Cambodia	Very good
16	Mr. Stanley Njogu Humaiya	Kenya	Very good
17	Eng. Dishon Mwawasi Mkaya	Kenya	Very good
18	Ms. Grace Wanjiru Njagi	Kenya	Very good
19	Mr. Romeo Belley Kaioh	Liberia	Very good
20	Mr. Augustine Binda Flomo	Liberia	Very good
21	Ms. Fatima Jumaa Tawor Halowf	Sudan	Very good
22	Mr. Ogwal Emmanuel	Uganda	Very good

ANNEXURE – VII

Feed The Future India Triangular Training (FTF-ITT) International Training Program on "Strategies for Enhancement of Farmers Income in Dryland Agriculture" for Extension Practitioners of Asian and African Countries
16-30th January, 2018 at ICAR-Central Research Institute for Dryland Agriculture, Santoshnagar, Hyderabad, India
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PRE & POST EXAM REPORT

S.No	Names	Pre Training	Post Training	Difference
1	Mr. Emmanuel Ayimbire Anaba	40	70	30
2	Mr. Romeo Owusu Kankam	30	70	40
3	Mr. Stanley NGOJU Humaiya	40	80	40
4	Mr. Dishon Mwawasi Mkaya	40	70	30
5	Ms. Grace Wanjiru Njagi	60	90	30
6	Mr. Kyi Myint	50	80	30
7	Mr. Thant Sin Kyaw	60	80	20
8	Mr. Edward Daniel Mjojo	40	70	30
9	Ms. Yatipa Nangoma	30	70	40
10	Ms. Eliza Chinula	40	70	30
11	Mr. Emuron Joseph	50	90	40
12	Mr. Emmanuel Ogwal	40	80	40
13	Mr. Sokhet OUK	30	70	40
14	Mr. Vanthy Vong	40	80	40
15	Miss. Ifua Basele Celestine Marie-Robert	20	60	40
16	Ms. Fatima Jumaa Tawor Halowf	10	70	60
17	Ms. Rwan Mohamed Elhassan Osman	40	60	20
18	Mr. Romeo Belley Kaioh	20	70	50
19	Mr. Augustine Binda Flomo	30	60	30
20	Mr. Rohullah Qayoumi	10	80	70
21	Mr. Mohammad Kabir Sharifi	10	70	60
22	Mr. Sharifullah Rahimi	40	70	30
	Average	35	73	38