

Annual Report

July 2014–June 2015

Farmer-centric Integrated Watershed Management for Improving Rural Livelihoods in Anantapur, Andhra Pradesh and Mahabubnagar, Telangana

Submitted to
Rural Electrification Corporation Limited
Hyderabad, Telangana, India



**International Crops Research Institute
for the Semi-Arid Tropics**

This work is being
undertaken
as part of the



RESEARCH
PROGRAM ON
Dryland Systems

In partnership with



Table of Contents

Executive Summary	1
Background	2
Penukonda Watershed, Anantapur, Andhra Pradesh	3
Site Selection	3
Watershed Committee Formation.....	5
Stratified Soil Sampling and Soil Test- based Fertilizer Recommendation.....	7
Participatory Work Plan Prepared	10
Activities Done	11
Publicity Awareness Activities	16
International Women’s Day.....	18
ANNEXURE 1	19
Wanaparthy Watershed, Mahabubnagar, Telangana	20
Site Selection	20
Watershed Committee Formation.....	23
Stratified Soil Sampling and Soil Test- based Fertilizer Recommendation.....	24
Participatory Action Plan Prepared	26
Field Day held in Rajapet, Mahabubnagr District.....	32
ANNEXURE 2.....	35

Executive Summary

The Rural Electrification Corporation Limited, Hyderabad, Telangana, India has supported the ICRISAT-led consortium to develop “Model Sites of Learning” in Mahabubnagar district in Telangana state and Anantapur district in Andhra Pradesh with an aim to sustainably increase agricultural productivity and improve the livelihoods of the rural poor in vulnerable rain-fed areas. A participatory integrated watershed management approach is one of the tested, sustainable, and eco-friendly options available for upgrading rain-fed agriculture for sustainable intensification. The approach also has additional multiple benefits in terms of improving livelihoods, addressing equity issues, and biodiversity concerns along with the conservation of water and other natural resources. In this context, two potential sites for watershed project were identified in Penukonda Mandal (Gonipeta, Settipalli, Kondampalli, and Cherlopalli villages) in Anantapur district in Andhra Pradesh and Wanaparthy Mandal (Rajapet, Kadakunla, Peddagudem and Mentepalli villages) in Mahabubnagar district in Telangana state with support from the District Water Management Agency (DWMA) and Department of Agriculture officials. Baseline survey has been conducted in both the sites for the watershed project. The Penukonda watershed (Anantapur district) comprised of 1,480 families (8,700 population) and included groundnut, maize, paddy, finger millet, and sunflower as major crops. Similarly, the Wanaparthy watershed (Mahabubnagar district) comprised of 2295 families (11726 population) having groundnut, castor, maize, paddy, sorghum, pigeonpea, and cotton as major crops. The baseline analysis showed lower crop yields and identified a good potential for improvement in productivity and livelihoods.

In order to initiate the project, watershed committees were formed at both the watershed sites; the Penukonda watershed comprised of 19 members and the Wanaparthy watershed comprised of 22 members. These committees duly represented all the sections of the community including women representatives and proportionately small, medium, big and landless farmers. As an entry point activity and means to assess the soil fertility status of farmers’ fields, geo-referenced soil samples were collected through stratified soil sampling method both in Penukonda (220 samples) and Wanaparthy (210 samples) watersheds. Both the watersheds showed widespread multi-nutrient deficiencies including the deficiency of secondary and micro-nutrients. The soils in Penukonda watershed in Anantapur district showed severe deficiency of soil organic carbon (87% deficiency) and available nutrients such as phosphorus (69%), sulfur (77%), zinc (94%), and boron (77%). Similarly, in the Wanaparthy watershed, in Mahabubnagar district, widespread deficiencies were recorded for soil organic carbon (83% deficiency), sulfur (64%), zinc (69%), and boron (63%). Based on the soil test results, crop-wise fertilizer recommendations were developed and shared with the farmers. Productivity enhancement demonstrations (36 in Penukonda and 25 in Wanaparthy) were conducted to evaluate the soil test-based fertilizer application including micro and secondary nutrients along with improved cultivars and seed treatment. The inputs including improved cultivar seeds, micro and secondary nutrient fertilizers such as agrabor, zinc sulfate, and gypsum were arranged for the farmers participating in the demonstration activities. Based on the farmers’ demands, an action plan was prepared for both the watersheds in consultation with farmers, NGOs, line staff officials, and ICRISAT scientists. The action plan in both the watersheds included soil and water conservation activities (nala plugs/RFDs, sunken pits, farm ponds, masonry check dam, well recharge

pits), productivity enhancement (crop demonstration) trials, livelihood and income generating activities (vermicompost), and afforestation/avenue plantation.

To enhance the awareness and improve the farmers' skills in science-led technologies, capacity building programs were conducted during June to August 2014. In the Penukonda watershed, about 140 farmers participated in the training programs conducted on six different days. Similarly in the Wanaparthy watershed, about 65 farmers participated in the training programs conducted on three different days.

The active involvement of all the team members and the great enthusiasm in farmers helped the watershed works to progress well.

Background

The overall goal of this initiative was to sustainably increase agricultural productivity and improve the livelihoods of rural poor in vulnerable rain-fed areas through integrated watershed management. The specific goal of this initiative was to increase the agricultural productivity, improve rural livelihoods, and achieve sustainable rural development in the selected villages.

The specific objectives were:

1. To establish "Model Sites of Learning" in Mahabubnagar and Anantapur districts of Andhra Pradesh for harnessing the potential of rainfed areas by adopting integrated water resource management approach;
2. *To enhance* the water availability and its (green and blue water) use efficiency for diversifying the livelihood systems in the target villages by adopting integrated water resource management approach; and
3. *To build* the capacity of the farmers in the region for improving the rural livelihoods through knowledge sharing and dissemination strategy.

The selection of watershed location was the first major activity taken up with the coordination of the District Water Management Agency (DWMA), Department of Agriculture and the local NGOs. The following criteria were considered in the selection of sites for the watershed project.

- Representativeness in terms of soil, landscape (slope and terrain), rainfall, crops, and socio-economic conditions.
- Cooperative farmers who were willing to take an active part in the watershed program.
- Good potential for increasing the agricultural productivity, income, and conservation of natural resources.
- Strong need for the watershed program.
- Major area under rainfed.
- Good accessibility even during the rainy season.

Considering the above key criteria, two potential sites for the watershed project were identified in Anantapur district in Andhra Pradesh and Mahabubnagar district in Telangana. The ICRISAT team and Watershed Development Department officials visited the proposed

sites. At each site, the farmers meetings were conducted, and interactions were held with the local institutions and community members. Based on these discussions and observations collected followed by a transect walk, the final selection of sites for the watershed project was done.

Penukonda Watershed, Anantapur, Andhra Pradesh

Site Selection

The DWMA and Department of Agriculture officials coordinated in the selection of project location in Penukonda Mandal, Anantapur district (Figure 1). A meeting was held at the Joint Director of Agriculture (JDA) office in Anantapur that included JDA Mr. PV Sriram Murthy, Additional Project Director DWMA Mr. Nagabhushanam, Penukonda Assistant Director of Agriculture Mr Srinivasulu and Agriculture Officers to discuss and propose an ideal location for the watershed project supported by the Rural Electrification Corporation before the field visit (Figure 1). Based on the information, existing on-going project location, topography, drainage maps, and farmers response, the department officials suggested four villages of Penukonda Mandal with a total geographical area of 6,811 ha, including 3,150 ha of area under cultivation (Figure 2).



Figure 1. Discussion with JDA, PD DWMA for the site selection and transect walk during field visit, Penukonda watershed, Anantapur.

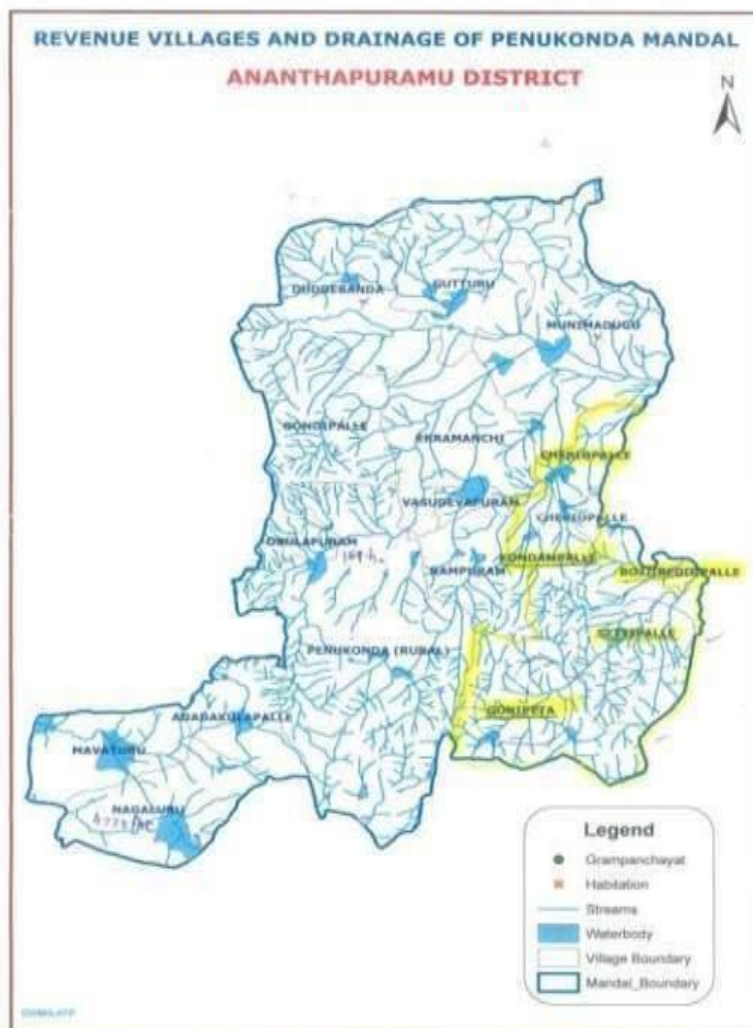


Figure 2. Watershed map with drainage network (marked in yellow color), Penukonda Mandal, Anantapur district.

The area selected for watershed development project comprised of four villages: Gonipeta, Settipalle, Kondampalle, and Cherlopalle in Penukonda Mandal spreading over 14° 03' 35" – 14° 08' 09" latitude and 77° 38' 48" – 77° 39' 23" longitude (Table 1).

Sl. No.	Villages	GPS points	Geographical area (ha)	Cultivable area (ha)
1	Gonipeta	14° 03' 35" 77° 38' 48"	2345	750
2	Settipalle	14° 05' 34" 77° 41' 10"	2524	1379
3	Kondampalle	14° 07' 20" 77° 38' 49"	1010	585
4	Cherlopalle	14° 08' 09" 77° 39' 23"	932	444
	Total		6811	3158

Some of the important demographic details such as the number of households (1400), population (8700), and the major crops grown are shown in Table 2.

Sl. No.	Villages	HH (no.)	Population	Major crops
1	Gonipeta	400	2000	Groundnut, maize, paddy, finger millet, sunflower
2	Settipalle	740	4500	Groundnut, paddy
3	Kondampalle	300	2000	Groundnut, maize, paddy
4	Cherlopalle	40	200	Groundnut, paddy
	Total	1480	8700	

During the site selection process, we also surveyed the water resources, which are mentioned in Table 3. In all of the three villages except Cherlopalli, bore wells existed. The depth of open wells ranged from 20 to 40 ft. The water table in bore wells ranged from 300 to 500 ft. The groundwater table in the bore wells had declined over the years and the duration of water availability had also reduced, which suggested that various water harvesting and groundwater recharge structures need to be implemented to sustain the groundwater levels.

Villages	Open wells		Bore wells (nos.) & depth	Tanks (area irrigated) & PT (nos.)	Remarks
	Total (nos.)	Functioning (nos.) & depth			
Gonipeta	50	30 (20'–30')	16	2	Water in open wells was available for 6–10 months
Settipalle	>200	5-6 (30'–40')	300 (400'–500')	1 (230 ac); 1 small PT	Percolation Tanks are for Groundwater recharge only
Kondampalle	~50	Nil	300 (300'–450')	Nil; 1 small PT	50% of bore wells worked in summer
Cherlopalle	15	0 (20'–30')	Nil	3 (220 ac); 7 small PT	All open wells defunct; no bore wells; depends on tank water for irrigation

Watershed Committee Formation

One watershed committee (WC) consisted of 19 members that included the representatives from all the four villages. The WC comprised of all the sections of the community, including women representatives, proportionately small, medium, big and landless farmers and represented all the communities. A bank account was opened in the name of the WC. A meeting was conducted with the WC members to brief the project activities and its benefit (Figure 3). Table 4 shows the watershed committee members list that includes 50% women of Other Castes (OC) (4 members), Backward Castes (BC) (5 members), Scheduled Tribes (ST) (7 members), and Scheduled Castes (SC) (3 members). The farmers were so enthusiastic that people collectively elected the committee members and shared their expectations to improve the water resource in the area. They also assured active participation and cooperation. The meeting was covered by the local media (Figure 4).



Figure 3. Briefing to the Watershed Committee members, Penukonda watershed, Anantapur.



Figure 4. Media coverage in Eenadu Telugu newspapers (7 August 2014).

Sl. No.	Name	Village	Caste	Designation
1	P Ramakrishna Reddy	Kondampalli	OC	President
2	B Bhagyamma	Shettipalli	OC	Vice-president
3	B Sudhakar	Ginopeta	BC	Member
4	Chenna Reddy	Shettipalli	OC	Member
5	K Rammaiah	Shettipalli	BC	Member
6	M Venkataramanamma	Shettipalli	ST	Member
7	B Tulasiram	Shettipalli	ST	Member
8	M Jayabai	Shettipalli	ST	Member
9	K Nagamma	Kondampalli	OC	Member
10	G Gangaratnamma	Kondampalli	BC	Member
11	S Narayan naik	Kondampalli	ST	Member
12	S Navatabhai	Kondampalli	ST	Member
13	M Nagappa	Cherlopalli	SC	Member
14	M Krishnamma	Cherlopalli	SC	Member
15	K Nagendrappa	Gonipeta	BC	Member
16	G Krishnamma	Gonipeta	BC	Member
17	H Alivelamma	Gonipeta	SC	Member
18	P Motilal naik	Gonipeta	ST	Member
19	P Chamantibai	Gonipeta	ST	Member

Stratified Soil Sampling and Soil Test- based Fertilizer Recommendation

To build the rapport with the community and develop the partnership knowledge-based entry point activity (EPA), which would benefit the community as well as fulfill the project goal of achieving improved rural livelihood and sustainable development, soil health mapping was undertaken by adopting stratified sampling in the target villages. To assess the soil fertility status and develop a soil health based fertilizer recommendation, 220 geo-referenced soil samples were collected and analyzed (Figure 5; Table 5). The soils in four watershed villages revealed severe deficiency of organic carbon (78–95% deficiency), available phosphorus (46–80%), sulfur (63–95%), available zinc (92–98%) and boron (58–93%) (Table 6). Based on the soil test results, crop wise fertilizer recommendations were provided to the farmers (Table 7). Training was provided to demonstrate the soil sampling method, and the results were shared with the farmers.



Figure 5. Hands-on training to farmers for participatory soil sampling in Penukonda watershed.

Table 5. Soil health status in Penukonda watershed, Anantapur, Andhra Pradesh.

Villages	pH	EC dS/m	OC %	Av. P ppm	Av. K ppm	Av S ppm	Av Zn ppm	Av B ppm	Av Fe ppm	Av Cu ppm	Av Mn ppm	Ca ppm	Mg ppm	Na ppm
Cherlopalli	7.0	0.12	0.26	4.3	65	7.0	0.31	0.26	9.71	0.44	6.99	975	151	54
Gonipeta	8.1	0.12	0.24	4.0	78	3.5	0.39	0.27	5.76	0.59	4.97	1595	164	77
Kondampalli	8.0	0.25	0.31	8.5	75	18.3	1.0	0.46	5.63	2.06	5.16	1566	249	136
Settipalli	8.4	0.23	0.34	4.1	88	9.5	0.41	0.48	8.00	0.88	5.67	2225	322	216
Mean of villages	7.9	0.19	0.29	5.3	78	10.0	0.54	0.39	7.26	1.04	5.66	1656	234	132

Table 6. Per cent farmers filed deficient in nutrients, Penukonda watershed, Anantapur, Andhra Pradesh.

Villages	OC	Av. P	Av. K	Av S	Av Zn	Av B
Cherlopalli	88	80	43	90	98	90
Gonipeta	95	80	8	95	93	93
Kondampalli	92	46	12	68	92	76
Settipalli	78	73	3	63	93	58
Mean of villages	87	69	15	77	94	77

* When SSP is used only Urea, DAP, Gypsum changes and others will be same

Table 7. Soil-test-based fertilizer recommendations (kg ha⁻¹), Penukonda watershed, Anantapur, Andhra Pradesh.										
Crop	Urea	DAP	MOP	Gypsum	ZnSO ₄ 7H ₂ O	Agribor	Borax	Urea	SSP*	Gypsum
	(kg ha ⁻¹)									
Maize (Kharif)	175	109	33	200	50	2.5	5	217	357	0
Maize (Rabi)	210	130	42	200	50	2.5	5	261	429	0
Paddy (Kharif)	149	120	33	200	50	2.5	5	196	393	0
Paddy (Rabi)	210	130	33	200	50	2.5	5	261	429	0
Pearl Millet (Rainfed)	105	65	17	200	50	2.5	5	130	214	0
Pearl Millet (Irrigated)	140	87	25	200	50	2.5	5	174	286	0
Sorghum (Rainfed)	129	87	25	200	50	2.5	5	163	286	0
Sorghum (Irrigated)	145	130	33	200	50	2.5	5	196	429	0
Sunflower (Rainfed)	80	130	25	200	50	2.5	5	130	429	0
Sunflower (Irrigated)	86	196	25	200	50	2.5	5	163	643	0
Cotton (Hybrids)	210	130	50	200	50	2.5	5	261	429	0
Castor	129	87	25	200	50	2.5	5	163	286	0
Ragi	105	65	17	200	50	2.5	5	130	214	0
Safflower	66	54	0	200	50	2.5	5	87	179	3
Sesame (Kharif)	36	130	33	200	50	2.5	5	87	429	0
Chillis (Irrigated)	601	130	100	200	50	2.5	5	652	429	0
Chillis (Rainfed)	96	87	42	200	50	2.5	5	130	286	0
Groundnut (Rainfed)	9	87	42	500	50	2.5	5	43	286	217
Groundnut (Irrigated)	31	87	42	500	50	2.5	5	65	286	217
Pigeonpea (Kharif)	1	109	0	200	50	2.5	5	43	357	0
Greengram, Blackgram, Chickpea	1	109	0	200	50	2.5	5	43	357	0

Participatory Work Plan Prepared

The Action plan was prepared by the team comprising of ICRISAT scientists, farmers and NGO officials with a participatory approach. A transect walk was taken up to for the purpose of preparing the action plan that covered all the four villages in the watershed area (Figure 6). Based on the opinions of the local farmers and technical feasibility, suitable sites for the interventions were selected. A good number of enthusiastic farmers along with the WC members actively participated in the transect walk, which indicated the immediate need for improving the water resource and productivity enhancement initiatives (Figure 7).



Figure 6. Site selection for under ground check wall, farm pond, and well recharge pit, Penukonda watershed, Anantapur.



Figure 7. Enthusiastic farmers showed National Rural Employment Guarantee Scheme (NREGS) work initiated for horticulture and continuous contour trenches (CCT) on hillock.

Activities Done

The action plan in Penukonda Watershed, Anantapur included soil and water conservation activities (such as nala plugs/rock filled dam (RFDs) (20 nos), sunken pits, farm ponds, masonry check dam, well recharge pits); productivity enhancement (crop demonstration); livelihoods, and income-generating activities (vermicompost); and afforestation/avenue plantation.

Soil and water conservation:

Check dams, RFD/gully plugs, well recharge pits, and farm ponds were constructed for soil and water conservation (Table 8 and Figure 8).



Farm Ponds (Gonipeta and Kondampalli)



Sunken pit (Kondampalli)

Rock-filled dam (Settipalli)



Check dams (Settipalli and Gonipeta)

Figure 8. Various soil and water conservation interventions done in watershed villages.

Sl. No.	Works	Quantity (nos.)
1	Farm pond	5
2	Check dams	2
3	Rock filled Dam	8
4	Sunken pits	6
5	Bore well recharge pits	1

Crop demonstration:

Poor rainfall was recorded in 2014 that adversely affected the crops. Even the percentage of sown area in the district was low. Figure 9 displays a farmer showing his groundnut crop with irrigation. He mentioned that only a small area was cultivated this year due to limited availability of groundwater in the Shettipalli, Penukonda watershed (Figure 9). Despite the situation, productivity enhancement demonstration plots were established (36) with improved technologies such as improved cultivar seeds, seed treatment, and soil test based fertilizer application, which included micro and secondary nutrient application (Table 9). The inputs such as improved cultivar seeds, micro and secondary nutrients such as boron (agribor), zinc (zinc sulfate) and sulfur (gypsum) were also provided to the farmers who participated in the demonstration activities.

The yield data revealed that the crop yields with micronutrients were 17% higher in groundnut, 12% in maize, and 14% in paddy compared to the earlier yield obtained from farmers' practice (Figure 10 and Table 9& 10). Crop yields under rainfed cultivations were affected severely due to poor rainfall (~40% deficit rainfall).



Figure 9. Poor groundnut crop in Kondampalli and farmers interaction in Shettipalli in a demonstration field (has irrigation facility), Penukonda watershed.

Villages	No. of demonstration fields	Remarks
Konampalli	12	Soil-test based nutrient management; Groundnut demo - 12; paddy - 10; maize - 14 farmers.
Shettipalli	14	
Gonipeta	10	
Cherlopalli	NIL	Could not sow due to delayed rain
Total	36	

Crop	Improved practice (IP)	Farmers Practice (FP)	% increase in IP
Groundnut	1.35	1.15	17.4
Maize	4.81	4.23	12.2
Paddy	4.63	4.05	14.2



Figure 10. Collection of yield samples from demo farmer (Ms Rangamma) at Settipalli village.

Income-generating Activities:

Various income generating activities such as sheep rearing, improving the local goat breeds through cross breeding with Sirohi goats, vermicomposting, nursery and home gardening were taken up by the women self-help groups (SHGs) during 2014–15 (Figure 11).



Ram lamb Rearing Units



Vermicomposting unit



Sirohi bucks for breed improvement



Fruit plants distributed



Nursery, Kondampalli

Figure 11. Income-generation activities SHG members, REC-ICRISAT watershed, Penukonda, Anantapur

Avenue plantation:

About a 0.5 km long avenue plantation with pongamia and gliricidia plants was taken up in the Cherlopalli village (Figure 12).



Figure 12. Avenue plantation alongside Cherlopalli village road.

Capacity building/ awareness creating activities:

Several capacity building programs were conducted to create awareness about the watershed project on various aspects such as community formation, participatory soil sampling, soil health, and action plan preparation, use and application of improved crop productivity initiatives, and integrated pest management (Table 11; Figures 13 and 14).

Table 11. Capacity building activities in Penukonda watershed, Anantapur		
Date	Topics discussed	Participants attended
7-8 June 2014	Site selection, briefing the objective of the project	30–40 in each of the villages
20 July 2014	Briefing the project objectives to the Watershed committee members and NGO staff	27
21 July 2014	Hands-on training on participatory soil sampling	18–35
7-8 August 2014	Improved production technology including soil health and integrated nutrient management, integrated pest management, soil and water conservation, rainfall measurement, and tropicultor.	35–40



Kondapalli watershed committee members



Shettipalli SHG members meeting



Gonipeta farmers



Cherlopalli farmers



Seed Treatment Training Programme with the convergence of Agriculture Department



Demonstration of the Tropiculter at Kondampalli village

Figure 13. Awareness and capacity building activities with farmers and watershed committee members, Penukonda watershed, Anantapur.



Figure 14. Four rain gauges installed in watershed villages for rainfall measurement.

Publicity Awareness Activities

Several publicity and awareness activities such as wall writings, field board display, and media/ press coverage were performed in the watersheds (Figures 15 and 16).



Village boards and wall writing in watershed villages

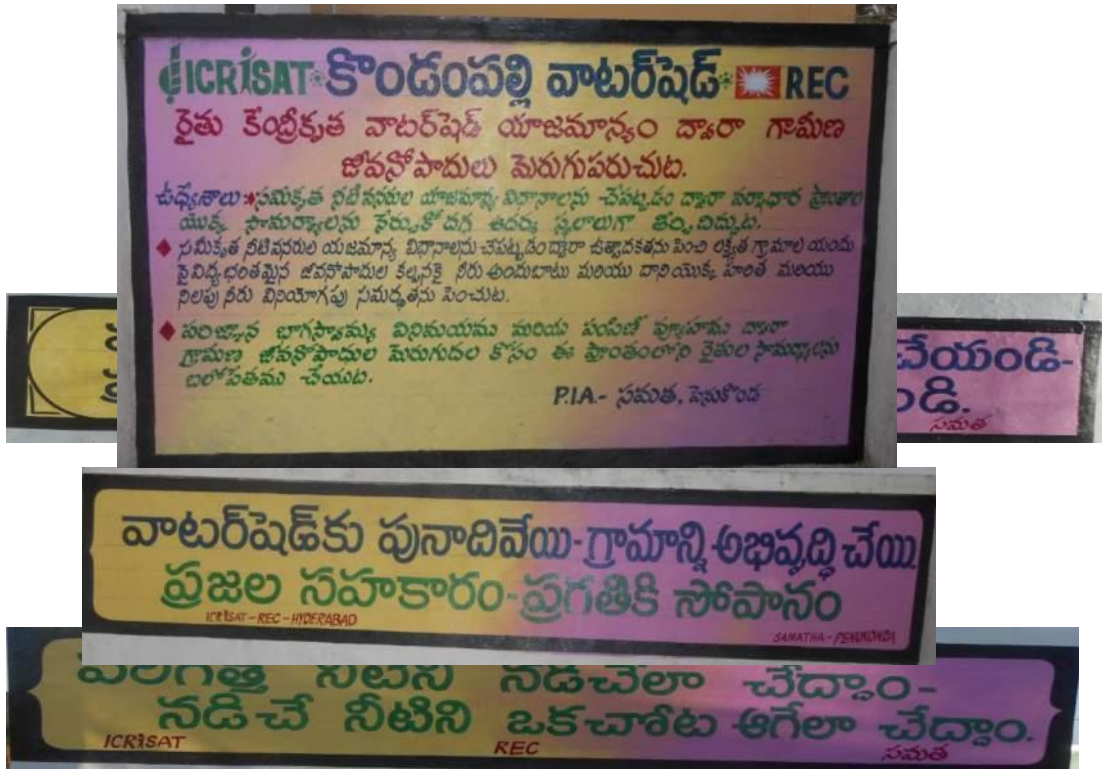


Figure 15. Some of the popular watershed related displays on walls for awareness



Figure 16. Some of the watershed activities coverage in media, Penukonda.

International Women's Day

The international women's day was celebrated on March 8 in the Kondampalli village. It was attended by about 65 watershed SHGs and women farmers. One of the women members of Zila Parishad (ZP) was invited to preside over this function (Figure 17).



Figure 17. International women's day celebration in Kondampalli, Penukonda.

ANNEXURE 1

REC-ICRISAT watershed activities in Anantapur, Andhra Pradesh, 2014–15.

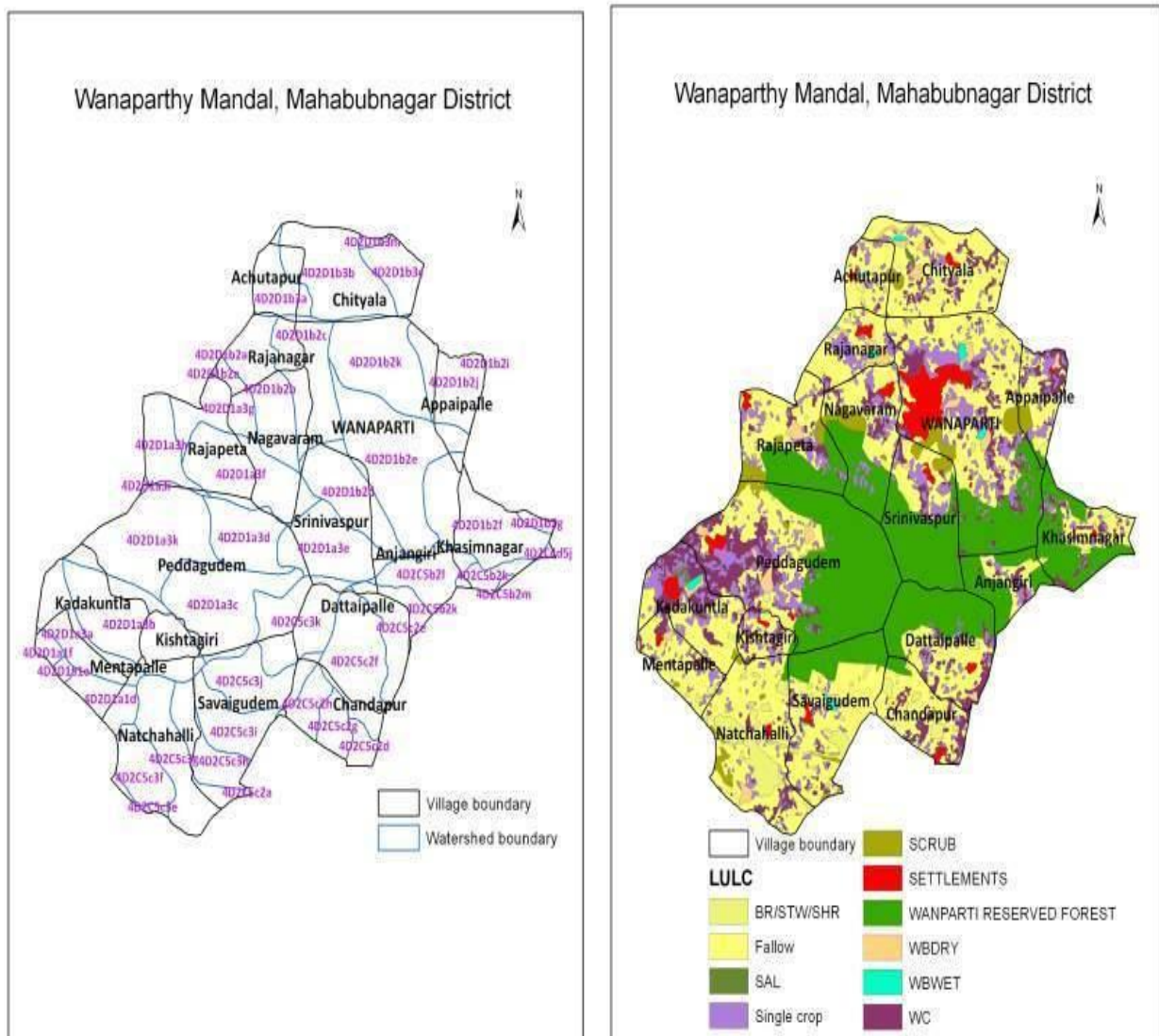
Sl. No	Activities	2014–15	Total Achievements	No. of farmers Benefitted
A				
1	Base line Survey	1200	1200	
2	Total Soil Samples Drawn	200	200	5000
B	Soil and Water conservation structures			
1	Farm pond (FP)	05	05	05
2	Rock Filled Dam (RFD)	05	05	15
3	Sunken pits	05	06	15
4	Bore well recharge pit	05	01	01
5	Check Dam (CD)	02	02	40
D	Income generating activities			
1	Nursery raising (1 SHG)	01	01	500
2	Vermicomposting	02	02	5
3	Lamb rearing	100	120	500
4	Sirohi bucks- breed improvement		02	50
5	Dairy, vegetable vendors, petty shops, etc.	05	08	50
E	Afforestation, horticulture and Livestock Improvement			
1	Avenue plantation	0.5 km	0.5 km	Kondampalli-Cherlopalli
2	Home gardening (4 fruit plants to each HH)	500	500	2000
G	Productivity Enhancement conducted trails			
1	Balanced nutrient management (NPK+Zn+S+B and improved varieties)	25 ha	20 ha	60
2	Improved implement (Tropiculture)	2 nos.	2 nos.	10
H	Capacity building /training/awareness conducted			
1	Farmers trainings	5	5	250
2	Women trainings	02	03	60
3	SHG's Capacity building trainings	02	02	50
4	Field day and international women day	02	02	150
5	Wall writing (W/s objectives & fertility status)	10	15	Many farmers
6	Exposure visit to ICRISAT	01	01	25

Wanaparthy Watershed, Mahabubnagar, Telangana

Site Selection

Site selection for the watershed project in Mahabubnagar district was taken up in coordination with the DWDA of Telangana government and Department of Agriculture officials. Additional PD, DWDA, Mr. Hussain Babu, Penukonda provided the required information, and his staff participated and facilitated the site selection process for the watershed project supported by the Rural Electrification Corporation. Based on the information, existing on-going project location, topography, drainage maps and farmers response, the department officials suggested four villages of Wanaparthy Mandal, Mahabubnagar district with a total geographical area of 5401 ha including 3968 ha of cultivated area.

Various thematic maps such as village and watershed boundary, drainage, slope, and land use were prepared based on the geographic information system (GIS) data (Figure 1). These maps are helpful in planning watershed interventions.



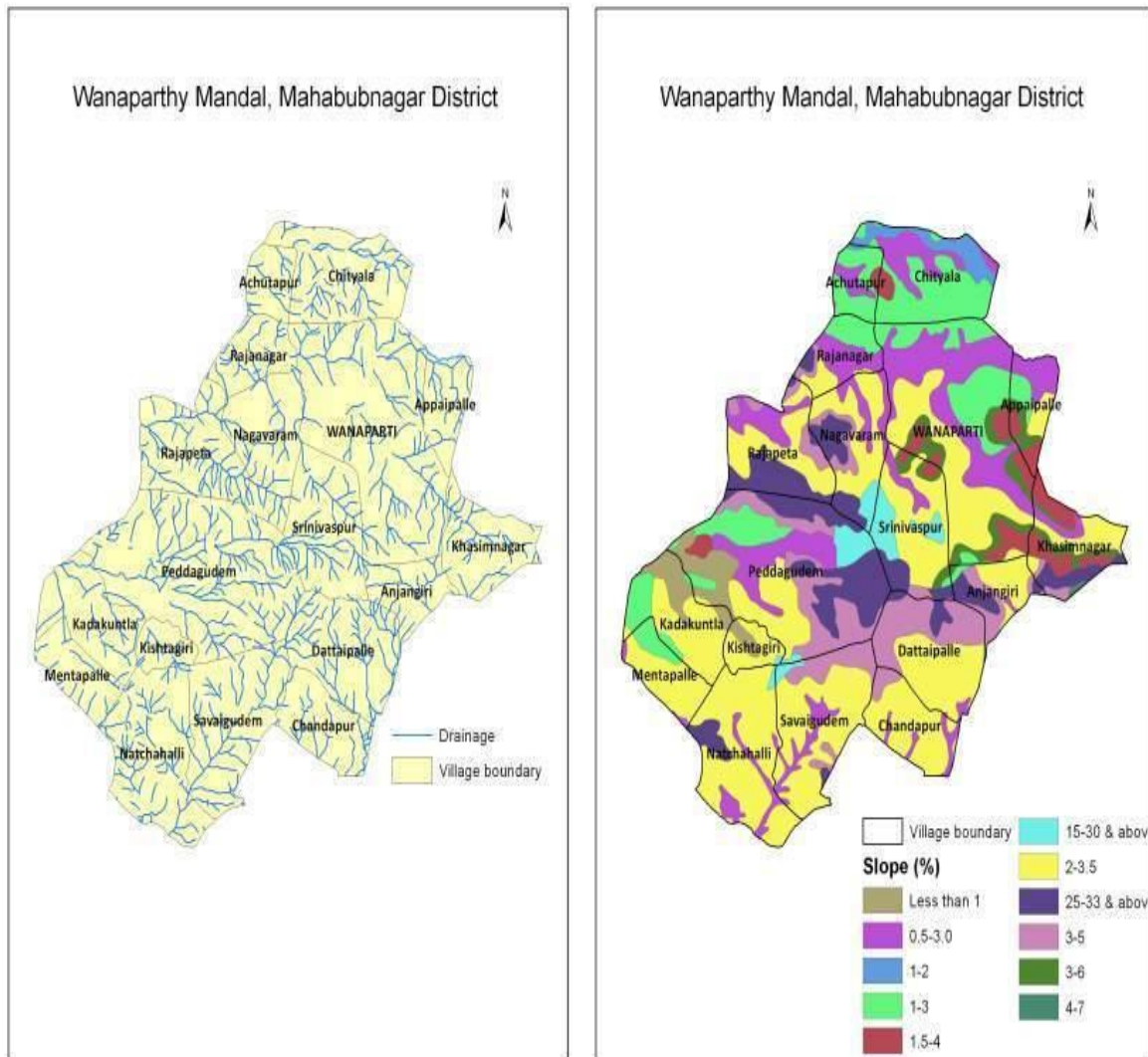


Figure 1. Various thematic maps of Wanaparthy watershed, Mahabubnagar district.

The area selected for the watershed development project comprised of four villages: Rajapet, Kadakuntla, Peddagudem, and Mentepalli in Wanaparthy Mandal (Table 1). More than 80% of this area was under rainfed cultivation. The area has red soil with soil depth ranging from 5–6 ft. The major crops grown in this area include groundnut, castor, maize, paddy, Pigeonpea, and sorghum. Peddagudem and Kadakuntla had 3–4 main drains of 3rd order (5–8 m wide and 1–2 m deep). Other two villages (Rajapet and Mentepalli) had poor drainage density. The other three villages had 2–3 conventional tanks, except Mentepalli, which had one tank but not filled for the past 15 years. Each of these villages had a good number of open wells with an average depth ranging from 40–50 ft, but all of them had dried except one in Peddagudem. Hence, the farmers had closed open wells with soil to use the land for cultivation while bore wells was used as the source of irrigation. The average depth of bore wells ranged from 300–400 ft. The farmers observed a decline in the depth (100 ft) and the yield of bore wells over time. The animal population in the three villages was good, but severe fodder scarcity persisted while Mentepalli had a negligible number of milking animals due to the severe shortage of water and fodder.

The major constraints perceived by the farmers include water scarcity, declining groundwater, availability of improved cultivar seeds on time, increasing the cost of cultivation and labor shortage.

Sl. No.	Villages	Geographical area (ha)	Cultivable (ha)	Forest (ha)	Waste land (ha)	Other
1	Peddagudem	2631	1863	563	185	20
2	Kadukuntla	945	856	0	84	5
3	Rajapeta	1225	781	332	105	7
4	Mentepalli	600	468	0	90	42
	Total	5401	3968	895	464	74

Some of the important demographic information such as number of households (2,295), population (11726) and the major crops grown are shown in Table 2.

Sl. No.	Villages	HH (no.)	Population	Major crops
1	Peddagudem	832	4363	Groundnut, castor, maize, paddy, sorghum, pigeonpea, cotton
2	Kadukuntla	738	3382	
3	Rajapeta	425	2381	
4	Mentepalli	300	1600	
	Total	2295	11726	

During the site selection process, water resources were also surveyed with, which are mentioned in Table 3.

Villages	Open wells		Bore wells (nos.) & depth (ft)
	Total (nos.)	Working status	
Peddagudem	100 (40'–50')	All defunct	400 (300–400)
Kadukuntla	150	All defunct	300 (400–500)
Rajapeta	12	All defunct	160 (450–550)
Mentepalli	85	All defunct	85 (500–600)

Watershed Committee Formation

The WC was formed followed by the village meeting. The WC consisted of 22 members that included members from all the four villages. The WC comprised of all the sections of the community i.e. proportionately small, medium, big and landless farmers and represented all the communities. A meeting was conducted with the WC members to brief about the project activities and its benefits (Figure 2). The following Table 4 shows the WC members list.

Sl. NO	Name of the Village	Name of the Person	Designation	Cast	Age
1	Rajapeta	M.Loka Reddy	Chairman	OC	63
2	Pedda Gudem	Undekoti.Kurmanna	Secretary	BC	55
3	Rajapeta	K.Balraj Goud	Member	BC	38
4	Rajapeta	Vadde.Doshanna	Member	BC	45
5	Rajapeta	Eashwaraiah	Member	SC	46
6	Rajapeta	K.Sukya nayak	Member	ST	25
7	Pedda Gudem	Chinna.Paga Srinu	Member	SC	33
8	Pedda Gudem	Toka.Tirumalaiah	Member	BC	45
9	Pedda Gudem	Eashwaramma	Member	BC	41
10	Pedda Gudem	Earladden Padamma	Member	BC	35
11	Pedda Gudem	Lambadi Krishna	Member	ST	35
12	Kadukuntla	Gunrati Naganna Goud	Member	OC	56
13	Kadukuntla	G.Govind Reddy	Member	OC	55
14	Kadukuntla	Harijana.Middya.Kurmanna	Member	SC	57
15	Kadukuntla	Bharataiah	Member	BC	42
16	Kadukuntla	Telugu.Pedda.Balaiah	Member	BC	65
17	Kadukuntla	Gopalapuram.Venkatesh	Member	BC	40
18	Mentapalli	M.Sayanna	Member	BC	50
19	Mentapalli	M.Ramulu	Member	SC	35
20	Mentapalli	M.Hanmanthu	Member	BC	48
21	Mentapalli	R.Ugendar Reddy	Member	OC	50
22	Mentapalli	Chennamma	Member	SC	45



Figure 2. Briefing the Watershed Committee members, Wanaparthy watershed, Mahabubnagar

Stratified Soil Sampling and Soil Test-based Fertilizer Recommendation

Knowledge-based EPA of soil health mapping was undertaken in the target villages to build rapport with the community. Farmers themselves collected soil samples by adopting the participatory approach. In order to assess the soil fertility status and develop a soil health based fertilizer recommendation, 210 geo-referenced soil samples were collected and analyzed (Figure 3; Table 5). The soils in four watershed villages revealed severe deficiency of organic carbon (83% deficiency), sulfur (64%), available zinc (69%) and boron (63%) (Table 6). Based on the soil test results crop wise fertilizer recommendations were provided to the local farmers (Table 7). Training was conducted to demonstrate the soil sampling method, and the results were shared with the farmers during the village meetings, through the wall writings and by providing soil health cards to the farmers.



Figure 3. Hands-on training to the farmers for participatory soil sampling in Wanaparthy watershed, Mahabubnagar, Telangana.

Villages	pH	EC dS/m	OC %	Av. P ppm	Av. K ppm	Av S ppm	Av Zn ppm	Av B ppm	Av Fe ppm	Av Cu ppm	Av Mn ppm
Mean of villages	7.8	0.25	0.34	14.69	109.8	20.65	1.01	0.56	7.36	0.54	7.54

Villages	OC	Av. P	Av. K	Av S	Av Zn	Av B
Mean of villages	83	13	6	64	69	63

Crop	Urea	DAP	MOP	Gyp sum	ZnSO ₄ 7H ₂ O	Agri bor	Borax	FeSO ₄ 7H ₂ O	CuSO ₄ 5H ₂ O	MnSO ₄ H ₂ O	Urea	SSP*	Gyp sum
	(kg ha ⁻¹)												
Maize (kharif)	196	54	33	200	50	2.5	5	2.5	2	0.76	217	179	0
Maize (Rabi)	235	65	42	200	50	2.5	5	2.5	2	0.76	261	214	0
Paddy (Kharif)	172	60	33	200	50	2.5	5	2.5	2	0.76	196	196	0
Paddy (Rabi)	235	65	33	200	50	2.5	5	2.5	2	0.76	261	214	0
Sorghum (Rainfed)	146	43	25	200	50	2.5	5	2.5	2	0.76	163	143	0
Sorghum 9Irrigated)	170	65	33	200	50	2.5	5	2.5	2	0.76	196	214	0
Sunflower (Rainfed)	105	65	25	200	50	2.5	5	2.5	2	0.76	130	214	0
Sunflower (Irrigated)	125	98	25	200	50	2.5	5	2.5	2	0.76	163	321	0
Cotton (Hybrids)	235	65	50	200	50	2.5	5	2.5	2	0.76	261	214	0
Castor	146	43	25	200	50	2.5	5	2.5	2	0.76	163	143	30
Groundnut (Rainfed)	27	43	42	500	50	2.5	5	2.5	2	0.76	43	143	350
Groundnut (Irrigated)	48	43	42	500	50	2.5	5	2.5	2	0.76	65	143	350
Pigeonpea (Kharif)	22	54	0	200	50	2.5	5	2.5	2	0.76	43	179	0
Pigeonpea (Rabi)	66	54	0	200	50	2.5	5	2.5	2	0.76	87	179	0
Greengram Blackgram, Chickpea	22	54	0	200	50	2.5	5	2.5	2	0.76	43	179	0

*When SSP is used only Urea, DAP, Gypsum changes and others will be same

Participatory Action Plan Prepared

Action plan was prepared by the team comprising ICRISAT scientists, farmers and NGO officials with a participatory approach. A transect walk was taken up to prepare action plan covering all the four village watershed area (Fig. 4). Suitable sites for interventions were selected based on technical feasibility taking into farmers' opinion.

The action plan was prepared along with a transect walk as done in the case of Penukonda Watershed in Anantapur, Andhra Pradesh. The proposed action plan in Wanaparthy Watershed, Mahabubnagar included soil and water conservation activities (such as nala plugs/RFDs, sunken pits, farm ponds, masonry check dam, well recharge pits); productivity enhancement (crop demonstration); livelihood and income generating activities (vermicompost); afforestation/avenue plantation.

Soil and water conservation:

Check dams, farm ponds, RFD, gully plugs well recharge pits were constructed (Fig. 4&5 and Table 8.)



Figure 4. Site selection for percolation tank and check dam, Wanaparthy watershed, Mahabubnagar.

Table 8. Soil and water conservation works done, 2014-15.		
Sl. No.	Works	Quantity (nos.)
1	Farm ponds	16
2	Check dams	2
3	Mini percolation pits	2
4	Rock filled Dam	1
5	Loose boulder checks	7
6	Open and bore well recharge pits	19+1



A Farm pond at P. Gudem at Laxmaiah field

Check dam at Rajapeta at Mr. Narasimhulu farm



Open well recharge with rain water at Lokya Ramulu naik and Lokya naik at Rajapeta



Rock fill dam in K. Buchanna field, Rajapeta

Figure 5. Various soil and water conservation works done in REC-ICRISAT watershed, Mahabubnagar

Crop demonstration:

The rainfall during the year 2014 was poor. This adversely affected the sowing area. Despite the situation, productivity enhancement demonstration plots were established (25 nos. covering 55 acres with maize, groundnut, and paddy crops) with improved technologies like, enhanced cultivar seeds, seed treatment, soil test based fertilizer application including micro and secondary nutrient application (Table 9; Figure 6). The inputs such as improved cultivar seeds, micro and secondary nutrients like boron (agribor), zinc (zinc sulfate) and sulfur (gypsum) were provided to farmers participating in the demonstration.

S. No.	Village	No of demonstrations	Area covered (acre)
1	Rajapeta	8	18
2	Mentepalli	6	14
3	Kadukuntla	6	11
4	Peddagudem	5	12



Figure 6. Demonstration field farmers in sowing operation, Wanaparthy watershed.



Figure 7. Crop yield sample collection; farmer showing the effect of micronutrients on crop.

Table 10. Crop yields (t/ha) in improved practice, REC-ICRISAT watershed, Mahabubnagar, 2014-15.			
Crop	Improved practice (IP)	Farmers Practice (FP)	% increase in IP
Maize (kharif)	4.32	3.54	22.0
Groundnut (rabi)	1.76	1.46	18.5
Paddy (rabi)	4.31	3.78	13.9

The yield data revealed that the crop yields with micronutrients were 22% higher in maize, 19 % in groundnut and 14 % in paddy as compared to the earlier yield obtained from the farmers' practice (Table 10 and Figure 7). Crop yields under rainfed cultivations were affected severely due to the poor rainfall (~40% deficit).

Vegetable Cultivation:

Eighty eight farmers were encouraged to cultivate vegetables (50 % subsidy) such as tomato, brinjal, cluster bean, lady finger, bitter gourd, onion, chilli and leafy vegetable in a small area of 0.25 acre with the available water to enhance their income (Figure 8).



Vegetable seeds distribution



Visit to Manda Naganna's field in Mentapalli



T. Mannemma cultivated brinjal and leafy vegetables, Rajapeta

Figure 8. Vegetable cultivation in REC-ICRISAT watershed, Wanaparthy, Mahabubnagar

Integrated pest management in groundnut crop was taken up with convergence of department of agriculture. The department has provided pheromone traps (Figure 9) and conducted training on integrated pest management system to farmers.



Figure 9. Department of agriculture staff giving training to the farmers on Integrated Pest Management (IPM) techniques (pheromone trap provided by department installed in farmers' field.

Livestock development as livelihood:

To improve the livelihoods and sustain to the uncertainty in agriculture, livestock activities were taken up. In this initiative, 36 women SHG farmers were benefitted taking loan from the revolving fund to buy sheep. Two Sirohi goats were also provided to improve the meat production of local goats through cross breeding with natural insemination (Figure 10). Vermicomposting was done with two farmers (Figure 11).



Mentepalli women SHGs with sheep



Shohari bucks for breeding (K. Venkatamma & Nagamma) at Rajapeta
Figure 10. Livestock activities, Wanaparthi watershed, Mahabubnagar



Figure 11. Vermicompost taken up by Mr. Chandraiah, Metapally

Capacity building/ awareness creating activities: Several capacity building programs were conducted to create awareness about the watershed project on various aspects such as community formation, participatory soil sampling, soil health and action plan preparation, use and application of improved crop productivity initiatives and integrated pest management (Table 11; Figures 12 and 13).



Awareness program at Peddagudem;



Watershed farmers at Bhoochetana Training, Wanaparthy



Micronutrients application hand-on training, Kadakuntla; Wanaparthy farmers visit ICRISAT

Figure 13. Various capacity building activities conducted in Wanaparthy watershed, Mahabubnagar, Telangana.

Table 11. Capacity building activities in Wanaparthy watershed, Mahabubnagar, Telangana.		
Date	Topics discussed	Participants attended
June 6, 2014	Site selection, briefing the objective of the project	12–15 in each of the villages
July 19, 2014	Hands-on training on participatory soil sampling	20–30 in each of the villages
August 5, 2014	Improved production technology including soil health and integrated nutrient management, Soil and water conservation	15–20 in each of the villages

Field Day held in Rajapet, Mahabubnagr District

A field day cum awareness building meeting was organized in REC-ICRISAT watershed in Rajapeta village, Mahabubnagar district, Telangana on 27 November 2014. At first, the WC chairman Mr. Lokareddy welcomed the Chief Guest Mr. Sridhar DGM (CSR), REC, New Delhi and Dr. Kaushal Garg. Mr. Dasharath RPC, BAIF Integrated Rural Development Society (BIRD) NGO - AP explained about the project and related activities, the support received from REC and ICRISATs role in organizing these activities. The event was attended by Mr. Kamalakar ICRISAT, Research Technician, Mr. Gopal reddy, JPD, BIRD-AP, *sarpanchs* from the project villages and about 120 farmers and media people.

Mr. Sridhar DGM (CSR), REC, New Delhi explained about their organization and their commitment towards social responsibility. He encouraged the farmers to visit Kothapalli watershed. He appreciated the commitment and technical support of ICRISAT. He also encouraged the farmers to take collective responsibility of developing their villages as model villages and also assured to support them for achieving this goal Dr. Kaushal Garg, Scientist, ICRISAT also explained about ICRISAT, dryland agriculture, soil analysis, soil analysis report, and watershed activities. In addition, he also explained about the role of ICRISAT in watershed development (Figure 14).

Sarpanchs from the Watershed villages, Mr. Balraju Goud (Rajapeta), Mr. Goverdhan (Kadukuntla), and Mr. Purushotham Reddy (Mentepally) expressed their gratitude to REC, New Delhi and ICRISAT for considering their villages for implementing this watershed development project. They all assured to extend their support and active participation in all the project related activities.

Mr. Lokareddy, Watershed Committee Chairman, Wanaparthy explained about the ICRISAT activities conducted in their villages. He encouraged the farmers to implement ICRISAT technology like soil test based fertilizer using micro nutrients application, soil and water conservation, and IPM practices.

Mr. Sridhar, REC, New Delhi interacted with the farmers and media persons. After the meeting, Mr. Sridhar visited proposed Mini percolation tank and performed *Bhoomi pooja* along with watershed committee members, BIRD - AP representatives, and farmers. He also visited Mr. Lokareddy's groundnut crop field which made use of the improved practices. The demonstration field farmers explained the other farmers and delegates about the impact of improved practices over the farmers' conventional practices.



Mr. Loka Reddy, WC Chairman presenting a bouquet



Mr. Dasarath briefing the farmers



Mr. Sridhar, DGM, REC addressing the watershed farmers



Figure 14. Ground breaking ceremony for a percolation tank performed in Bakkanna's field Rajapet; Groundnut demonstration field visited in Rajapet.



International women day:

An international women’s day was celebrated in Peddagudem viallge where about 55 watershed SHGs and women farmers attended on 8 March 2015. Wome officer and ZP women member were invited to participate in the function (Fig. 15).



Figure 15. International women day celebration in REC-ICRISAT watershed, Mahabubnagar.

ANNEXURE 2

REC – ICRISAT watershed activities in Mahabubnagar, Telangana, 2014-15.

Sl. No	Activities	2014-15	Total Achievements	No. of farmers Benefitted	
A	1	Base line Survey	1000	800	
	2	Total Soil Samples Drawn	230	230	5000
B	Soil and Water conservation structures				
	1	Farm pond (FP)	08	16	18
	2	Mini percolation tank (MPT)	02	02	10
	3	Nala plugs	15	15	30
	4	Bore well recharge pit	05	01	01
	5	Open well recharge pit	20	25	25
	6	Rock fill dam	01	01	5
	7	Loose boulder checks	05	07	14
	6	Check Dam (CD)	02	02	40
D	Income generating activities				
	1	Vegetable cultivation (no. of farmers)	60	88	250
	2	Vermicomposting	02	02	5
	3	Small ruminants (sheeps)	25	36	150
	4	Sirohi bucks – breed improvement	02	02	20
E	Productivity Enhancement conducted trails				
	1	Balanced nutrient management (NPK+Zn+S+B and improved varieties)	30 ha	20 ha	60
	2	Improved implement (Tropicultor)	2 nos.	2 nos.	10
F	Capacity building /training/awareness conducted				
	1	Farmers trainings	2	2	50
	2	Women trainings	01	01	10
	4	Field day and international women day	02	02	300
	5	Wall writing (W/s objectives & fertility status)	10	10	Many farmers
	6	Exposure visit to ICRISAT	01	01	25