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Selection workshop report

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Deliverable 2.3

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Introduction

Stakeholder workshops play a crucial role in WAHARA for selecting and adapting technologies that have synergies with existing farming systems and that are preferred by local stakeholders. Therefore, Water Harvesting Technology (WHT) selection stakeholder workshops were held in all 4 study sites during the last months in 2012. In each of these workshops, the replicable participatory WH selection methodology that was described in deliverable 2.2. was applied. Where necessary, the methodology was adapted to the appropriate situation of the country. The workshop programme followed a logical sequence of steps, as described in deliverable 2.2, and summarized in Table 1.

Table 1. Summary of methodology selection workshop

Step	**Objectives**
Step 1: Review and comment of the objectives	Define the aims of the meeting & what should be achieved
Step 2: Presentation of the technologies	In this step, the WAHARA project will experiment innovative water harvesting technologies against the effects of climate change in rainfed Africa. The technologies can be applied at individual level (household) and are meant to increase the crop production or improve the income of the household. Some of these they will know very well, as they are already in use in their own study site, but others will be new.
Step 3: Identification of criteria for the evaluation of the technologies	It is important that the participants describe the important things which need to be taken for the analysis
Step 4: Analysis of the technologies	The aim of the analysis is to rank the pre-selected WHT
Step 5: Prioritization of the technologies to implement	By combining scores of the different WHT in the different categories a final selection is made
Step 6: Definition of the content of the experiment	Investigate whether there are stakeholders that are willing to make commitments for the selected WHT

Step 7: Evaluation	What are positive points, disadvantages or inconveniences

The following sections provide a synthesis of the workshop as they were held in the different countries.

I- BURKINA FASO

The participants were policy makers headed by the general secretary of the northwestern region, administration, extension Regional services (agriculture, Breeding, Environment, Hydraulic) NGO, Farmers organization, Farmer innovators, school teachers, educational personnel, gender promotion service etc. The participants were composed of 45 men, 31 women and 19 young people. Figure 1 gives an impression of the meeting.

Figure 1. A view of the participants during the meeting of Ouahigouya in Burkina Faso, December 2012. (Picture by Sawadogo)

1. Introduced and local technologies

The technologies enumerated by the producers and completed by the researchers and extending services are:

- Stones lines
- Zaï
- Half moons
- Magoye ripper (added for an experiment, after description by the project manager)
- Talya tray (added for an experiment, after description by the project manager)
- Compost manure in two weeks
- Mulching
- Small dam
- Farming Management Natural Regeneration (FMNR)

Figure 2. Scoring the technologies at Somyaga (Sawadogo, 2012)

The farmers proceeded to the identification and the ranking of the criteria. After these exercises, they did the scoring (see table 2) using a large paper and markers directly on the soil (Figure 2).

Table 2: Identification of criteria and choice of technologies at Ouahigouya/ Soumyaga :

Technologies	Criteria 1 Improve yield	Criteria 2 Little organic matter Use	Criteria 3 Increase biodiversity	Criteria 4 Give income	Criteria 5 Easier Applicability	Criteria 6 Crop Diversification	Criteria 7 Improve water availability	Criteria 8 Improve soil moisture	Criteria 9 Little labor needs
Stones lines	9	9	10	10	10	10	10	9	9
Zaï	10	10	10	10	10	9	8	9	7
Half moons	10	7	9	9	8	8	9	10	2
Mango ripper	8	8	2	10	8	8	5	10	u
Talya tray	u	u	10	u	10		10	10	9
Compost manure in two weeks	10		2	3	u	10	6	9	5
Mulching	5	10	8	2	4	5	1	9	1
Small dam	10	2	10	10	4	9	10	2	2
Farming Management Natural Regeneration (FMNR)	8	6	10	8	5	10	7	7	5
	Classification of criteria : Cotation								
Men view	10		8	10	5	5	8	6	8
Women view	7		10	10	5	8	10	5	5
Total points / criteria	17	0	18	20	10	13	18	11	13

Farming Management Natural Regeneration (FMNR): Use like a technology and a criteria. It is the criteria 10

Criteria for the final choice : the 5 criteria that were chosen are the grey columns : criteria 1, 3, 4, 6 et 7 of the table.

Number of participants : 95 / Men : 45 ; Women : 31 ; Young people: 19

2. Criteria of the choice of technologies

There was a lot of discussion to establish the criteria, and men and women rated the different criteria differently. Finally, the participants agreed on:

- Criteria 1: Improve yield
- Criteria 2: Increase biodiversity
- Criteria 3: Give income
- Criteria 4 : Crop Diversification
- Criteria 5: Improve water availability

3. Choice of the technologies

This choice has been made according to the methodology adopted during the Wageningen meeting, and described in deliverable 2.2. The chosen technologies are:

- **Zaï,**
- **Stones lines,**
- **Magoye Ripper to combine with use of compost manure**
- **Talya tray was a special choice of women for an experimentation to useful tree.**

Conclusion

The evaluation indicates good opinions of the participants to the meeting. There was regret amongst participants that the Magoye ripper was not selected, and the facilitator promised to contact the colleagues of Zambia to obtain a Magoye ripper for testing. This ripper was provided by the Zambian team during the meeting in Djerba in April 2013, and can therefore be tested in Burkina Faso.

II- ETHIOPIA

The 63 participants included one farmer from each Tabia, and District (Woreda) experts of natural resources management, irrigation, water resources, and rural development. From the farmer participants, only two were females and the remaining were males. Figure 3 gives an impression of the meeting.

About the preparation of facilitation plan and agenda for the stakeholder, an agreement was reached to implement the following process in the selection of the WHT: (1) Pre-selection of WHT, (2) Identification and definition of the criteria to make a choice between innovative WHT, and (3) Ranking the WHT by giving them a weight.

Figure 3. View of participants in Tigray (Ethiopia) (picture by K. Woldearegay)

1. Introduced and local technologies

Eight potential water harvesting technologies were presented by the MU WAHARA team, discussed by the participants and approved or improved.

Technology 1: Hillside Cisterns with bench terraces

Construction of bench terraces along with series of hillside cisterns to harvest water for horticultural production using low pressure drip systems.

Technology 2: Stone faced vs. soil faced trench bunds

Both soil faced trench bunds (a) and stone faced trench bunds (b) are used in the study areas. The purpose of this study will be to determine in which soil type and land use each performs best.

Technology 3: Hillside Conduits with series of ponds

With these hillside conduits, man-made small conveyance channels are used to direct water to fields at the foot of a hill. These systems could be used along with community ponds.

Technology 4: Percolation/sediment storage ponds with hand-dug wells

These technologies can be applicable at hill bottom if the farmland is characterized by high infiltration as good results were observed in many areas of Tigray (e.g Abreha Weatsbeha). They can encourage infiltration and subsequent recharge of the groundwater and enable the construction of hand dug wells

Technology 5: Check-Dams

Construction of series of check-dams reinforced with biological measures along a gully can ensure multiple benefits such as gully rehabilitation, water harvesting, improved availability of feed and fruit production.

Technology 6: Infiltration trenches coupled with biological measures

Construction of infiltration trenches following the root system of nitrogen fixing trees such as “Momona” and cutting/notching the root can ensure multiple benefits (reduced evaporation; increased feed, fuel wood and farm implement availability; and increased fertility).

Technology 7: Soil Improvement Methods

Implementation of different soil management techniques such as mulching, compost and effective micro-organisms can improve the fertility and productivity of the land.

Technology 8: Sub-surface Dams

Sub-surface dams are dams that are built across a (dry) stream bed. Dam and reservoir behind the dam are then filled with sand. Although this reduces storage capacity compared to a dam that is not covered, it also reduces evaporation and protects the reservoir.

A discussion was made on the presented WHT pre-selected by MU WAHARA team and the participants have fully accepted the proposed technologies. They have also added the following two technologies to be included in the pool of technologies to be ranked by the participants:

Technology 9: Large Semi-Circular Bunds

The participants have suggested that these technologies are among the introduced technologies in Tigray and they have recommended further research to be carried out on the design and performance of such technologies.

Technology 10: Deep tillage and other on farm moisture conservation techniques

The participants (especially the farmers) have stressed that one of the problem with moisture stress is the fact that only the top 15 cm of the soil mass is ploughed by the traditional “maresha”. With deep tillage, the soil can store more moisture and there is a strong need by the farmers for the introduction of technologies which can plough deeper than the traditional ploughing depth.

2. Criteria of the choice of technologies

The selected six WHT ranking criteria (C1-C6) are equally important.

C1: Improve productivity

C2: Profitable

C3: Technology that protect erosion, increase arable land and reclaim plantation

C4: Adaptable to different ecological conditions

C5: Adaptable and socially acceptable

C6: Beneficial to females and the youth.

3. Choice of the technologies

The next step in the process is to prioritize the 10 pre-selected WHT based on the six ranking criteria. As a result, each Woreda rated each WHT from 1 to 10 for each WHT ranking criteria. This finally resulted in the selection of the following technologies for implementation:

T1: Series of Hillside Cistern with bench terraces

T4: Percolation/sediment storage ponds with hand dug wells

T5: Check dams

T7: Soil improvement methods (Mulching, Compost, EM)

A more extensive stakeholder workshop report for Ethiopia is available in the WAHARA reports series (WAHARA report 15).

III- ZAMBIA

The stakeholders meeting was held on November 30th 2013. 25 persons participated in the meeting, 19 persons are farmers and 5 are female. Figure 5 shows the participants.
After the formalities which included an opening prayer, welcoming remarks and introductions, the meeting proceeded with the opening remarks from the moderator before a presentation by Mr Arthur Chomba, the site manager for the Zambia study site. This was followed by group discussions on the merits and de-merits of the ex-situ and in-situ water harvesting technologies. The meeting was concluded after some field demonstration of the conservation tillage systems that will be tested in the project (figure 4).

Figure 4. Field demonstration of conservation tillage systems (Picture A.Chomba)

The presentation included a recap of the first stakeholder meeting where the objectives of the project were introduced and the stakeholders exposed to some of the available water harvesting (WH) technologies. It then went on to explain the criteria used to eliminate some of the WH technologies based on the bio-physical information, market structure and information from the first stakeholder meeting. It was explained to the farmers that due to the nature of the water problems in Magoye, the rainfall patterns, costs and the existing farming practices, it was decided that the project will not involve the testing of ex-situ water harvesting technologies that require irrigation. Several in-situ water harvesting technologies will be tested to assess the most suited for the conditions in Magoye. These technologies and the suitability were elaborated as well as the advantages/disadvantages. The presentation then went on to outline the objectives of the technology tests and what information is expected from the farmers.

After the presentation a structured discussion then followed in which the farmers were asked to evaluate and prioritize the technologies and explain the criteria they used. What came out of the discussion was that the stakeholders were unanimous that WH technologies

that involve external storage tanks were not viable as they all preferred to have a borehole. Some of the farmers then wanted to know if the project will sink boreholes for them so that they can start gardens. It was explained to them that boreholes will only be water harvesting if they are putting in place measures to recharge groundwater. However, looking at the scale of the aquifers and the fact that there isn't a serious problem with groundwater resources, recharging groundwater will be beyond the scope of WAHARA and maybe unnecessary. It was also pointed out that the markets for fresh produce is not well organized as demonstrated by the lack of gardens with the farmers currently with boreholes (including those in attendance).

The meeting was then followed by a field demonstration in which the new technologies that will be tested were shown to the farmers. Most if these farmers are already familiar with the other two technologies listed in project for testing namely the planting basins (Zai pits) and the magoye ripper and therefore the demonstration were only for the new technologies. The new technologies were the ox-drawn strip tillage and the ox-drawn zero tillage with the GART planter. The discussion after the demonstration went on longer than anticipated due to the interest of the farmers. Two of the farmers that have already used the technologies were on hand to testify about the benefits.

Figure 5. Participants in the stakeholder meeting in Zambia (picture A.Chomba)

1. Choice of the technologies

- **Minimum-Till Basin Method**

Southern province is predominantly a cattle rearing region where animal draft power is the mainstay. Planting basins have not really caught on and the few farmers practicing this system are for demonstrations. The number of farmers is not precisely documented but are less than those using the Magoye Ripper.

The Minimum till basin method is a conservation farming practice involving the preparation of small holes where the crops are planted so as to reduce soil disturbance, maintain soil cover and harvest water.

- **Conservation Tillage with Magoye Ripper**

250 rippers were distributed in Magoye and surveys show that only about half of these farmers continued to use the ripper. The field sizes range from 1/4ha to 1/2ha.

Conservation Tillage with the Magoye Ripper is an animal draft reduced tillage method that involves the use of the Magoye Ripper to loosen the soil instead of ploughing as a way of conserving the soil and soil water.

- **Strip Tillage Conservation Farming**

The strip tillage technology is only in its first year of promotion – 5 farmers used the technology in the 2011/12 season. The field sizes range from 1ha to 4ha

Strip Tillage Conservation Farming is an animal draft reduced tillage method that involves loosening a strip of soil where the crop will be planted with a strip tillage tool to reduce soil disturbance and improve soil and water conservation.

- **Animal Draft Zero-Tillage**

The Zero-Till technology is only in its first year of promotion – 2 farmers used the technology in the 2011/12 season

Animal Draft Zero-Till involves the use of an animal drawn mechanical planter to plant directly in untilled soil to minimise soil disturbance and leave a cover of crop residues to conserve the soil.

Conclusion

The contributions from the participants also indicate that they understood the principles of WH from the first workshop. However, there were a few farmers who were clearly participating for the sake of receiving handouts. These farmers dominated the discussions by insisting on the project sinking boreholes. It seems expectations from the project were very high probably due to previous experiences with GART. These farmers were disappointed when it was made clear that the project will only test water conservation tillage practices.

Fortunately, the field demonstrations restored their interest in the project as they were very excited with the new tillage technologies and the planter. They were initially not able to generate an opinion on the new tillage technologies from the presentation having never being exposed to them. It was only after the field demonstrations that the discussions become lively and diverted away from the issue of boreholes. After discussions, the farmers clamoured to be on the list of test farmers.

The information on the choice experiment (to be reported in deliverable 2.4) was useful in explaining to the farmers what information was being sought after and their role in the experiment. The list of information to gather from the experiments was particularly useful. We were however not able to use the quick scan tool (deliverable 4.1) due to the limited time. All in all, the workshop was very successful in that the farmers are clearly on board and looking forward to participating.

IV- TUNISIA

Process and main dates

- Workshop: 04-12-2012 Share understanding and a mutual learning on indigenous and innovative WHTs techniques to drive a range of WHTs alternatives
- Workshop: 15-12-2012 Reach a consensus regarding a feasible and promising set of WHTs and potential sites for the implementation of selected WHTs based on applicability decision-key-factors
- Working days in Up-stream, Down-stream and Mid-stream for criterias selections

Table 3 shows which WHT were preselected to enter the selection procedure in the stakeholder workshop.

Table 3. Pre-selected water harvesting technologies

Techniques	Origin	Definition/comments
Jessour	Indigenous	Jessour is an ancient runoff water harvesting technique widely practiced in the arid highlands (WOCAT Database) http://cdewocat.unibe.ch/wocatQT/qt_summary.php?lang=English&qt_id=239
Tabias	Indigenous	The Tabia earthen dyke is a water harvesting technique used in the foothill and piedmont areas. (WOCAT Database) http://cdewocat.unibe.ch/wocatQT/qt_summary.php?lang=English&qt_id=236
Cisterns	Indigenous	Cisterns are reservoirs used for storing rainfall and runoff water for multiple purposes: drinking, animal watering and supplemental irrigation (WOCAT Database) http://cdewocat.unibe.ch/wocatQT/qt_summary.php?lang=English&qt_id=235
Recharge wells	Indigenous	A recharge well comprises a drilled hole, up to 30-40 m deep that reaches the water table, and a surrounding filter used to allow the direct injection of floodwater into the aquifer (WOCAT Database) http://cdewocat.unibe.ch/wocatQT/qt_summary.php?lang=English&qt_id=234
Adapted recharge wells	Modified technique	
Gabion check dams	Indigenous	The technology of check dam is a technique consisting of binding different gabion cages filled with small stones together to form a complete flexible gabion unit. (WOCAT Database). http://cdewocat.unibe.ch/wocatQT/qt_summary.php?lang=English&qt_id=238
Zai planting holes	Introduced (Zambia)	Zai is an ancestral planting pit developed in the Yatenga province, North Western part of Burkina Faso (where average rainfall is about 600 mm, with recurrent droughts and where soils are heavily encrusted. (Fatondji et al., 2006). Fatondji, D., Martius, C., Bielders, C. L., Vlek, P. L. G., Bationo, A., and Gerard, B., 2006, Effect of planting technique and amendment type on pearl millet yield, nutrient uptake, and water use on degraded land in Niger: Nutrient Cycling in Agroecosystems, v. 76, no. 2-3, p. 203-217.
Retention ditches	Introduced (Ethiopia)	Retention ditches located in steep areas of Kenya, where runoff is captured and allowed to infiltrate. (Critchley et al., 1994). Critchley, W. R., Reij, C., and Willcocks, T. J., 1994, Indigenous soil and water conservation: A review of the state of knowledge and prospects for building on traditions: Land degradation & rehabilitation, v. 5, no. 4, p. 293-314

The selection and evaluation of WHT involved scientists, representatives of regional and local authorities, representatives of civil societies and NGOs and land users. This approach was flexible, in the way that we can introduce new technologies based on WOCAT database that can be assessed or evaluated together with the indigenous techniques. Using Multi-criteria analysis, the central aim is to provide an explicit relative weighting system for different WHTs impacts. Well balanced multi-stakeholders, scientist and actors group were invited. Different WHs alternatives were scored in order of their importance or stakeholder's preference regarding their impacts on sustainability dimensions (economic, social and environmental).

WHTs evaluation and selection

Firstly a topology of preselected WHTs was done (Figure 6). WHTs presented on two axes typology matrix. The vertical axis concerns the scale from plot to whole watershed, and the horizontal axis is related to the times horizon from short term to long term.

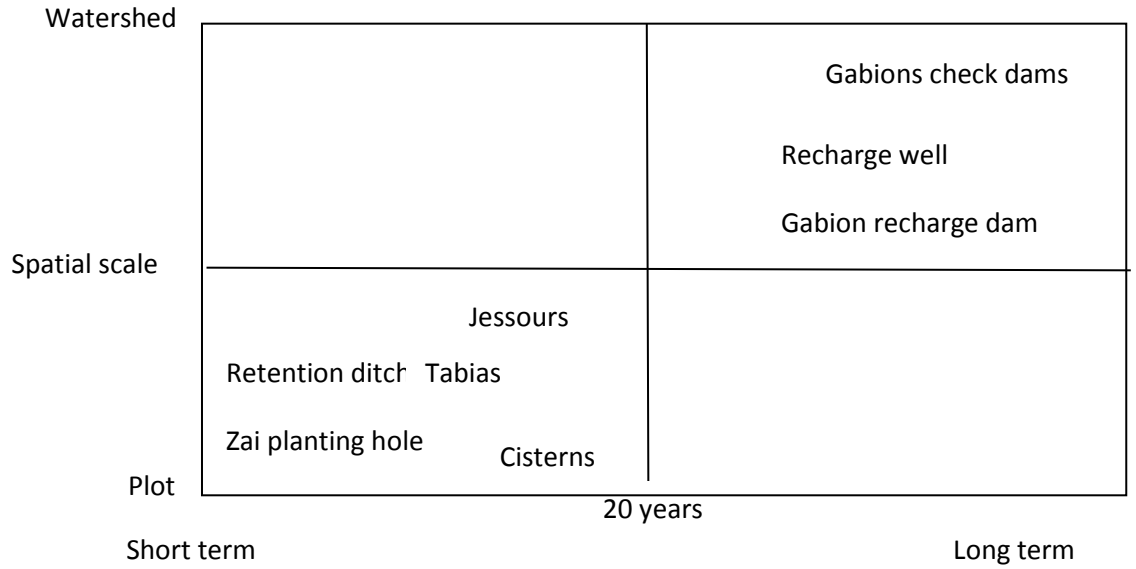

Figure 6. Topology of preselected water harvesting technologies in Oum Zessar watershed

Given the spatial and time scale and the construction costs two groups of WHTs were identified:

- Group 1 (Small and medium WHTs): Jessours, Tabias, Cisterns, Retention ditch and Zai planting hole
- Group 2 (Large/big WHTs): recharge well, Gabion check dams and Gabion recharge dams

Considering criterias that have been discussed and validated by scientist and stakeholders (table 4) each group of WHTs was scored separately. Three working days with farmers and several semi-structured interviewing were made with stakeholders and scientists for WHTs selection and evaluation. For each sustainable development dimension a balanced set of indicators was chosen. This chose was made to facilitate the scoring exercise and to be sure that all participants shared the same understanding.

Table 4. Final list of criteria

Criteria
Environmental • Conserving water & soil • Groundwater recharge • Conserving biodiversity Economic • Increasing crop yields • Increasing farm income • Low costs of implementation & maintenance Social • Increasing employment opportunities • Increasing food security • Resolving interest conflicts

Based on the scores of the different WHT, the following selection of WHT for implementation was made : Jessour, Gabion check dam, Tabia, Cistern and Recharge well. More information can be found in the full workshop report (WAHARA report 14).

V- CONCLUSION

The selection workshop allowed the WAHARA teams to strengthen the collaboration with partners in the study sites. It also showed a willingness of all stakeholder to be involved in field activities. In each country, people are interested to implement new technologies despite the risk. The advantages expected of the introduced technologies are to solve socio economic problems and the best adaptations to the effects of climate change. Table 5 gives and overview of the selected WHT for all 4 study sites

Table 5. WHT selected for test implementation in the 4 study sites

	Burkina Faso	**Ethiopia**	**Zambia**	**Tunisia**
1st selected WHT	Zaï	Series of Hillside Cistern with bench terraces	Minimum-Till Basin Method	Jessour
2nd selected WHT	Stones lines	Percolation/sediment storage ponds with hand dug wells	Conservation Tillage with Magoye Ripper	Gabion check dam
3rd selected WHT	Magoye Ripper to combine with use of compost manure	Check dams	Strip Tillage Conservation Farming	Tabia
4th selected WHT	Talya tray was a special choice of women for an experimentation to useful tree	Soil improvement methods (Mulching, Compost, EM)	Animal Draft Zero-Tillage	Cistern
5th selected WHT				Recharge well