Humanitarian Support to Arabica Coffee Communities
Coffee Quality Institute & Al Ezzi Coffee Company
Haraaz Region, Yemen

Despite the ongoing conflict in Yemen, coffee communities continue to produce, process and market Arabica coffee. The Al Ezzi Coffee Company located in Sana'a, Yemen, is working with fifty communities in the Haraaz region to improve food security and strengthen resilience. The current suspension of all economic development assistance is constraining the ability of Al Ezzi to provide support to their coffee farmer communities. In partnership with the Coffee Quality Institute (CQI), Al Ezzi seeks support to implement a one year assistance program focused on resilience, sustainability, and a strong partnership with local communities in the Haraaz Region.

Through crowd-funding mechanisms, $25,000 will be raised for dual purpose water projects in each of the five communities benefiting 30 families in each community. Total investment per beneficiary will be $140 with over a 20 percent return on investment.[1] Al Ezzi Coffee Company will interface with the communities, manage financing and program implementation. The Coffee Quality Institute will create the necessary networks within the U.S. specialty coffee sector to garner support for crowd-funding campaign through their retail outlets. A USAID humanitarian assistance provider will support implementation and monitor the program implementation.

A grant of $50,000 is needed to finance the crowd-funding outreach and marketing campaign conducted by the Coffee Quality Institute. Total cost of the project would be $175,000 with over $125,000 coming from private donations and $50,000 from a grant under the U.S.- Middle East Partnership Initiative (MEPI). Project would be implemented from July 2015 – June 2016 focused in five communities and would improve water availability for domestic and agricultural uses.

Program Description

As one of the most water stressed countries in the world (Yemen ranks seventh and is categorized as an "extreme risk" ), the critical limiting factor for increased vegetable production is lack of water. Small scale agriculture production programs using improved inputs (high quality seed, organic fertilizer, etc.), rainwater harvesting, and low tech drip irrigation systems have been shown to increase rural household income. Production located adjacent to homes has been reported to increase the likelihood that women will be involved in production and marketing decisions which in turn results in better nutrition outcomes for families.[2] Finding ways to provide domestic and agriculture water to Yemeni communities is especially critical given the current crisis causing a widespread lack of fuel for pumping water.

Rainwater harvesting can potentially serve both domestic and agriculture production needs by providing families with additional income, create an opening for women to manage an economic activity that is essentially located in, or adjacent to, their homes, and provide supplemental water. According to a global analysis of "multi-use" water systems the cost-benefit ratios range from

[1] See the attached cost benefit analysis which indicates that from a cost of $140 per beneficiary the project over the five year life span of the water harvesting system can realize a $173 per beneficiary profit from household vegetable production.
[2] Water and Livelihoods Initiative (WLI) research found that small scale agriculture production provides greater opportunity for woman's involvement especially if this seen as an in-home activity. Women's Empowerment in Agriculture Index: Case Studies, Dr. Sandra Russo (Univ. of Florida) and Dr. Samia Akroush (Jordan NCARE), in collaboration with International Center for Agricultural Research in the Dry Areas (ICARDA). See Case Study – Production, p. 9 "Key Findings," August 2012.

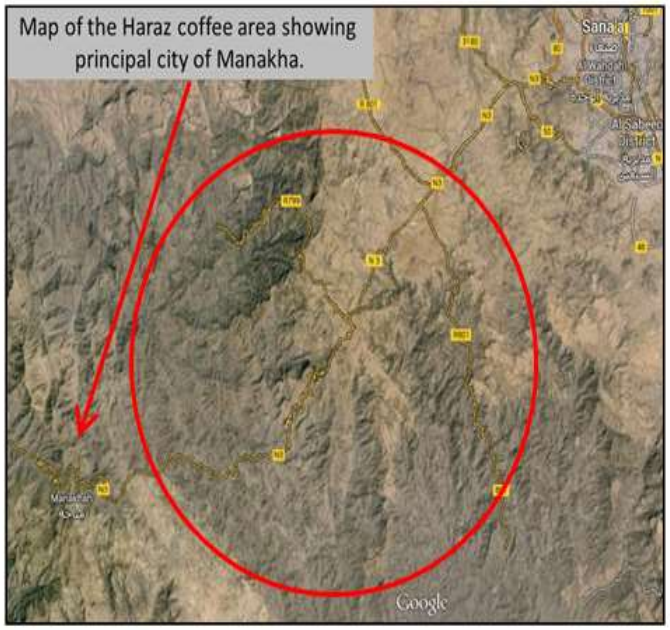
2.9 to 27 with benefits greatly outweighing costs.[3] At current vegetable prices in Yemen, small scale production via home gardens – approximately 50 square meters (5 m by 10 m) – could produce two vegetable crops a year providing a return on investment exceeding 20 percent (see attachment one - cost benefit analysis).

Water, a critical limiting factor for increased vegetable production, is primarily from wells or water catchments which are under increasing stress from ground water depletion and rising fuel prices. Water costs have increased significantly as the cost of fuel has risen to highest level in Yemen's modern history. This situation, increased domestic water demand and rising water costs, makes small scale horticulture production using rainwater harvesting, water storage, and micro-irrigation a viable enterprise that can be replicated across Yemen to increase food security and promote resilience (see attachment three).

A review of development literature indicates that the introduction of low pressure drip irrigation combined with rainwater harvesting and storage as well as agronomic and marketing support can promote sustainable small scale vegetable production. USAID experience with low tech drip systems in other countries has been successful. For example, in Zimbabwe, more than 24,000 drip irrigation vegetable plots have been established. Designed to save labor and water, enhance nutrition and improve food security, the average drip-irrigation kit is low cost, easy to install, and far more water efficient than traditional watering systems. Surplus vegetables produced by drip irrigation generated additional income for participants that contributed to expanding agriculture activities, keeping their children in school and obtaining better healthcare.[4]

Haraaz Region Rainwater Harvesting Program

This project will demonstrate the effectiveness of rainwater harvesting in the Haraaz Region (located in Sana'a and Dhamar governorates) for domestic and agriculture use. Approximately 30 families per community will be supported through the provision of rainwater harvesting equipment, water storage infrastructure, and low tech drip irrigation systems. Two horticulture crops per year will be produced and supplying part of the domestic water requirements of participating families. The purpose of this initiative is to demonstrate the technology and its potential to improve food security and improve access to domestic water in Arabica coffee producing communities of Yemen.




3 "Multiple-use Water Services: Cost-effective Investments to Reduce Poverty" Jojoh Faal, Alan Nicol, & Josephine Tucker. MUSGroup., See http://www.rippleethiopia.org/documents/stream/20090901-briefing-paper.

4 See http://transition.usaid.gov/stories/zimbabwe/ss_zimbabwe_dripirrigation.pdf

Based on the World Bank rainfall data for these governorates, the potential rainwater harvesting capacity of a roof top or a tile paved patio that is 10 meters by 5 meters (50 square meters or 540 square feet) is 5,147 gallons of water (see attachment one). This amount of rainfall is sufficient to produce at least two crops of cucumbers under micro-irrigation and supply part of a rural family's domestic water needs. Storage would be accomplished with the construction of an earthen storage pit measuring 1 m high by 2 m wide and 1 m long (2 cubic meters) with plastic lining and covered; this structure would serve as a water cistern with a storage capacity of more than 500 gallons.[5] Using low cost drip-irrigation technology, this amount water would be sufficient to irrigate two 50 square meter cucumber crops and provide part of the domestic water needs for a rural family.[6]

The Al Ezzi Coffee Company will work with 5 Arabica coffee producing communities in the Haraaz region to improve food security and strengthen resilience to social and economic shocks resulting from the ongoing conflict in Yemen. The current suspension of all economic development assistance is constraining the ability of Al Ezzi to provide support to their coffee farmer communities. In partnership with the Coffee Quality Institute (CQI) and a U.S. humanitarian assistance entity, Al Ezzi will support a one year rainwater harvesting and horticulture production program focused in the Haraaz Region.

Objectives

1. Create linkages between Haraaz coffee communities and U.S. specialty coffee retailers and their customers in order to promote empathy, awareness and market-based community development programs.

2. Establish crowd-funding campaigns using social media, web-based donor sites (e.g., GlobalGiving, VillageX, etc.) and specialty coffee outlets in the U.S. to finance specific community development activities in the Haraaz region.

3. Design and implement community-led development activities in five of the fifty Haraaz coffee communities with a focus on improving domestic water supply as well as increasing water available for agriculture production.

Through crowd-funding mechanisms, $25,000 will be raised for dual purpose water project in each of the five communities benefitting 30 families in each community. Total investment per beneficiary will be $140 with over a 20 percent return on investment.[7] Al Ezzi Coffee Company will interface with the communities, manage financing and program implementation. The Coffee Quality Institute will create the necessary networks within the U.S. specialty coffee sector to garner support for crowd-funding campaign through their retail outlets. A USAID humanitarian assistance provider will support implementation and monitor the program implementation.

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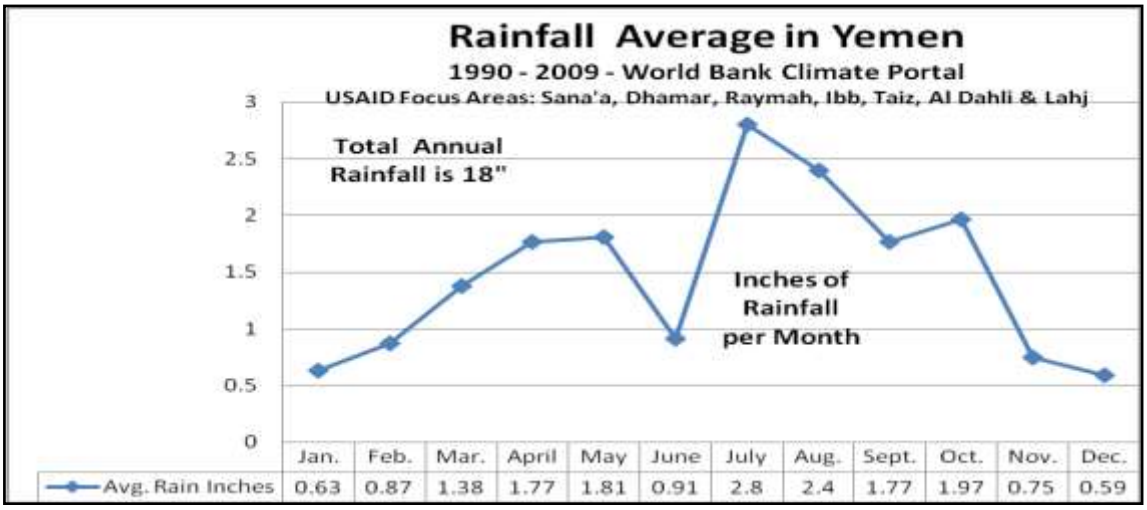
[5] 1 cubic meter equals 264.2 gallons

[6] The estimation is based on cucumbers have a 9 week growing season and requiring under normal conditions approximately 7.5 gallons of water per square foot per week. The total amount of water required for 50 square meters or 535 square feet of cucumber production would be 36,113 gallons (7.5 gallons per square foot) times 9 weeks of the growing season). With a drip irrigation system at 90 percent efficiency, the amount of water needed to produce the cucumber crop could be reduced to 3,618 gallons or 0.75 gallons per square foot.

[7] See the attached cost benefit analysis which indicates that from a cost of $140 per beneficiary the project over the five year life span of the water harvesting system can realize a $173 per beneficiary profit from household vegetable production.

A successful rainwater harvesting and micro-irrigation program design requires determining the amount of rainfall and estimating the potential amount of water that can be harvested and available. It is estimated that surface runoff to the sea in Yemen exceeds 270 million m3 of water annually.[3] The graph below, compiled from World Bank data indicates that seven key governorates receive an average of 18 inches of rain per year.




**Rainwater Harvesting, Domestic Water Use, Agriculture Use and Monthly Deficit* Gallons of Water**

| Months | Avg. Rain | $H_2O$ Storage | Rainfall on Veg. | Total Rainwater | Total $H_2O$ Needs | Water Deficit |
|---|---|---|---|---|---|---|
| Jan. | 0.63 | 184 | | 184 | 675 | 491- |
| Feb. | 0.87 | 254 | | 254 | 675 | 421- |
| Mar. | 1.38 | 402 | 447 | 850 | 1,881 | 1,031- |
| April | 1.77 | 516 | 573 | 1,090 | 1,881 | 791- |
| May | 1.81 | 528 | 586 | 1,114 | 1,881 | 767- |
| June | 0.91 | 265 | | 265 | 675 | 410- |
| July | 2.8 | 816 | 907 | 1,724 | 1,881 | 157- |
| Aug. | 2.4 | 700 | 778 | 1,477 | 1,881 | 404- |
| Sept. | 1.77 | 516 | 573 | 1,090 | 1,881 | 791- |
| Oct. | 1.97 | 574 | | 574 | 675 | 101- |
| Nov. | 0.75 | 219 | | 219 | 675 | 456- |
| Dec. | 0.59 | 172 | | 172 | 675 | 503- |
| | 17.65 | 5,147 | 3,865 | 9,012 | 15,336 | 6,324- |

Notes: (1) Average rainfall is based on the 20 year data from World Bank Climate Portal; (2) Water storage is the amount of rainfall that could be harvested each month with a 50 square meter catchment area (rooftop or patio) minus 10% loss – see attachment two for calculation; (3) Rainfall on vegetable plot is the average monthly rainfall during production season; (4) Total rainfall is the harvested rainfall plus rainfall on crop; (5) Total water needs is the estimated domestic water use based on a DFID survey in Africa (15 liters/person/day – Yemen - 6 family members) at 675 gallons per month plus water needed for vegetable crop at 1,206 gallons per month; (6) Water deficit is the total rainwater minus the total water needs (domestic and agriculture).[8] In terms of increased domestic water supply, supplementary methods of water collection might be attempted (e.g., fog collectors – see attachment six).

[3] See http://www.eoearth.org/article/Water_profile_of_Yemen.

[8] "Handbook for the Assessment of Catchment Water Demand and Use" DFID HR Wallington, Zimbabwe and Swaziland, pp. 90 – 91. May 2003 "

Attachment One - Horticulture Cost Benefit Analysis

| **Cucumber Value Chain*** | **Item** | **Without Project** | **Year 1** | **Year 2** | **Year 3 - 5** |
|---|---|---|---|---|---|
| Gross Revenue | Total Value of Production | $176 | $350 | $467 | $526 |
| Cash Sales | | $141 | $280 | $373 | $420 |
| Costs | Variable Costs | $65 | $175 | $175 | $175 |
| Net Revenue | Gross Margin | $76 | $105 | $198 | $245 |
| CASH Project Investment - $800 | Overhead | 0 | $200 | $200 | $200 for Year 3 & 4 |
| | Profit | $76 | $105 | $198 | $245 |
| Profit plus family labor | Net Farm Income** | $76 | $105 | $198 | $245 |

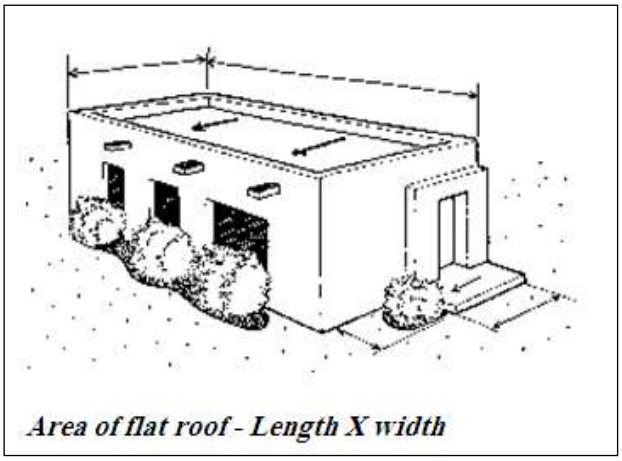
Price for cucumber in 2011 in Taiz, Ibb, Dhamar, Al Dali, Sana'a, Lahj and Rahmah averaged 180 YER per kg. However, this price fluctuates during the year from a low of 85 YR to 171 YR per kg. The farm-gate price received per kilogram for cucumber is estimated at 125 YER.

"Without Project" cucumber yield is estimated to be one fourth of US average cucumber yields in the US or approximately three metric tons per hectare. In a fifty square meter production area, the "Without Project" scenario will yield approximately 150 kgs of cucumber in two growing season (March – May & July – Sept.) which at 125 YR per kg would result in gross revenue of $176. Variable costs in the "Without Project" scenario are estimated to be $65 (labor, seed and soil preparation).

"With Project" yields are based on two crops a year with supplemental rainwater harvesting used for micro-irrigation (March –May and July – September). Total annual production area is estimated to be 100 sq. meters (two production cycles on a 50 sq. meter plot) with the following yields: Year One yield is 600 kg; Year Two 800 kg; Year Three through Five – 900 kg. Variable costs in the "With Project" scenario are estimated to be $175 (labor, seed, fertilizer, soil preparation and low tech drip system). Grant support provides rainwater harvesting system and water storage tank - $200 per year – and is not counted against production costs. Cash sales are estimated at 80% of Gross Revenue (with 20% of production being consumed by the family).

Attachment Two

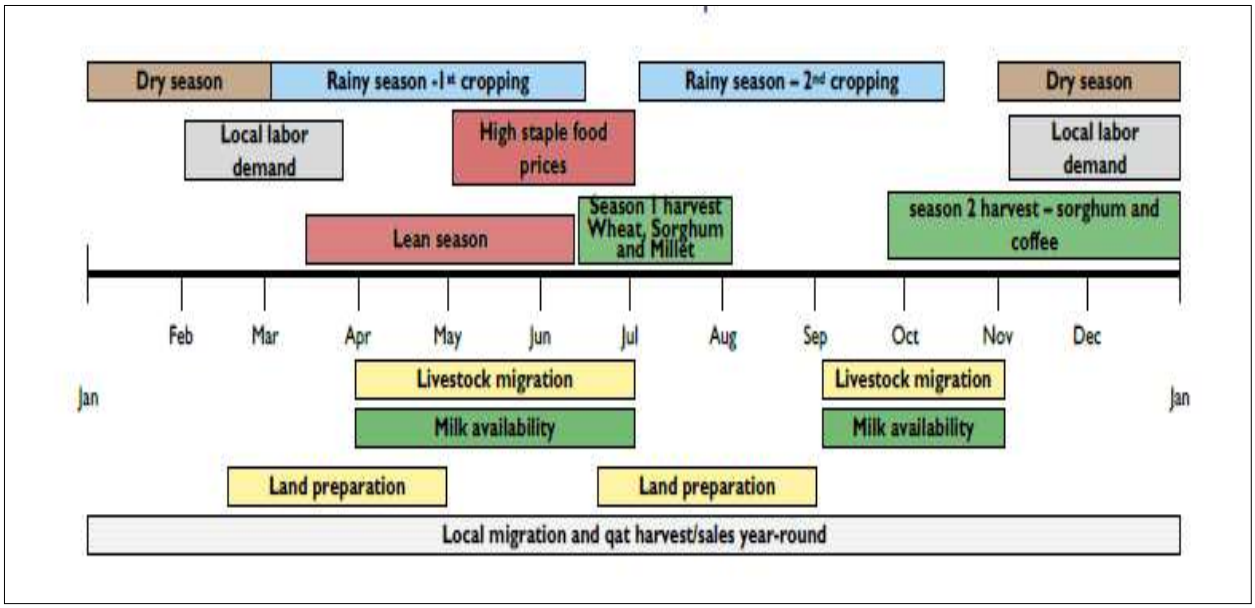
American Rainwater Catchment Systems Association - http://www.arcsa.org/



*Area of flat roof - Length X width*

**Table 2 --Annual Supply Form Roof Catchement**

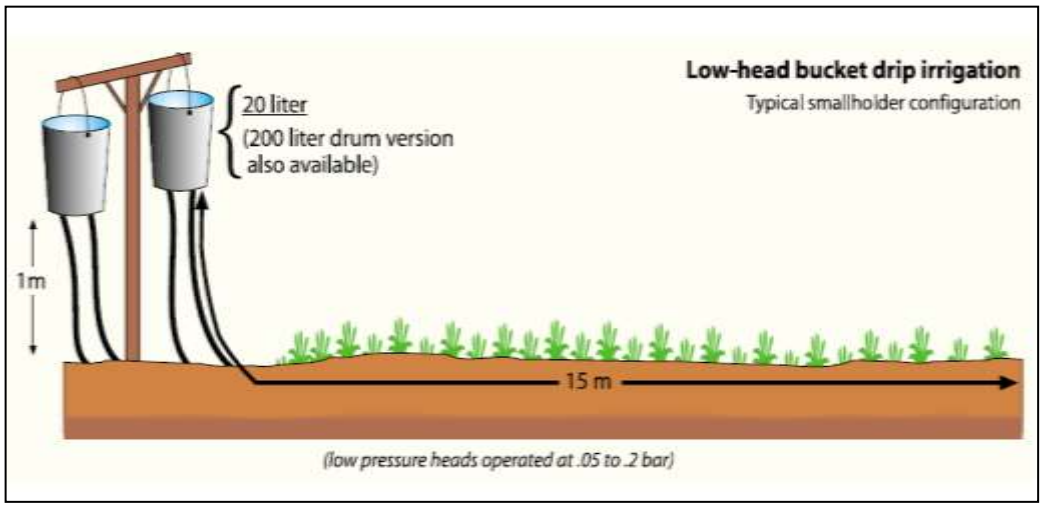
| Inches/Rainfall | Gallons/Square Foot |
|---|---|
| 0 | 0 |
| 1 | .6 |
| 2 | 1.3 |
| 3 | 1.9 |
| 4 | 2.5 |
| 5 | 3.1 |
| 6 | 3.7 |
| 7 | 4.4 |
| 8 | 5.0 |
| 9 | 5.6 |
| 10 | 6.2 |
| 11 | 6.8 |
| 12 | 7.5 |
| 13 | 8.1 |
| 14 | 8.7 |
| 15 | 9.3 |



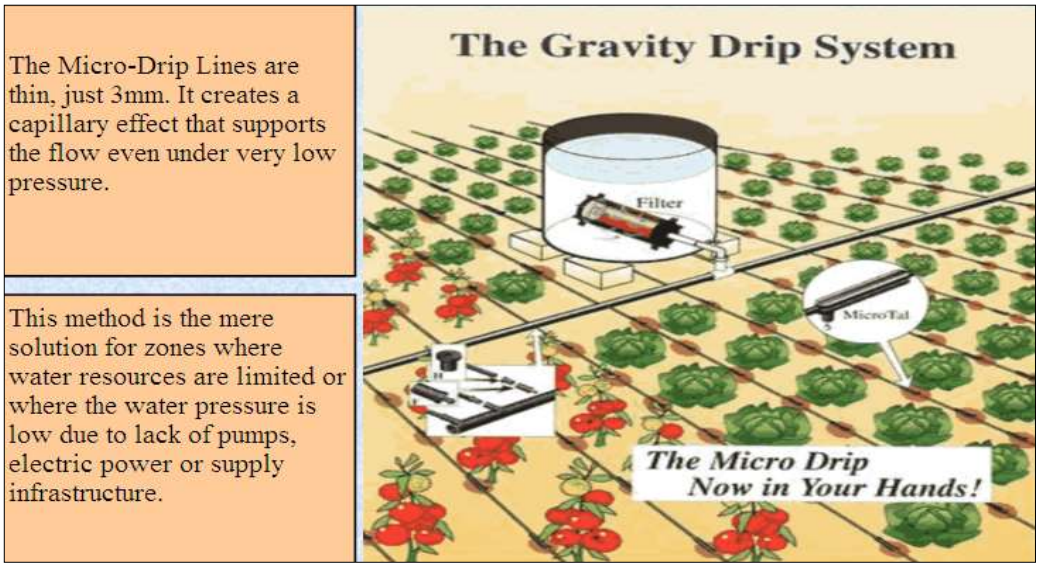

Yemen's Agriculture Seasons

Attachment Three – Micro-Irrigation Systems

Two potential approaches could be used either a low pressure system from Ein-Tal Irrigation Systems or very low tech gravity feed system promoted by the International Water Management Institute.




International Water Management Institute

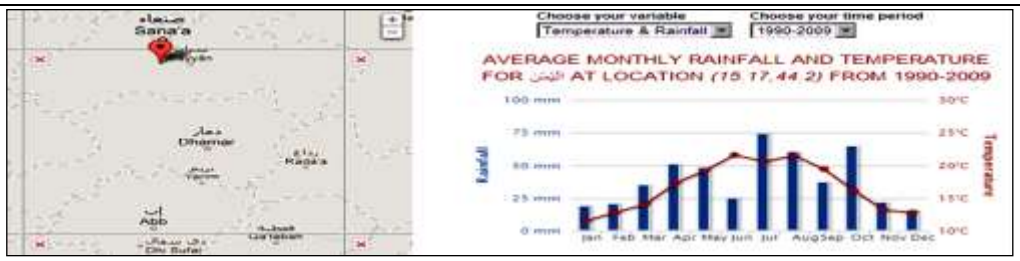



Ein-Tal Irrigation

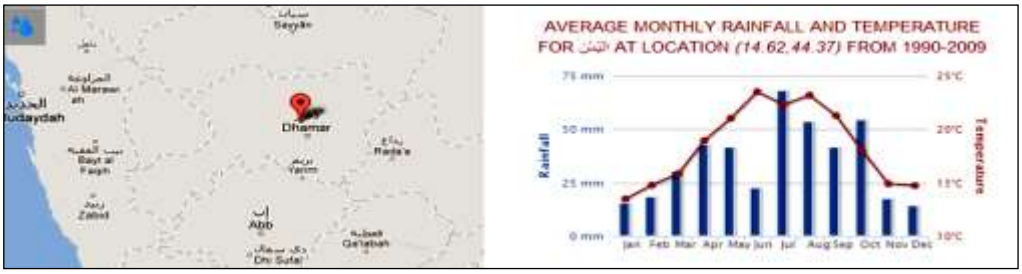
Attachment Four

# World Bank Climate Portal - Yemen Rainfall & Temperature Data

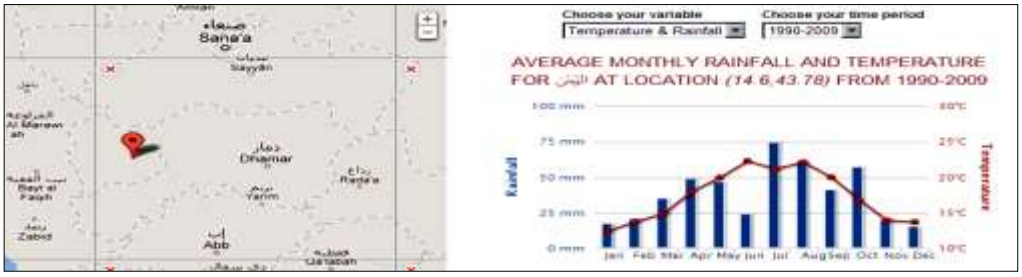
http://sdwebx.worldbank.org/climateportal/index.cfm?page=country_historical_climate&ThisRegion=Asia&ThisCCode=YEM#




SANA'A - Jan. – 19 mm; Feb. – 21mm; Mar. – 35 mm; April – 51mm; May – 48mm; June – 25mm; July – 74mm; Aug. – 61mm; Sept. – 37mm; Oct. – 65mm; Nov. – 22mm; Dec. – 16mm

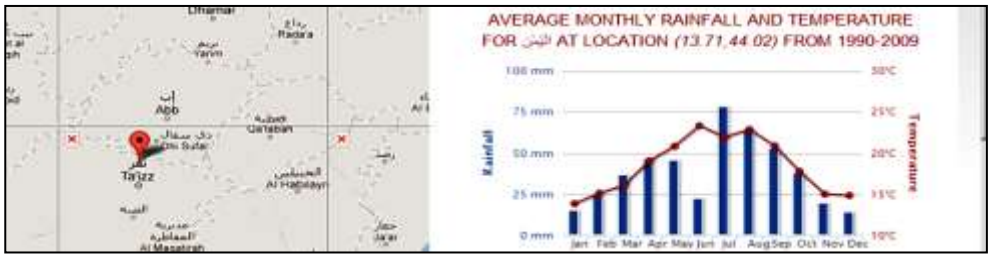



DHAMAR - Jan. – 15.5 mm; Feb. – 18.6 mm; Mar. – 31 mm; April – 43 mm; May – 42 mm; June – 23 mm; July – 68 mm; Aug. – 54 mm; Sept. – 42 mm; Oct. – 54 mm; Nov. – 18 mm; Dec. – 14 mm




RAYMAH - Jan. – 18mm; Feb. – 21mm; Mar. –35mm; April – 49mm; May – 47mm; June – 24mm; July – 74 mm; Aug. – 61mm; Sept. – 41mm; Oct. – 57mm; Nov. – 20mm; Dec. – 15mm


IBB - Jan. – 17mm; Feb. – 24mm; Mar. – 38 mm; April – 50 mm; May – 48mm; June – 25mm; July – 81mm; Aug. – 67mm; Sept. – 52 mm; Oct. – 48 mm; Nov. – 21 mm; Dec. –16 mm




TAIZ - Jan. – 15mm; Feb. – 24mm; Mar. – 37mm; April – 46mm; May – 45mm; June – 22 mm; July – 78mm; Aug. –64mm; Sept. – 53mm; Oct. – 38mm; Nov. – 20mm; Dec. – 14mm


LAHJ - Jan. – 14mm; Feb. – 21mm; Mar. –30mm; April – 40mm; May – 40mm; June – 20 mm; July – 66mm; Aug. – 54mm; Sept. – 47mm; Oct. – 34mm; Nov. – 17mm; Dec. – 14mm


AL DALI - Jan. – 17mm; Feb. – 24mm; Mar. –37mm; April –48 mm; May – 48mm; June – 25 mm; July – 78mm; Aug. –63 mm; Sept. –56 mm; Oct. – 48mm; Nov. – 19mm; Dec. – 16mm

Attachment Five – Previous Water Harvesting Activities

The Social Fund for Development (SFD) implemented rainwater harvesting activities as part of its effort to provide increased water supply to rural areas. Building on systems first established before the rise of the Roman Empire, SFD's interventions in the water sector focus on renewable water resources such as rainwater and springs. Their goal was to increase water availability to 30 l/c/d (liter per capita per day) within a 30 minute roundtrip throughout the year.
In Phase IV (2011-2015), SFD selected 4,400 communities based on needs criteria (100% of the houses don't have water in their premises; population at or above 300; and poverty index exceeds 50%). To provide communities with water for domestic use, SFD supported: rooftop rainwater harvesting; public rainwater harvesting – closed cisterns; public rainwater harvesting – open cisterns; surface water (springs and reservoirs); and ground water (shallow and deep wells).

Two key areas for discussion are:

(1) <u>What is the potential of using water catchments and drip irrigation to maintain or expand current coffee production areas?</u> Yemini coffee is severely water stressed and suffers lower lowers yields, what is the potential to focus USAID coffee production support to areas that have sufficient rainfall (possibly combined with water catchments) to raise yields. Yemen's per hectare average coffee yields are 1/3 to 1/2 of similar production in Uganda (250 kg/ha in Yemen versus 500 kg/ha in Uganda) – sufficient water, husbandry, quality control in harvesting, drying and processing, could result in raising yields and increasing quality which if combined with an effective export marketing program could increase net returns to small producers; and

(2) <u>How can we expand horticulture under rainwater harvesting systems?</u> The key constraint over the medium term is water and there needs to be an assessment of horticulture systems that could be self-sufficient – that is, could include water harvesting systems that meet their ag production requirements. One idea would be to explore is the potential of establishing "production pockets" linked to "community markets" where small scale producers (home gardens) are provided rainwater harvesting systems (collecting rainwater that runs off rooftops), horticulture production assistance, and marketing assistance linked to major wet markets as well as hotels and other institutions. This project can help evaluate the effectiveness of this production approach.