IRAN

- Area: 1.648 million km²
- Population: 75 million
- No. of provinces: 31
- Average Rainfall: 271 mm
- Cultivable Area: 51 million ha
- Potentially good & moderately good Crop land: 37 million ha
- Cultivated area: 18.5 million ha
- Irrigated area: 8 million ha

Drainage in IRAN; A Country Report

ARDAVAN AZARI

Drainage & Environment Working Group of IRNCID
Tehran- October 2011

Modern Irrigation & Drainage Networks in Iran

Total irrigated area in Iran: 8 million ha

Main Irrigation Canals – million ha

<table>
<thead>
<tr>
<th>Constructed</th>
<th>Under construction</th>
<th>On study phases</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.8</td>
<td>0.27</td>
<td>1.84</td>
<td>3.91</td>
</tr>
</tbody>
</table>

Rainfall and Runoff Volumes In the Country Main Basins - MCM

- Mean rainfall: 1/3 of world mean rainfall
- Mean evaporation: 3 times of mean world evaporation
- 70% of rainfall over 25% of lands
- Rainfall: 75% in winter season
- 25% in spring season
- Evaporation: 361

Khazar

Persian Gulf

Ghareh ghom

Uromieh

Urmia

Central Basin

Hamoon

Rainfall:

- 361
- Evaporation: 2899

Evaporation: 361
Iranian National Committee on Irrigation & Drainage (IRNCID)

Drainage & Environment Working Group

On-Farm Irrigation Network - million ha

<table>
<thead>
<tr>
<th>Constructed</th>
<th>Under construction</th>
<th>On study phases</th>
<th>Remainder area</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.82</td>
<td>0.08</td>
<td>0.90</td>
<td>2.13</td>
</tr>
</tbody>
</table>

ACTIVITIES

- Members: 13
- Published books: 22
- Workshops: 6
- Technical sessions on drainage challenges: 7
- Commenting on national standards
- Collaboration with other working groups
- Visits & surveys
Workshops

- First workshop (1999) - 9 articles
- Second workshop (2000) - 7 articles
- Third workshop (2003) - 11 articles
- Fourth workshop (2006) - 9 articles
- Fifth workshop (2008) - 9 articles
- Sixth workshop (2010) - 7 articles

Technical Visits & Surveys

Drainage challenges sessions with collaboration of many drainage experts of the country

- First session (2001) - Modification of drainage rate
- Second session (2002) - Controlled water table
- Fourth session (2006) - Improvement of drained water
- Fifth session (2007) - Drain envelops
- Sixth session (2010) - Drainage challenges in Khuzestan
- Seventh session (2011) - Use of models on drainage
Subsurface Drainage in Iran

Backgrounds

- First modern irrigation & drainage network, 1932 - southern part of the country (Bushehr & Khuzestan)
- Open drains (machine made) 1956 - Shavoor, Khuzestan
- Tile drains (by trenchers), 1963 - Ahvaz (Mollasani) 500 ha
- Hafftappeli project, 1966 - North Khuzestan, 11,000 ha
- Voshngir project, 1970s - East Mazandaran 18,000 ha
- Army pilot farm, 1970s - East Mazandaran, 7,000 ha
- Karoon project, 1970s - Khuzestan 24,000 ha

The location of drainage projects in Iran

General view of drainage in Iran – year 2011

<table>
<thead>
<tr>
<th></th>
<th>Constructed</th>
<th>Under construction</th>
<th>Designed</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subsurface drains</td>
<td>214,000</td>
<td>60,000</td>
<td>236,000</td>
<td>536,000</td>
</tr>
<tr>
<td>Deep open drains</td>
<td>26,000</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total existing drained area: 240,000 ha
The sugarcane has a main role of drained area in Khuzestan:

<table>
<thead>
<tr>
<th>Company</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haftteh sugarcane co. (1960s)</td>
<td>11,000 ha</td>
</tr>
<tr>
<td>Karoon sugarcane co. (1970s)</td>
<td>24,000 ha</td>
</tr>
<tr>
<td>Sugarcane development co. (1980s) - 7 sites</td>
<td>84,000 ha</td>
</tr>
<tr>
<td>Mianab sugarcane co. (1980)</td>
<td>6,000 ha</td>
</tr>
<tr>
<td><strong>Total area of sugarcane crop</strong></td>
<td><strong>125,000 ha</strong></td>
</tr>
</tbody>
</table>

Present condition & view of drainage in near future in KHOOZESTAN:

<table>
<thead>
<tr>
<th></th>
<th>Under operation</th>
<th>under construction</th>
<th>Designed</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Under operation</strong></td>
<td>140,000</td>
<td>30,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Designed</strong></td>
<td></td>
<td></td>
<td>236,000</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>406,000</td>
<td></td>
</tr>
</tbody>
</table>

Present drainage networks:

- **Total present drained area in IRAN**
  - 240,000 ha (100%)
  - 140,000 ha (58%)
  - 100,000 ha (42%)

- **Khuzestan region**
  - 140,000 ha (58%)

- **Other regions**
  - 100,000 ha (42%)

- **Khoozestan province**
  - 30,000 ha in Khoozestan
  - 30,000 ha in other parts

Under construction:

- 30,000 ha in Khoozestan
- 30,000 ha in other parts
The specifications of drainage projects in Iran

- **Type of drains:** Mostly subsurface pipe drains. (deep open drains also exist)
- **Type of pipes:** Corrugated & perforated plastic pipes. (in the past, tile & concrete pipes also used)
- **Envelope materials:** Sand & gravel. (recently synthetic envelops also used, but not yet evaluated)
- **Installation technique:** Trenchers with laser grade control. (in the past backhoe & excavators also used)
- **Type of collectors:** Mostly concrete pipes. (some open drains also used)
- **Inspection system:** Manholes & flushing pipe system.
- **Drain installation depth:** In the past 2.2 to 2.5; recently 1.5 to 1.8 m
- **Controlled water table depth:** In the past 1.2 to 1.5; recently 0.8 to 1 m
- **Drainage rate:** In the past 3 to 6; recently reduced up to 2 mm/day

Drainage in Moghan region
Two different characters of waterlogged areas of Iran

A: The wide & low slope plains
- Drainage is necessary if irrigation is done.
- Drainage must start when irrigation begins.
- Drainable area is the same as the irrigation area.
- The location of drained area follow the irrigated area.

B: The alluvial plains with or without lowland on downstream
- Not always drainage necessary if irrigation is done.
- The drainage problems appear few years after introduction of irrigation.
- Drainage is need only in the part of area(downstream).
- The location of drainable area may not follow the irrigated area.

Samples of two types of drainable area in IRAN

A: Flat plains with low level ground water
- All the area need drainage

B: Alluvial plains, lowland area on downstream
- All the area need drainage
Some our experiences that resulting in modification of criteria

✓ The laterals installed alternately in some projects, the results was Ok.

Causes:
✓ Over estimated Drainage rate.
✓ Not counted the direct discharge of the collectors & deep open drains

Examples of reducing of drain installation depths in the recent years

<table>
<thead>
<tr>
<th>Installation depth (m)</th>
<th>Year</th>
<th>project</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.8</td>
<td>1999</td>
<td>Sugarcane Development co.</td>
</tr>
<tr>
<td>1.5</td>
<td>2000</td>
<td>Dalaki</td>
</tr>
<tr>
<td>2</td>
<td>2001</td>
<td>Shadeghan</td>
</tr>
<tr>
<td>1.8</td>
<td>2001</td>
<td>behbahan</td>
</tr>
<tr>
<td>1.5</td>
<td>2010</td>
<td>Salamat</td>
</tr>
<tr>
<td>1.5</td>
<td>Under construction</td>
<td>Ra’d-kosar</td>
</tr>
<tr>
<td>1.5</td>
<td>Under construction</td>
<td>vals</td>
</tr>
</tbody>
</table>

Examples of reducing of drainage rate in the recent years

<table>
<thead>
<tr>
<th>Drainage rate (mm/day)</th>
<th>Year</th>
<th>project</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.6</td>
<td>1999</td>
<td>Sugarcane developing</td>
</tr>
<tr>
<td>3.5</td>
<td>2000</td>
<td>Dalaki</td>
</tr>
<tr>
<td>2.6</td>
<td>2001</td>
<td>Moghan</td>
</tr>
<tr>
<td>2.5</td>
<td>2001</td>
<td>behbahan</td>
</tr>
<tr>
<td>2</td>
<td>2010</td>
<td>Shadeghan</td>
</tr>
<tr>
<td>2</td>
<td>Under construction</td>
<td>Salamat</td>
</tr>
<tr>
<td>2</td>
<td>Under construction</td>
<td>Ra’d-kosar</td>
</tr>
<tr>
<td>2</td>
<td>Under construction</td>
<td>vals</td>
</tr>
</tbody>
</table>

Nowadays the drainage projects are designed with drainage rate of about 2 mm/day
Our Urgent Needs of Subsurface Drains in the country

- 700,000 ha. under modern irrigation networks (Rough estimated)
- 400,000 ha. in Khuzestan including 350,000 in Karkheh basin

Our experiences in alluvial plains with lowland in downstream

- Constructing the deep open drains in depressions, instead the pipe drains, in some plains; drainage problem reduced or solved completely.
- Drains installed only in the part of waterlogged area (downstream & critical waterlogged); the problem solved in other parts.
- Constructing the local open drains through the natural slope, shift the problem to the uncultivated desert area on downstream.

Thanks For your attentions