Micro irrigation and Fertilization
Protected cultivation

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and
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What is micro irrigation?

Frequent application of small quantities of water directly above and below the soil surface; usually as discrete drops, continuous drops, tiny streams, or micro spray; through emitters or applicators placed along a water delivery line.
High frequency, Low volume, Low pressure
Discharge range of micro irrigation emitters

Light soils - High discharge - Less operation time

Heavy soils - Less discharge – More operation time
A new concept of drip system to work on low operating pressure has found favour from farmers with small holdings.

Drum kit system, bucket kit are some other names given to such small drip systems.

4 types of low cost system for different elevation heads are designed and evaluated.

<table>
<thead>
<tr>
<th>Irrigation system</th>
<th>Elevation head, m</th>
<th>Tank, height, m</th>
<th>Total head, m</th>
<th>Tank capacity, litres</th>
<th>Cost of the system, Rs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>I1</td>
<td>4</td>
<td>1.1</td>
<td>5.10</td>
<td>1000</td>
<td>21,000</td>
</tr>
<tr>
<td>I2</td>
<td>3</td>
<td>1.1</td>
<td>4.10</td>
<td>1000</td>
<td>16,500</td>
</tr>
<tr>
<td>I3</td>
<td>2</td>
<td>1.0</td>
<td>3.0</td>
<td>200</td>
<td>3,000</td>
</tr>
<tr>
<td>I4</td>
<td>1</td>
<td>0.36</td>
<td>1.30</td>
<td>25</td>
<td>750</td>
</tr>
</tbody>
</table>
Fertigation is a field technique which precisely delivers the plant nutrients via irrigation system in the crop root zone according to the crop demand during crop growing season.

N = Nitrogen, K = Potassium
P = Phosphorus, + = Micro elements
Distribution of nutrients and water in soil

Sandy soil
- P
- K, NH₄
- NO₃

Sandy loam soil
- P
- K, NH₄
- NO₃

Loamy soil
- P
- K, NH₄
- NO₃

Chart showing soil moisture extraction pattern:

<table>
<thead>
<tr>
<th>Soil depth (cm)</th>
<th>% Soil moisture extraction</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 20</td>
<td>62.0</td>
</tr>
<tr>
<td>20 - 40</td>
<td>23.4</td>
</tr>
<tr>
<td>40 - 60</td>
<td>8.8</td>
</tr>
<tr>
<td>60 - 80</td>
<td>4.4</td>
</tr>
<tr>
<td>80 - 100</td>
<td>1.4</td>
</tr>
</tbody>
</table>

Sugarcane - Moisture Extraction Pattern Under Surface Drip

(Source: Rao, 1997)
FERTIGATION PROCESS
Fertigation Equipments

- Ventury Injector
- Fertilizer Tank
- Injector Pump
List of Fertilizer Suitable for Fertigation

N --------- P --------- K
& MICRONUTRIENTS

- Urea (46 – 0 – 0)
- Ammonium Nitrate (34 – 0 – 0)
- Ammonium Sulphate (21 – 0 – 0)
- Calcium Nitrate (16 – 0 – 0)
- Magnesium Nitrate (11 – 0 – 0)
- Urea Ammonium Nitrate (32 – 0 – 0)
- Potassium Nitrate (13 – 0 – 46)
- MAP (12 – 61 – 0)

- Potassium Chloride (0 – 0 – 60)
- Potassium Nitrate (13 – 0 – 46)
- Potassium Sulphate (0 – 0 – 50)
- Potassium Thiosulphate (0 – 0 – 25)
- MKP (0 – 52 – 34)

- Magnesium Nitrate (11 – 0 – 0)
- Urea Ammonium Nitrate (32 – 0 – 0)
- Potassium Nitrate (13 – 0 – 46)

- MAP (12 – 61 – 0)
- MKP (0 – 52 – 34)
- Phosphoric Acid (0 – 52 – 0)

- NPK
  19 – 19 – 19
  20 – 20 – 20

Micronutrients
- Fe EDTA (13%), Fe DTPA (12%), Fe EDDHA (6%), Zn EDTA (15%),
  Ca EDTA (9.7%), Rexolin CXK (B+Cu+Fe+Mn+Mo+Zn+Mg)
Fertigation scheduling and uptake

<table>
<thead>
<tr>
<th>Crop</th>
<th>Total nutrients, kg/ha</th>
<th>Crop development</th>
<th>Fertilizer application rate (kg/ha/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Stage</td>
<td>Weeks</td>
</tr>
<tr>
<td>Cucumber</td>
<td>135</td>
<td>112</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tomato</td>
<td>179</td>
<td>149</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pepper</td>
<td>135</td>
<td>112</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Corn age, days</th>
<th>Nutrients uptake, micro mol /m/day</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>P</td>
<td>K</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>26.9</td>
<td>11.3</td>
<td>52.9</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>32.4</td>
<td>0.90</td>
<td>12.4</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>18.5</td>
<td>0.86</td>
<td>8.0</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>11.2</td>
<td>0.66</td>
<td>4.75</td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>5.7</td>
<td>0.37</td>
<td>1.63</td>
<td></td>
</tr>
<tr>
<td>70</td>
<td>1.2</td>
<td>0.17</td>
<td>0.15</td>
<td></td>
</tr>
<tr>
<td>80</td>
<td>0.46</td>
<td>0.08</td>
<td>0.06</td>
<td></td>
</tr>
<tr>
<td>90</td>
<td>2.0</td>
<td>0.10</td>
<td>0.37</td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>4.2</td>
<td>0.23</td>
<td>0.16</td>
<td></td>
</tr>
</tbody>
</table>
Protected cultivation

- Modify a plant’s natural environment.
- Best alternative for using land and other resources.
- Protect plants from frost.
- Capitalize on early markets and higher prices.

Protected structures

- Greenhouse/polyhouse cultivation
- Shade net house cultivation
- Low tunnel cultivation
- **Physiology**
- **Physical aspects**
- **Equipment**

- Plant /growth factors
- Temp, RH, Radiation, CO₂
- Record above parameters
<table>
<thead>
<tr>
<th>ACRP No.</th>
<th>Name of ACRP</th>
<th>Geog. Area (Lha)</th>
<th>Names of the States</th>
<th>No. of district</th>
<th>Rainfall (mm)</th>
<th>Crop growing period (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Western Himalayan</td>
<td>331.39</td>
<td>H. P; J &amp; K Uttaranchal</td>
<td>39</td>
<td>165-2000</td>
<td>&lt;90 -210</td>
</tr>
<tr>
<td>II</td>
<td>Eastern Himalayan</td>
<td>274.94</td>
<td>Arunachal Pradesh; Assam; Manipur; Meghalaya; Mizoram; Nagaland; Sikkim; Tripura &amp; three districts of West Bengal.</td>
<td>79</td>
<td>1400-12000</td>
<td>&gt;270</td>
</tr>
<tr>
<td>III</td>
<td>Lower Gangetic Plains</td>
<td>69.73</td>
<td>15 districts of West Bengal</td>
<td>15</td>
<td>1300-2100</td>
<td>150-270</td>
</tr>
<tr>
<td>IV</td>
<td>Middle Gangetic plains</td>
<td>164.59</td>
<td>23 districts of Uttar Pradesh &amp; Bihar State</td>
<td>60</td>
<td>1211-1470</td>
<td>150-180</td>
</tr>
<tr>
<td>V</td>
<td>Upper Gangetic plains</td>
<td>141.08</td>
<td>40 districts of Uttar Pradesh</td>
<td>40</td>
<td>721-979</td>
<td>150-180</td>
</tr>
<tr>
<td>VI</td>
<td>Trans-gangetic Plains</td>
<td>116.80</td>
<td>Delhi; Haryana; Punjab; Chandigarh UT &amp; two districts of Rajasthan</td>
<td>48</td>
<td>360-890</td>
<td>&lt;90</td>
</tr>
<tr>
<td>VII</td>
<td>Eastern Plateau &amp; Hills</td>
<td>371.23</td>
<td>Chhattisgarh; Jharkhand; three districts of Madhya Pradesh; four districts of Maharashtra; 15 districts of Orissa &amp; one district of West Bengal.</td>
<td>57</td>
<td>1270-1430</td>
<td>&lt;120</td>
</tr>
<tr>
<td>VIII</td>
<td>Central Plateau &amp; Hills</td>
<td>371.64</td>
<td>30 districts of Madhya Pradesh; 20 districts of Rajasthan &amp; 7 districts of Uttar Pradesh</td>
<td>57</td>
<td>490-1300</td>
<td>&gt;120-150</td>
</tr>
<tr>
<td>IX</td>
<td>Western Plateau &amp; Hills</td>
<td>334.53</td>
<td>15 districts of Madhya Pradesh; 25 districts of Maharashtra and one district of Rajasthan.</td>
<td>41</td>
<td>602-1040</td>
<td>90-150</td>
</tr>
<tr>
<td>X</td>
<td>Southern Plateau &amp; Hills</td>
<td>400.14</td>
<td>14 districts of Andhra Pradesh; 21 districts of Karnataka and 13 districts of Tamilnadu.</td>
<td>48</td>
<td>576-1051</td>
<td>&lt;90</td>
</tr>
<tr>
<td>XI</td>
<td>East Coat Plains &amp; Hills</td>
<td>214.49</td>
<td>9 districts of Andhra Pradesh; 15 districts of Orissa; 15 districts of Tamilnadu and 4 districts of Pondicherry.</td>
<td>43</td>
<td>800-1904</td>
<td>115-210</td>
</tr>
<tr>
<td>XII</td>
<td>West Coast Plains &amp; Ghats</td>
<td>116.04</td>
<td>Goa; Kerala; 6 districts each of Karnataka &amp; Maharashtra and two districts of Tamilnadu.</td>
<td>30</td>
<td>1457-5000</td>
<td>&gt;270</td>
</tr>
<tr>
<td>XIII</td>
<td>Gujarat Plains &amp; Hills</td>
<td>196.63</td>
<td>Gujarat; D &amp; N Haveli and Daman &amp; Diu</td>
<td>28</td>
<td>340-1793</td>
<td>90-150</td>
</tr>
<tr>
<td>XIV</td>
<td>Western Dry</td>
<td>175.73</td>
<td>9 districts of Rajasthan</td>
<td>9</td>
<td>256</td>
<td>&lt;80</td>
</tr>
<tr>
<td>XV</td>
<td>The Islands</td>
<td>8.28</td>
<td>A &amp; N Islands and Lakshdweep.</td>
<td>3</td>
<td>2836-3159</td>
<td>&lt;270</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>3287.24</strong></td>
<td><strong>597</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Total water requirement (mm) of capsicum

<table>
<thead>
<tr>
<th>S. N.</th>
<th>Stages</th>
<th>Days after Transplanting</th>
<th>ET&lt;sub&gt;o&lt;/sub&gt;</th>
<th>ET&lt;sub&gt;c&lt;/sub&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Outside</td>
<td>Inside</td>
<td>Outside</td>
</tr>
<tr>
<td>1.</td>
<td>Initial</td>
<td>0-25</td>
<td>0-30</td>
<td>49.5</td>
</tr>
<tr>
<td>2.</td>
<td>Dev.</td>
<td>26-55</td>
<td>31-65</td>
<td>88.8</td>
</tr>
<tr>
<td>3.</td>
<td>Middle</td>
<td>56-95</td>
<td>66-110</td>
<td>170.4</td>
</tr>
<tr>
<td>4.</td>
<td>Late</td>
<td>96-120</td>
<td>111-140</td>
<td>122.2</td>
</tr>
</tbody>
</table>
Indeterminate tomato (Hybrids G.S.600) under different protected structures

<table>
<thead>
<tr>
<th>Force Ventilated Polyhouse</th>
<th>Naturally ventilated Polyhouse</th>
<th>Insect proof Net house</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-4 °C</td>
<td>2-3 °C</td>
<td>0.5-1.0 °C</td>
</tr>
</tbody>
</table>
## Comparison between open and protected cultivation yield

<table>
<thead>
<tr>
<th>Crops</th>
<th>Open cultivation (t/ha)</th>
<th>Protected cultivation (t/ha)</th>
<th>Increase (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capsicum</td>
<td>25</td>
<td>30</td>
<td>27.5</td>
</tr>
<tr>
<td>Tomato</td>
<td>40</td>
<td>45</td>
<td>42.5</td>
</tr>
<tr>
<td>Cucumber</td>
<td>15</td>
<td>20</td>
<td>17.5</td>
</tr>
<tr>
<td>Beans</td>
<td>10</td>
<td>15</td>
<td>12.5</td>
</tr>
<tr>
<td>Peas</td>
<td>10</td>
<td>15</td>
<td>12.5</td>
</tr>
<tr>
<td>Coriander</td>
<td>10</td>
<td>12</td>
<td>11.0</td>
</tr>
<tr>
<td>Spinach</td>
<td>10</td>
<td>15</td>
<td>12.5</td>
</tr>
</tbody>
</table>
Protected cultivation provide employment opportunities to the unemployed youth making it an attractive agricultural option for the farmers as well as at the service provider level with the business expanding into rural areas.

A total of 0.132 man days/m² required

India's labour force consists of 459 million workers. Out of these, 433 million (94%) are in the unorganized sector and the remaining 260 million (6%) are in the organized sector, according to a survey conducted by NSSO
Case study
General information

27° 4' and 28° 4' North Latitudes and 76° 7' and 77° 13' East Longitude at 250 Amsl

7,83,281 ha (2.5 % of the State)

12 sub-divisions,
16 tehsils,
14 panchayat samiti,
1946 inhabited village,
45 un-inhabited villages with
9 towns

Agro Ecological Sub Region (Northern plain including Aravallis, Hot Semi-Arid)

Agro-Climatic Zone (Central plateau and Hills Region).

Alluvial soils with high fertility

Av. rainfall (1957- 2010) : 611 mm

Annual PET : 1780 mm
Irrigation and crops

Irrigated area : 83 %  Rainfed area : 17 %

Double cropped area : 2,72,508 ha
  32,230 ha (12%) irrigated
  2,40,278 ha (88%) unirrigated

Kharif crops : Bajra, Maize, Jowar, Pulses, Arhar, Sesamum, Cotton, Guar

Rabi crops : Wheat, Barley, Gram, Mustard, Taramira, Pulses

Source of irrigation : Tubewells
  (35470 electric motors &
  66502 diesel pump sets)
Demography

✓ 36,71,999 year 2011 census
   (77th in India out of a total of 640)

✓ Population density- 438 inhabitants per square km

✓ Population growth rate - 22.7 %

✓ Sex ratio - 894 females for every 1000 males

✓ Literacy rate - 71.68%

✓ 82% of the farmers come under small (1-2 ha) and marginal (<1 ha) land holding categories

✓ Five rivers but deforestation and mining activities dried them
Normalized Difference Vegetation Index: Alwar District
Climate: Semi-arid, very hot in summer and extremely cold in winter
Ground water resources

- Main sources of irrigation are wells and tube wells
- Rates of ground water decline were maximum (pre-monsoon season 1.88 m/year and post monsoon -1.38 m/year) in Behror block

<table>
<thead>
<tr>
<th>Blocks</th>
<th>Dynamic ground water availability, Mm³</th>
<th>GW draft, Mm³</th>
<th>Stage of development, %</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fresh</td>
<td>Saline</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bansur</td>
<td>73.51</td>
<td>Nil</td>
<td>130.51</td>
<td>177.54</td>
</tr>
<tr>
<td>Behror</td>
<td>37.52</td>
<td>0.99</td>
<td>102.52</td>
<td>273.24</td>
</tr>
<tr>
<td>Kathumar</td>
<td>39.74</td>
<td>8.55</td>
<td>114.58</td>
<td>288.32</td>
</tr>
<tr>
<td>Kishangarh Bas</td>
<td>34.69</td>
<td>4.46</td>
<td>76.57</td>
<td>220.73</td>
</tr>
<tr>
<td>Kotkasim</td>
<td>47.29</td>
<td>4.02</td>
<td>89.51</td>
<td>189.28</td>
</tr>
<tr>
<td>Lachhmangarh</td>
<td>36.75</td>
<td>12.79</td>
<td>72.20</td>
<td>196.46</td>
</tr>
<tr>
<td>Mandawar</td>
<td>67.08</td>
<td>Nil</td>
<td>127.18</td>
<td>189.59</td>
</tr>
<tr>
<td>Neemrana</td>
<td>36.67</td>
<td>3.79</td>
<td>66.84</td>
<td>182.27</td>
</tr>
<tr>
<td>Rajgarh</td>
<td>28.05</td>
<td>1.88</td>
<td>50.24</td>
<td>179.11</td>
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<tr>
<td>Ramgarh</td>
<td>63.91</td>
<td>0.78</td>
<td>111.76</td>
<td>174.87</td>
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<tr>
<td>Reni</td>
<td>19.45</td>
<td>2.36</td>
<td>44.86</td>
<td>230.64</td>
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<tr>
<td>Thanagazi</td>
<td>35.03</td>
<td>0.66</td>
<td>46.54</td>
<td>132.86</td>
</tr>
<tr>
<td>Tijara</td>
<td>79.49</td>
<td>2.45</td>
<td>149.86</td>
<td>188.53</td>
</tr>
<tr>
<td>Umren</td>
<td>68.34</td>
<td>0.69</td>
<td>148.53</td>
<td>217.34</td>
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</tbody>
</table>
## Total water demand

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Components</th>
<th>Water demand, Mm³</th>
<th>% of total water demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Agriculture</td>
<td>1171.54</td>
<td>88.7</td>
</tr>
<tr>
<td>2.</td>
<td>Domestic</td>
<td>95.35</td>
<td>7.2</td>
</tr>
<tr>
<td>3.</td>
<td>Livestock</td>
<td>29.28</td>
<td>2.2</td>
</tr>
<tr>
<td>4.</td>
<td>Wildlife</td>
<td>0.495</td>
<td>0.038</td>
</tr>
<tr>
<td>5.</td>
<td>Industrial</td>
<td>25.21</td>
<td>1.91</td>
</tr>
<tr>
<td>6.</td>
<td>Forest</td>
<td>0.075</td>
<td>0.00567</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>1321.95</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Total ground water draft : 1331.7 Mm³
Selection of villages in consultation with KVK, Navagaon (working under RAU Rajasthan) and State Government

PR with farmers through interaction with KVK officials, Project staff and farmers of all the three villages

PRA study was conducted to get information on the socio-economic and demographic pattern and perception of farmers about water saving technologies
Survey of farmers field

Determination of tube well discharge

Soil samples collection

Interaction with the Industry
## Existing crops and irrigation technologies in the villages

<table>
<thead>
<tr>
<th>Season</th>
<th>Crop</th>
<th>Methods of water application</th>
<th>No. of irrigations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kharif</td>
<td>Bajra</td>
<td>Furrow</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Jwar</td>
<td>Furrow</td>
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# Soil physical properties

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## Soil nutrient status of farmers field

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Capacity building of farmers
## Water requirement

(i) Kharif onion

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(ii). Cotton

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<td>-----------------------------</td>
<td>-------------------</td>
<td></td>
</tr>
<tr>
<td>Kharif</td>
<td>Bajra</td>
<td>Furrow</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Jwar</td>
<td>Furrow</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gwar</td>
<td>Furrow</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cotton</td>
<td>Furrow</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Rabi</td>
<td>Wheat</td>
<td>Check Basin</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Barley</td>
<td>Furrow</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Musturd</td>
<td>Check Basin</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tomato</td>
<td>Check Basin</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chilli</td>
<td>Check Basin</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

Water savings technologies – disseminated and demonstrated

- Laser leveling
- Water conveyance system improvement
- Biogas slurry application through Micro irrigation
- Low head drip system
- Rain gun, sprinkler and drip
- Water harvesting
- Solar photovoltaic system
- Nursery raising
- Polyhouse
- Shade net house
✓ Bucket kit can produce-
  150 kg of bottle gourd
  90 kg of bitter gourd
  75 kg of okra

(March to June)
Layout for design of the system

Suresh 30.5
X 33 =
2676.5 m²

45 m
34.5 X 150 =
5175 m²

Total =
7851.5 m²

Borewell
7.5 HP
270 ft 12
Nozzles

W
N
E
S

150 m
60 m
44 m

144 m
24 m

33 m
33 m

66 m
56 m

150 m

06/02/2012
## Effect of drip irrigation on water savings in kharif onion

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Particular</th>
<th>Drip irrigation</th>
<th>Flood irrigation</th>
<th>Saving, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>No. of irrigation</td>
<td>20</td>
<td>10</td>
<td>50</td>
</tr>
<tr>
<td>2.</td>
<td>Time per irrigation (h)</td>
<td>1.31</td>
<td>4.32</td>
<td>69.7</td>
</tr>
<tr>
<td>3.</td>
<td>Total time of irrigation (h)</td>
<td>156.9</td>
<td>261.4</td>
<td>66.6</td>
</tr>
<tr>
<td>4.</td>
<td>Irrigation cost</td>
<td>18822</td>
<td>31368</td>
<td>66.7</td>
</tr>
<tr>
<td>5.</td>
<td>Irrigation water (m³)</td>
<td>3388</td>
<td>5646</td>
<td>66.7</td>
</tr>
<tr>
<td>6.</td>
<td>Yield (t/ha)</td>
<td>24</td>
<td>16</td>
<td>50</td>
</tr>
</tbody>
</table>
## Effect of drip irrigation on water savings in cotton

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Particular</th>
<th>Drip irrigation</th>
<th>Flood irrigation</th>
<th>Saving, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>No. of irrigation</td>
<td>33</td>
<td>12</td>
<td>63.6</td>
</tr>
<tr>
<td>2.</td>
<td>Time per irrigation (h)</td>
<td>1.2</td>
<td>2.36</td>
<td>49.1</td>
</tr>
<tr>
<td>3.</td>
<td>Total time of irrigation (h)</td>
<td>237</td>
<td>474</td>
<td>50.0</td>
</tr>
<tr>
<td>4.</td>
<td>Irrigation cost</td>
<td>28440</td>
<td>56880</td>
<td>50.0</td>
</tr>
<tr>
<td>5.</td>
<td>Irrigation water (m³)</td>
<td>5120</td>
<td>10240</td>
<td>50.0</td>
</tr>
<tr>
<td>6.</td>
<td>Yield (t/ha)</td>
<td>2.8</td>
<td>1.6</td>
<td>75.0</td>
</tr>
</tbody>
</table>
Protected Cultivation Technologies

NV polyhouse for vegetables
## Farmer field demonstration

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Particular</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Name and Address of the Farmer</td>
<td>Mr. Budha Singh Nangli, Ramgargh Alwar District, Rajasthan</td>
</tr>
<tr>
<td>2</td>
<td>Area under technology</td>
<td>Poly house - 1008 m2</td>
</tr>
<tr>
<td>3</td>
<td>Crops grown</td>
<td>Cucumber and Tomato</td>
</tr>
<tr>
<td>4</td>
<td>Economics (2015-16)</td>
<td>Gross Income=275000, Cost of cultivation=174065, Net return=100935 (1500 USD)</td>
</tr>
<tr>
<td>5</td>
<td>Impact of technology</td>
<td>Water saving = 42.5%, Yield increase = 38 %</td>
</tr>
</tbody>
</table>
## Farmer field demonstration

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Particular</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Name and Address of the Farmer</td>
<td>Mr. Jitenrda Saini, Gujuki, Tahseel and District - Alwar, Rajasthan</td>
</tr>
<tr>
<td>2</td>
<td>Area under Technology</td>
<td>Poly house=7168 M2 Drip Irrigation =2.75 ha</td>
</tr>
<tr>
<td>3</td>
<td>Crops grown</td>
<td>Cucumber, Tomato, cauliflower, Capsicum</td>
</tr>
<tr>
<td>4</td>
<td>Economics (2015-16)</td>
<td>Gross Income=3312935 Cost of cultivation=1165704 Net return=2147231 (32500 USD)</td>
</tr>
<tr>
<td>5</td>
<td>Impact of technology</td>
<td>Water saving = 48% Yield increase = 41 %</td>
</tr>
<tr>
<td>S.No.</td>
<td>Particular</td>
<td>Detail</td>
</tr>
<tr>
<td>-------</td>
<td>----------------------------------------</td>
<td>------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| 1     | Name and Address of the Farmer         | Mr. Hari singh  
Village Nangli District Alwar (Rajasthan)                             |
| 2     | Area under technology                  | Drip irrigation system= 1 ha  
Poly house= 1008 m2                                                      |
| 3     | Crops grown                            | Cucumber, Ber, Cotton and wheat                                        |
| 4     | Economics (2015-16)                    | Gross Income=317400  
Cost of cultivation=88,000  
Net return=229400 (3444 USD)                                             |
| 5     | Impact of technology                   | Water saving = 45 %  
Yield increase = 41 %                                                    |
## Farmer field demonstration

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Particular</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Name and Address of the Farmer</td>
<td>Mr. Jagdeesh Rajput Village Tilwar District Alwar (Rajasthan)</td>
</tr>
<tr>
<td>2</td>
<td>Area under technology</td>
<td>Drip irrigation system= 0.04 ha Poly house= 1008 M2</td>
</tr>
<tr>
<td>3</td>
<td>Crops grown</td>
<td>Tomato, Potato and cucumber</td>
</tr>
<tr>
<td>4</td>
<td>Economics (2015-16)</td>
<td>Gross Income=1,85,000 Cost of cultivation=52,000 Net return=133000 (2000 USD)</td>
</tr>
<tr>
<td>5</td>
<td>Impact of technology</td>
<td>Water saving = 48 % Yield increase = 31 %</td>
</tr>
</tbody>
</table>
## Farmer field demonstration

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Particular</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Name and Address of the Farmer</td>
<td>Mr. Omprakash Village Chauma District Alwar (Rajasthan)</td>
</tr>
</tbody>
</table>
| 2     | Area under technology         | Drip irrigation system= 1 ha  
Poly house= 1008 M2                                                                                      |
| 3     | Crops grown                   | Tomato, Wheat, cotton and cucumber                                                                     |
| 4     | Economics 2015-16 (Rs.)       | Gross Income=2,17,000  
Cost of cultivation=95,000  
Net return=1,22,000 (1830 USD)                                                                           |
| 5     | Impact of technology          | Water saving = 48 %  
Yield increase = 39 %                                                                                   |
Shade Net

Reduced inside temperature by 4-5°C in hot and dry climate of summer season.

Vegetable produced 40 ton in 0.4 ha

Net profit of Rs. 4 lakh/year

Farm Women Innovators-2012, ICAR, New Delhi
## SPV linked Micro irrigation

<table>
<thead>
<tr>
<th>Water table depth, m</th>
<th>Drip system</th>
<th>Mini sprinkler system</th>
<th>Sprinkler system</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td>4000</td>
<td>5500</td>
<td>7300</td>
</tr>
<tr>
<td>45</td>
<td>5000</td>
<td>6500</td>
<td>8200</td>
</tr>
<tr>
<td>55</td>
<td>5600</td>
<td>7200</td>
<td>9200</td>
</tr>
</tbody>
</table>

Return period 5 yr  SPV 64% of Diesel PS in 10 yr
✓ Production cost per seedling: Rs. 0.6 to 0.7 without seed cost

✓ 1.5 to 2.0 lakhs seedling in 500 m² area under semi climate controlled poly house (10 to 16 lakhs in year, 6-8 batch per year)

✓ Benefits:

Selling price Rs. 1.5 to 2.0 / seedlings

Income: 4-8 lakhs per year

Employment generation: 2-3 persons/structure

✓ Developing seedlings 15 days earlier with minimal mortality also helps in earning extra benefit of Rs 37,500-50,000 per ha
युवा पीढ़ी के लिए प्रेरणा देने : जितेन्द्र

अक्षांश रेखाओं के लिए निर्देश तथा उनके नाम और उनके अंतर्गत दी यह प्रेरक हिन्दी के रूप में है जो निर्देशित यह प्रेरक का दर्शाव किया है जो यह प्रेरक का दर्शाव किया है जो यह प्रेरक का दर्शाव किया है जो यह प्रेरक का दर्शाव किया है। निर्देशित यह प्रेरक का दर्शाव किया है जो यह प्रेरक का दर्शाव किया है जो यह प्रेरक का दर्शाव किया है जो यह प्रेरक का दर्शाव किया है।

मुख्य बांधन में ही ईंट उत्पादन का आयात नहीं होगा। जिसे निर्देशित यह प्रेरक का दर्शाव किया है जो यह प्रेरक का दर्शाव किया है जो यह प्रेरक का दर्शाव किया है जो यह प्रेरक का दर्शाव किया है जो यह प्रेरक का दर्शाव किया है।

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मुख्य बांधन के निर्देशित यह प्रेरक का दर्शाव किया है जो यह प्रेरक का दर्शाव किया है जो यह प्रेरक का दर्शाव किया है जो यह प्रेरक का दर्शाव किया है।
1 बीघा से 80 हजार

पूर्व सांसद

जयपुर अन्तर्राष्ट्रीय बागवानी, अग्रणी, चीनी, नागरिक, राष्ट्रीय, इंटरनेट, दुनिया, महादेव पार्क ने नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए विद्युत के लिए मिल जाने के मद्देनजर में नए
Development of Decision Support System for design of micro irrigation system based on agro-climatic data
<table>
<thead>
<tr>
<th>Input parameters needed</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Topographical data</strong></td>
</tr>
<tr>
<td><strong>Water source</strong></td>
</tr>
<tr>
<td><strong>Agricultural details</strong></td>
</tr>
<tr>
<td><strong>Climatological data</strong></td>
</tr>
<tr>
<td><strong>Soil and water</strong></td>
</tr>
</tbody>
</table>
Database available in default
1. India-States-Districts Administrative Boundary Data

- Administrative boundary data from various data sources like scanned maps, SOI toposheet, websites, census of India maps available online were used to generate GIS layers for creation of base map. Different layers were created for Country, states and districts level mapping. Total 641 districts were included in the database.
2. Generation and compilation of Soil Database

• Soils physico-chemical parameters were extracted from the collected data and Harmonized World Soil Database viewer ver. 1.21 software developed by Food and Agriculture Organization of the United Nations (FAO), Chinese Academy of Sciences (CAS), International Institute for Applied Systems Analysis (IIASA), International Soil Reference and Information Centre (ISRIC), Joint Research Centre of the European Commission (JRC) using Arc GIS, MS Access and MS Excel. World Image were extracted in .bill format and then converted into shape file format for GIS data analysis. Later, the boundary of India was over layed and clipped from the shape file and a new shape file was generated containing soil information of each district at a the scale of 1:1000000 after applying many image and data processing algorithms.

• District wise GIS database created for whole India using available online and offline data sources where 29 States and 641 Districts were created in different GIS layers.
Soil related Data has been attached with each corresponding district on 1:100000 scale for whole India.

District Soil Type maps were created for whole India.
3. District wise Ground Water level multi location Database

- District wise multiple location based Groundwater level data were downloaded for whole India from Central Ground Water Board/NIC website for period from 2005 to 2009. This data was refined further and outlier figures were deleted from the data to avoid disparity and average value for each given location were calculated. Also some of the districts does not have any data for groundwater level and these districts were marked as 'No Data Available'. The data will be collected from other sources in the future and simultaneously database will be updated time to time.

<table>
<thead>
<tr>
<th>STATE</th>
<th>DISTRICT</th>
<th>LOCATION</th>
<th>Average GW Level (mtr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Telangana</td>
<td>Adilabad</td>
<td>Abdullapur</td>
<td>15.235</td>
</tr>
<tr>
<td>Telangana</td>
<td>Adilabad</td>
<td>Adilabad1</td>
<td>7.388</td>
</tr>
<tr>
<td>Telangana</td>
<td>Adilabad</td>
<td>Asifabad</td>
<td>11.748</td>
</tr>
<tr>
<td>Telangana</td>
<td>Adilabad</td>
<td>Asifabad1</td>
<td>21.315</td>
</tr>
<tr>
<td>Telangana</td>
<td>Adilabad</td>
<td>Asifabad2</td>
<td>21.195</td>
</tr>
<tr>
<td>Telangana</td>
<td>Adilabad</td>
<td>Basar-PZ</td>
<td>7.580</td>
</tr>
<tr>
<td>Telangana</td>
<td>Adilabad</td>
<td>Bela1</td>
<td>4.956</td>
</tr>
<tr>
<td>Telangana</td>
<td>Adilabad</td>
<td>Bela-PZ</td>
<td>5.540</td>
</tr>
<tr>
<td>Telangana</td>
<td>Adilabad</td>
<td>Bellampally</td>
<td>3.133</td>
</tr>
<tr>
<td>Telangana</td>
<td>Adilabad</td>
<td>Bellampally1</td>
<td>18.858</td>
</tr>
<tr>
<td>Telangana</td>
<td>Adilabad</td>
<td>Bhimavaram1</td>
<td>6.422</td>
</tr>
<tr>
<td>Telangana</td>
<td>Adilabad</td>
<td>Bhimini -PZ 1</td>
<td>4.568</td>
</tr>
<tr>
<td>Telangana</td>
<td>Adilabad</td>
<td>Bhimini-PZ 2</td>
<td>3.908</td>
</tr>
<tr>
<td>Telangana</td>
<td>Adilabad</td>
<td>Bhosi</td>
<td>12.625</td>
</tr>
<tr>
<td>Telangana</td>
<td>Adilabad</td>
<td>Boath</td>
<td>7.250</td>
</tr>
<tr>
<td>Telangana</td>
<td>Adilabad</td>
<td>Boath-PZ</td>
<td>4.292</td>
</tr>
<tr>
<td>Telangana</td>
<td>Adilabad</td>
<td>Chennur</td>
<td>36.563</td>
</tr>
<tr>
<td>Telangana</td>
<td>Adilabad</td>
<td>Chennur1</td>
<td>28.168</td>
</tr>
<tr>
<td>Telangana</td>
<td>Adilabad</td>
<td>Dandepalli-PZ</td>
<td>4.182</td>
</tr>
<tr>
<td>Telangana</td>
<td>Adilabad</td>
<td>Dantlapally</td>
<td>5.452</td>
</tr>
<tr>
<td>Telangana</td>
<td>Adilabad</td>
<td>Echoda</td>
<td>4.270</td>
</tr>
<tr>
<td>Telangana</td>
<td>Adilabad</td>
<td>Echoda-PZ</td>
<td>5.516</td>
</tr>
<tr>
<td>Telangana</td>
<td>Adilabad</td>
<td>Gudihatthur</td>
<td>3.926</td>
</tr>
</tbody>
</table>
4. District wise Climatic Data Tables and Maps

• The following climatic parameter data were downloaded of all the districts of 29 states and 7 UT’s of India from indiawaterportal website - Average Temperature, Cloud cover, Diurnal Temperature, Ground frost frequency, Maximum Temperature, Minimum Temperature, Potential Evapotranspiration, Precipitation, Reference Crop Evapotranspiration, Vapour Pressure, Wet day Frequency. Some of the district data were missing and also some of the whole state have no data particularly near to coastal areas of Arabian sea.

• 40 years (1963-2002) data was extracted from the downloaded data for all the districts of India to calculate and analysis of important agro-climatic parameters.

• Yearly and monthly average of 40 years (1963-2002) were calculated for all the parameters and of all the available districts.
A database for monthly averaged Potential Evapotranspiration ($ET_0$ mm/day) for given 40 years data was compiled for all districts.
5. Solar and wind Energy Database

• Solar Energy data (GHI - Global Horizontal Irradiance and DNI - Direct Normal Irradiance) was downloaded from National Renewable Energy Lab website for whole India and District wise GIS layers were generated.
District wise Wind Speed data were downloaded and was attached with corresponding district database in GIS environment.

<table>
<thead>
<tr>
<th>A</th>
<th>State</th>
<th>District</th>
<th>B</th>
<th>Wind_Jan</th>
<th>Wind_Feb</th>
<th>Wind_March</th>
<th>Wind_April</th>
<th>Wind_May</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Andaman &amp; Nicobar Island</td>
<td>Nicobar</td>
<td></td>
<td>24.183</td>
<td>18.855</td>
<td>15.048</td>
<td>12.816</td>
<td>18.432</td>
</tr>
<tr>
<td>3</td>
<td>Andaman &amp; Nicobar Island</td>
<td>North &amp; Middle Andaman</td>
<td></td>
<td>19.606</td>
<td>15.35</td>
<td>12.823</td>
<td>13.86</td>
<td>18.77</td>
</tr>
<tr>
<td>5</td>
<td>Andhra Pradesh</td>
<td>Anantapur</td>
<td></td>
<td>10.724</td>
<td>12.028</td>
<td>12.1</td>
<td>12.816</td>
<td>15.104</td>
</tr>
<tr>
<td>7</td>
<td>Andhra Pradesh</td>
<td>East Godavari</td>
<td></td>
<td>15.379</td>
<td>15.883</td>
<td>16.639</td>
<td>18.187</td>
<td>17.41</td>
</tr>
<tr>
<td>8</td>
<td>Andhra Pradesh</td>
<td>Guntur</td>
<td></td>
<td>11.385</td>
<td>12.159</td>
<td>12.762</td>
<td>14.904</td>
<td>16.038</td>
</tr>
<tr>
<td>10</td>
<td>Andhra Pradesh</td>
<td>Kurnool</td>
<td></td>
<td>9.706</td>
<td>10.843</td>
<td>10.937</td>
<td>12.204</td>
<td>15.271</td>
</tr>
<tr>
<td>14</td>
<td>Andhra Pradesh</td>
<td>Visakhapatnam</td>
<td></td>
<td>14.268</td>
<td>14.754</td>
<td>15.774</td>
<td>17.382</td>
<td>16.428</td>
</tr>
<tr>
<td>15</td>
<td>Andhra Pradesh</td>
<td>Vizianagaram</td>
<td></td>
<td>14.16</td>
<td>14.904</td>
<td>16.656</td>
<td>18.492</td>
<td>17.472</td>
</tr>
</tbody>
</table>
6. Crop coefficient and crop spacing database

• Crop coefficient data were compiled for Horticulture, cereals, pulses, spices, ornamental, medicinal crops according to their length of crop development stages. These data were collected from FAO 24 & 56, and some from research papers and other sources.

• Crop spacing data was collected from the book “Handbook of Horticulture” ICAR, New Delhi and from the guidelines of MIDH program.
8. Database of district wise major crops grown...

- The database of District wise major crops have been generated. It include all cereal crops, horticulture (Vegetables, Fruits, medicinal and aromatics) crops, fibre crops, oilseed and millet crops etc. A screen shot of the same has given below here-

<table>
<thead>
<tr>
<th>C</th>
<th>Andaman &amp; Nicobar Island</th>
<th>D</th>
<th>Andhra Pradesh</th>
<th>AD</th>
<th>Arunanchal Pradesh</th>
<th>AL</th>
<th>Assam</th>
<th>BI</th>
<th>Chhattisgarh</th>
</tr>
</thead>
<tbody>
<tr>
<td>South Andaman</td>
<td>Rice</td>
<td>Rice</td>
<td>Rice</td>
<td>Rice</td>
<td>Sali rice</td>
<td>Rice</td>
<td>Rice</td>
<td>Rice</td>
<td>Groundnut</td>
</tr>
<tr>
<td>Rabi-pulses</td>
<td>Jowar</td>
<td>Maize</td>
<td>Summer rice</td>
<td>Wheat</td>
<td>Rice</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sweet-potato</td>
<td>Bajra</td>
<td>Millet</td>
<td>Banana</td>
<td>Maize</td>
<td>maize</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tapioca</td>
<td>Maize and Millets</td>
<td>Wheat</td>
<td>Papaya</td>
<td>chickpea</td>
<td>pigeon pea</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sugarcane</td>
<td>Mulberry</td>
<td>Pulses</td>
<td>Orange</td>
<td>Lentil</td>
<td>sesameum</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rubber</td>
<td>Paddy</td>
<td>Potato</td>
<td>Pineapple</td>
<td>Pigeonpea</td>
<td>oilseed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red-oil</td>
<td>Sugarcane and sunflower</td>
<td>Ginger</td>
<td>Guava</td>
<td>Blackgram</td>
<td>pulses</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Palm</td>
<td>Mango</td>
<td>Mustard</td>
<td>Litchi</td>
<td>Pea</td>
<td>Wheat</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cashewnuts</td>
<td>Chini</td>
<td>Soyabean</td>
<td>Jack fruit</td>
<td>Rapeseed</td>
<td>Tomato</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coconut</td>
<td>Lemon</td>
<td>Pea</td>
<td>Mango</td>
<td>Mustard</td>
<td>brinjal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arecanut</td>
<td>Grapes</td>
<td>Arhar</td>
<td>potato</td>
<td>Linseed</td>
<td>Coriander</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mango</td>
<td>Banana</td>
<td>Oil seeds</td>
<td>sweet potato</td>
<td>Mango</td>
<td>Garlic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sapota</td>
<td>Papaya</td>
<td>Turmeric</td>
<td>tapioca</td>
<td>Guava</td>
<td>Onion</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orange</td>
<td>Sapota</td>
<td>Chilli</td>
<td>chilli</td>
<td>Banana</td>
<td>Mango</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Banana</td>
<td>sunflower</td>
<td>Sugarcane</td>
<td>turmeric,</td>
<td>citrus</td>
<td>Citrus</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Papaya</td>
<td>groundnut</td>
<td>Tomato</td>
<td>ginger</td>
<td>Aonla</td>
<td>Wheat</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
• Information about Agro-climatic data, Maps, water resources, water quality, rainfall, wind speed, Solar Energy, Source of irrigation, Major soil type, Land utilization, Major crop cultivated, Agriculture institute and KVKs, agriculture land use etc were also downloaded and is being compiled for each district to provide additional information about the desired district. Example Figure given below ▼
(1) Faridabad

Introduction:

Faridabad district of Haryana located on south eastern part of Haryana state lies between 27° 30′, 72° 80′ north latitude and 76° 40′ and 77° 32′ east longitudes. In the north it is bordered by the Union Territory of Delhi in the east by Uttar Pradesh, in the North West by Mewat, Gurgaon districts of Haryana and in the west. Total geographical area of the district is 2151 sq. km. Faridabad district is divided into five Blocks, namely, Faridabad, Ballabgarh, Palwal, Hodal and Hansi, and four subdivisions, Faridabad, Ballabgarh, Palwal, Hodal. Faridabad town is the headquarters of the district.

<table>
<thead>
<tr>
<th>1. Geographical Area (Sq. Km.)</th>
<th>1721.67</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) No. of Blocks</td>
<td>5</td>
</tr>
<tr>
<td>b) No. of villages (inhabited)</td>
<td>334</td>
</tr>
<tr>
<td>c) No. of villages (electrified)</td>
<td>334</td>
</tr>
</tbody>
</table>

2. Rainfall (mm)  
2005 | 2006 | 2007
---|---|---
470.5 | 317.0 | 522.4

3. Climate  
Extremely hot and dry in summer and very cold in winter

a) Male | 1084138 
| b) Female | 906587 
| c) Total | 1990725 
| d) Population Density per sq. km. | 1156 

5. Classification of workers  
a) Cultivators | 139785 
| b) Agricultural Labourers | 59990 
| c) House hold/cottage industries | 22137 
| d) Other Works | 473572 

6. Land Utilization (in Hectares)  
a) Geographical area as per village papers | 172167 
| b) Total cultivable land | 128100 
| c) Net Sown Areas | 121696 
| d) Forest Land | 5075 
| e) Barren Land | 1000

7. Size of holdings (Agriculture Census – 2000-01)  

<table>
<thead>
<tr>
<th>Type of Holding</th>
<th>No. of holdings</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Less than 1 Ha</td>
<td>30689</td>
<td>215416</td>
</tr>
<tr>
<td>b) Between 1.0-2.0 Ha</td>
<td>16144</td>
<td>21028</td>
</tr>
<tr>
<td>c) Between 2.0-4.0 Ha</td>
<td>8028</td>
<td>18121</td>
</tr>
<tr>
<td>d) Between 4.0-10.0 Ha</td>
<td>4121</td>
<td>14763</td>
</tr>
<tr>
<td>e) Above 10.0 Ha</td>
<td>6086</td>
<td>46325</td>
</tr>
<tr>
<td>Total</td>
<td>85444</td>
<td>121753</td>
</tr>
</tbody>
</table>

8. Irrigation (in Hectares)  
a) Net Irrigated Area | 112491 
| b) By Canals | 25630 
| c) Tube wells | 82960 

Agro-climate Region:

The climate of Faridabad district can be classified as tropical steppe, semi-arid and hot which is mainly characterized by the extreme dryness of the Air except during monsoon months. During 7-8 three months of south west monsoon from last week of June to September, the moist air of oceans penetrate into the district and causes high humidity, cloudiness and monsoon rainfall. The period from October to December constitutes post monsoon season. The cold weather season prevails from January to the beginning of March and followed by the hot weather or summer season which prevails up to the last week of June.

| Normal Annual Rainfall | 542 mm | Average Temperature (Yearly) | 25.23°C |
| Normal Monsoon Rainfall | 400 mm | Cloud Cover (Yearly) | 32.24% |
| Normal Rainy days | 27 | Diurnal Temperature | 13.13°C |
| Annual | 595.6 | Ground frost frequency | 0.34/day |
| Solar Radiation (annual average) | 5.23 (KWh/m²/day) | Potential Evapotranspiration | 6.44/day |
| Wind Speed (annual average) | 3.07 | Reference Crop Evapotranspiration | 4.75/day |

Solar Insolation:
An interactive Graphical User Interface (GUI) and responsive home page has been designed. DOMIS provides general information about Government schemes, different micro irrigation systems, details about districts, implementing agencies in different States of India, approved system suppliers in different States and other general information about micro irrigation.
Know your District - DOMIS

In district profile details, you may get information about agro-climatic data, maps, water resources, water quality, rainfall, wind speed, solar energy, source of irrigation, major soil type, land utilization, major crop cultivated, agriculture institute and KVKs, agriculture land use etc. has been compiled and showing in DSS for users information.
DSS-DOMIS : Govt. Schemes

Govt. Schemes : To easy access the other Agricultural Govt schemes, the major schemes has been linked. On a single click users can go to the official website of scheme and get the information.

Quick link to the schemes

NMSA, MIDH, NHM, PMKSY, PMFBY, NCPAH, and other Agricultural Govt. schemes

Benefits: Farmer can easy access the information
Micro-Irrigation Systems: Users can select the desired micro irrigation system namely, DRIP, Sprinkler, Micro Sprinkler to design the system and cost estimation.
DSS-DOMIS: Micro Irrigation Systems (DRIP)

Drip Irrigation - Decision Support System

Welcome to DOMIS - Decision support system for designing of drip irrigation system. DOMIS can design drip irrigation system for any crop, soil, climate and ground water situations. DOMIS will assist you and provide an expert advice in the form of default values of most parameters. You may use these or enter your values to reach an optimal design of drip irrigation system.

Enter user/farmer name
Enter Village name or address
Select state & district
Enter valid email and phone number (optional)

Micro-Irrigation Systems - DRIP: Farmer has to insert and select these basic details options to use DRIP design system.
Cost of DRIP system:

<table>
<thead>
<tr>
<th>Items</th>
<th>Specification</th>
<th>Unit price (Rs)</th>
<th>Validation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of dripper</td>
<td>N/A lph</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Cost of laterals</td>
<td>16 mm</td>
<td>14.724</td>
<td></td>
</tr>
<tr>
<td>Cost of sub main pipes</td>
<td>63 mm</td>
<td>64.18</td>
<td></td>
</tr>
<tr>
<td>Cost of main pipe</td>
<td>90 mm</td>
<td>129.35</td>
<td></td>
</tr>
<tr>
<td>Cost of sand filter</td>
<td>30</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>Cost of screen filter</td>
<td>30</td>
<td>2612.98</td>
<td></td>
</tr>
<tr>
<td>Cost of hydrocyclone filter</td>
<td>30</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>Cost of disc filter</td>
<td>30</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>Cost of venture injector</td>
<td>--</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>Cost of fertilizer tank</td>
<td>30 Lit</td>
<td>4410</td>
<td></td>
</tr>
<tr>
<td>Cost of fertigation pump</td>
<td>--</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>Cost of motor pumping unit</td>
<td>3 HP</td>
<td>13500</td>
<td></td>
</tr>
</tbody>
</table>

Specification with per unit cost of DRIP system equipment (Lateral, Submain, main pipes) will be shown. User has the permission to modify cost as per their local market price.
Micro-Irrigation Systems- DRIP : Field Layout and Cost estimation : Item specification will per unit cost will be displayed and user has to change as per his/her near by market price.
Micro-Irrigation Systems- SPRINKLER : User has to go through the same inputs for Sprinkler field layout and cost estimation.
DSS-DOMIS: Micro Irrigation Systems (MICRO-SPRINKLER)

Thank you for using the Decision Support System - Micro Sprinkler irrigation system. The design of the Micro Sprinkler irrigation system is based on the data inputted by you and on the values suggested by the DSS DOMIS, as default values for different parameters used in different computations. Besides a suitable layout planning and its design details, the DSS also provides a cost estimate based on the indicative prices of different components of the micro-sprinkler irrigation system. Actual cost of installing the system may however be obtained from the different system suppliers approved by your State Government.

Data input by the user:
- Length of field (m): 150
- Width of field (m): 150
- Crop to be grown: Brinjal
- Source of water: Tube well
- Location of water source: corner_corner

Data provided by the DSS and/or modified by the user:
- Soil type: loam
- Soil infiltration rate (mm/hr): 10
- Crop coefficient: 1
- Canopy factor: 1
- Plant spacing (m): 0.3
- Maximum permissible lateral length (m): 60
- Lateral/Micro Sprinkler Spacing (m): 6.6
- Potential evapotranspiration (mm/day): 8.60700
- Water application efficiency (in fraction): 0.8
- Motor pumping system efficiency (in fraction): 0.7

<table>
<thead>
<tr>
<th>Type of Pipe</th>
<th>Selected Size</th>
<th>Unit Needed</th>
<th>Unit Price (Rs)</th>
<th>Cost Rs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Micro Sprinkler</td>
<td>0.08 lps</td>
<td>792</td>
<td>50.00</td>
<td>39600</td>
</tr>
<tr>
<td>Lateral</td>
<td>20 mm</td>
<td>4950</td>
<td>7</td>
<td>34650</td>
</tr>
<tr>
<td>Sub-main pipe</td>
<td>50 mm</td>
<td>450</td>
<td>41.43</td>
<td>18643.5</td>
</tr>
<tr>
<td>Main pipe</td>
<td>80 mm</td>
<td>250</td>
<td>129.35</td>
<td>32337.5</td>
</tr>
<tr>
<td>Cost of all Pipes</td>
<td></td>
<td></td>
<td></td>
<td>125231</td>
</tr>
<tr>
<td>Sand Filter</td>
<td>50 m³/h</td>
<td>1</td>
<td>18619.15</td>
<td>18619.15</td>
</tr>
<tr>
<td>Screen Filter</td>
<td>50 m³/h</td>
<td>1</td>
<td>3303.85</td>
<td>3303.85</td>
</tr>
<tr>
<td>Hydrocyclone Filter</td>
<td>50 m³/h</td>
<td>1</td>
<td>5361.97</td>
<td>5361.97</td>
</tr>
<tr>
<td>Disc Filter</td>
<td>50 m³/h</td>
<td>1</td>
<td>6962.95</td>
<td>6962.95</td>
</tr>
<tr>
<td>Venturi</td>
<td>15 in</td>
<td>1</td>
<td>2757.19</td>
<td>2757.19</td>
</tr>
<tr>
<td>Fertilizer tank</td>
<td>90 ltr</td>
<td>1</td>
<td>7938</td>
<td>7938</td>
</tr>
<tr>
<td>Fertilization pump</td>
<td></td>
<td>1</td>
<td>10000</td>
<td>10000</td>
</tr>
<tr>
<td>Micro Sprinkler System Cost (SG) Total of all items above</td>
<td>180164.11</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accessory Cost (SG)</td>
<td>10% of Total of system</td>
<td>18016.41</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Micro-Irrigation Systems - MICRO-SPRINKLER: User has to go through the same inputs for Sprinkler field layout and cost estimation.
<table>
<thead>
<tr>
<th>State</th>
<th>Mission Director</th>
<th>Phone Numbers</th>
<th>Mobile Number</th>
<th>Email</th>
</tr>
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<tbody>
<tr>
<td>Andhra Pradesh</td>
<td>Smt. V Usha Rani, Commissioner of Horticulture</td>
<td>040-23240124/23398639, 569, 23313012</td>
<td>09963281686</td>
<td><a href="mailto:horticulturedept@yahoo.co.in">horticulturedept@yahoo.co.in</a></td>
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<td></td>
<td>Department of Horticulture, Government of Andhra Pradesh, Public Gardens, Nampally, Hyderabad - 500004, Andhra Pradesh</td>
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<tr>
<td>Arunachal Pradesh</td>
<td>Mr. J Ratan, Mission Director</td>
<td>0360-2203396</td>
<td>9435508000</td>
<td><a href="mailto:directorhortiassam@gmail.com">directorhortiassam@gmail.com</a></td>
</tr>
<tr>
<td></td>
<td>Department of Horticulture, Govt. of Arunachal Pradesh, Chimpui, Naharlagun, Itanagar - 791 110, Arunachal Pradesh</td>
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<tr>
<td>Assam</td>
<td>Mr. T. D. Hanse, Director of Horticulture &amp; FP. Directorate of Horticulture &amp; Food Processing, Govt. of Assam, Khanapara, Guwahati - 781 022, Assam</td>
<td>0361-2334115</td>
<td>9435508000</td>
<td><a href="mailto:directorhortiassam@gmail.com">directorhortiassam@gmail.com</a></td>
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<td>Fax: 0361-2332766/2335303</td>
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<tr>
<td>Bihar</td>
<td>Shri Arvinder Singh, Director of Horticulture &amp; State Mission Director (MIDH), 2nd Floor, Pant Bhawan, Bailey Road, Patna - 800 001, Bihar</td>
<td>0612-25217765</td>
<td></td>
<td><a href="mailto:dir-bhds-bih@nic.in">dir-bhds-bih@nic.in</a></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fax: 0612-</td>
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</table>

Mission Directors: Name of state wise mission directors along with their contact details has been mentioned for user/farmer help. Farmer may contact them for more information.
System Supplier: Contact details of irrigation equipment system supplier has been mentioned for user help. User may directly contact the supplier for rate and other help.
DSS Link available at

www.iari.res.in
Email: np_wtc@yahoo.com

SAVE WATER, SAVE LIFE.....

Thank you