Crop Yield Forecasting and Agrometeorological Service System Development in Armenia

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Weather and Agriculture

Development of agriculture is unimaginable without reliable agrometeorological actual data and forecasts
Information base

- 47 meteostations
- 1 aerological
- Remote sensing (Eumetcast)
- 38 agrometeorological
Agrometeorological observations

- Soil and air temperatures
- Water deficit
- Effective soil water content
- Snow depth
- Minimum temperature at the tillering node, soil frost depth
- Precipitation
Phenological observations

• Phenological stages
• Timing of farming operations
• Implementation of agro-technical measures
• Plant damage, winter wheat and fruit viability
Collection and exchange of hydrometeorological information
<table>
<thead>
<tr>
<th>Elevation above sea level, m</th>
<th>Elevation zone area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>In thousand sq. km</td>
</tr>
<tr>
<td>400-500</td>
<td>0.02</td>
</tr>
<tr>
<td>500-800</td>
<td>0.53</td>
</tr>
<tr>
<td>800-1000</td>
<td>2.37</td>
</tr>
<tr>
<td>1000-1500</td>
<td>5.43</td>
</tr>
<tr>
<td>1500-2000</td>
<td>9.30</td>
</tr>
<tr>
<td>2000-2500</td>
<td>7.29</td>
</tr>
<tr>
<td>2500-3000</td>
<td>3.80</td>
</tr>
<tr>
<td>3000-3500</td>
<td>0.97</td>
</tr>
<tr>
<td>Over 3500</td>
<td>0.03</td>
</tr>
</tbody>
</table>
Climate of Armenia

• Subtropical dry continental climatic zone
• Existence of all altitudinal zones, except for tropical and equatorial
• January average temperature -5.3 C°
• July average temperature 15.1 C°
• Annual average precipitation: lowlands - 250-300 mm, piedmonts - 300-500 mm, mountainous regions 500-800 mm
• Temperature low -42.1°C (February 1972, Ashotsq)
• Temperature high +43.7°C (2011, Meghri).
Forecasts

Agrometeorological
Meteorological
Hydrological

Forecast term
- Short-term
- Medium-term
- Seasonal

Dangerous phenomena
Agrometeorological forecasting

Reliable long-term forecasting would allow the decision-makers to implement:

- Correct agricultural planning (sowing, measures, harvesting, etc.)
- Effective use of resources
- Application of protective measures, etc.
Agrometeorological forecasting

- Sowing and transplanting time
  On sowing times of rareripe potato in valleys

- Anthesis times
  Forecasting anthesis of apricots, peaches and grapes in Ararat Valley

- Crop yield
  Average total yield in the country for all cereals, grapes, vegetables (including separately for onion, cabbage, tomato), potatoes, meadow grasses
October 2010 – Start of the EC/FAO Programme on Information Systems to Improve Food Security Decision-Making

- Study of the state of agrometeorological stations
- Information provided
- Methods of information transfer
Conclusions and recommendations based on analysis and survey results

- Establishment of a Working Group
- Modernisation of the network
  - Installation of 3 automated stations and 9 automated soil moisture stations important for agriculture
- Improvement of crop yield forecasting
  - Yield forecasting for winter wheat, potatoes and grapes using remote sensing data
- Improvement of service
  - Agromet Bulletin
  - Creating agrometeorological part of the website
Working Group Objectives

- Participate in discussions on the results of the yield forecasting for the country’s main crops
- Contribute to the improvement of agrometeorological services
Basis for the Crop Yield Forecasting

- Meteo data
- Phenological data
- Remote sensing data
Information base for Forecasting

Database

Weather forecast

Data automation

www.fieldclimate.com
Data collection process

- cultivated land
- permanent crop
- permanent grassland
- forest
- brush tree
- bare soil
- sparse vegetation
- (water)
- (artificial ground)

Parameters
- Land cover
- Land use
- Transect, etc.

Dissemination

1 100 000 points

Sample of 260,000 pts

11-Dec-2008
Crop monitoring & Yield forecasting: General Flowchart

- **Remote sensing**
  - Vegetation indices (NDVI/DMP)
  - Water balance parameters

- **Weather stations**
  - Climate data
  - Crop growth simulation model(s)

- **Crops**
  - Crop, soil & management parameters

- **Soils**

- **Agricultural statistics**

- **Crop growth simulation model(s)**

- **Yield prediction module**

- **Production**
  - Cultivated area
  - Country yield

**Estimates for each YEAR x REGION x CROP on:**

- Yield = \( f_{\text{cal}}(\text{4 types of Indicators}) \)
  - Trend, Meteorology, Crop growth model, Remote Sensing

- Production = Yield x Area
Improvement of service

- Publishing a new Agromet Bulletin (4 issues annually)
- Creating an Agromet website

http://grid.am/armMeteo
http://192.168.0.2/index_humidity.php
Key information

<table>
<thead>
<tr>
<th>Marz</th>
<th>Area (ha)</th>
<th>Mean of Yield (2007-2011)</th>
<th>Yield forecast done in August (qx/ha)</th>
<th>Yield forecast done in September (qx/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gegharkunik</td>
<td>13498</td>
<td>163.1, 178.9</td>
<td>189.7</td>
<td>212.5</td>
</tr>
<tr>
<td>Kotayk</td>
<td>3258</td>
<td>180.9, 206.1</td>
<td>204.4</td>
<td>210.8</td>
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<tr>
<td>Shirak</td>
<td>3667</td>
<td>187.7, 226.6</td>
<td>212.1</td>
<td>255.9</td>
</tr>
<tr>
<td>Syunik</td>
<td>1677</td>
<td>156.9, 168.4</td>
<td>184.4</td>
<td>171.5</td>
</tr>
</tbody>
</table>

Note: The table provides the area of each region, the mean yield from 2007 to 2011, and the forecasted yields for August and September.
New type of information for servicing agriculture
Agrometeorological website
Weather is increasingly fickle and uncertain under climate change

- Weather forecast models improvement
- Improvement of forecast accuracy
- Increase of forecast time span
- Concretizing the location
- Application of new technologies to assess drought conditions
Necessary measures

- Training and professional development of highly qualified specialists
- Modernisation
- Database upgrade
- Development of methodological manuals in Armenian language
- Establishment of an Early Warning System
THANK YOU!