WHAT IS TO EXPECT IN AGRICULTURE IN VIEW OF CLIMATE CHANGE

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Abstract

Two aspects actually reflecting the global climate change are generally accepted: temperature rise and increase of CO_2 in the atmosphere. Regional climatic forecast on a basis of regional modules ECHAM4 and HadCM2 sees rise in temperature and precipitation.

Climate forecasting will allow us to adapt agriculture to new conditions.

Possible climate changes create favorable conditions for plant growth and development. It is forecasted that phenological phases and ripening periods will be reduced, while crop productivity will grow. The following increase in crop yields is expected: 11% - cotton; 7-15% - cereals; and, 10-15% - vegetables, melons and gourds.

However, achievement of this positive forecast is possible under high agronomic practices and availability of all necessary inputs, including water. Otherwise this positive potential will not be achieved. Besides, forecasted increment of days with extremely high temperatures may lead to plant stress under low water availability. Yield losses could be 9-15% for cotton and cereals, 10-20% for rice, and 10-50% for vegetables, melons and gourds.

1. Agricultural production and climatic factor

Two aspects actually reflecting the global climate change are generally accepted: temperature rise and increase of CO_2 in the atmosphere.

The Third Assessment of Intergovernmental Panel on Climate Change has shown that for the last century average surface temperatures in the world have increased by 0,6 degrees Celsius.

Annual growth of carbon dioxide concentrations (CO2) in the atmosphere is registered. This parameter is measured at less than 10 stations dispersed all over the world. Whether T° rise is a result of greenhouse effect - has been still discussed.

However, the both are facts and have their own consequences.

Climate behavior studies show that there is a change in various elements of the climatic system. Besides, we observe positive trends in temperature series during cold and warm half-year periods, increase in CO2 concentrations, and greenhouse effect.

How this will influence sustainable development of the region and, first of all, agriculture, which provides 70-90% of population with job?

Situation study, awareness of forecasted climate changes, and assessment of vulnerability to the changes will contribute to the development of adaptation strategy for agriculture, water resources and ecosystems.

Response to climate changes in agricultural production is found in context of sustainable socio-economic development in the region, interstate water management policy, and desertification and drought control measures.

At present the climate change study is a priority direction in regional research.

Using climate forecasts to improve management of climate-sensitive sectors such as agriculture, and water resources is a new frontier, with potentially very significant implications for humanity. Climate information and skillful seasonal climate forecasts have the potential to improve results in agriculture, Climate forecasting can help people to better understand and prepare for natural variations in climate, to prepare for global climate change and to work toward more sustainable levels of development.

The climate change will entail correspondent changes in biotope and will influence greatly on plant development processes.

The most important parameters of the climate change, such as air temperature 0C, precipitation, relative air humidity, and CO2 concentration in the atmosphere form conditions that influence crop productivity.

These climatic parameters condition the following:

Air temperature – duration of growing season; sowing dates; conditions of germination, phenological phases, and growth; moreover, extremely high temperatures slow down physiological processes in plants.

Humidity – evaporation rate; creates conditions for moisture-heat exchange, which is necessary for each particular crop.

Precipitation – soil moisture and air humidity provide natural moistening and conditions for growing; storm precipitation could hinder sprouting and farm operations.

In general, temperature, humidity, and precipitation form crop evapotranspiration and change salinization processes.

Concentration of CO2 in atmosphere determines photosynthesis and respiration intensity and, as a result, biomass formation and crop productivity.

Available lands used in agriculture consist of the following categories: irrigated lands, dry farming lands, and natural pastures. Regional land resources are characterized by well-defined horizontal and vertical zoning.

Altitude of irrigated zone is 500-520 m. The total precipitation is 200-300 mm. Dry lands with additional irrigation are located from 500-520 to 1000 m above sea level. Precipitation reaches 300-400 mm in this area. Dry lands are located higher than 1000 m above sea level, with total precipitation of more than 400 mm per year.

Soils are mainly light, typical, taupe desert sierozem, with different degrees of salinity, partly eroded.

General area of irrigated lads is about 7,95 million ha. About 90% is tilled soil. Cropping patterns are comprised of: 25,3 % - cotton; 19,6 % - cereals; 36,7 % - grain crops; 3,0 % - potato, vegetables, gourds and melons; 13,6 % - other crops.

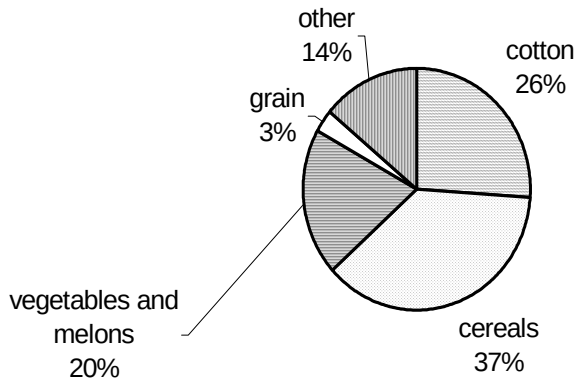

Fig. 1 | Regional cropping patterns

Most irrigated lands of the Aral Sea basin are located in subtropical desert, semi-desert, desert and premountain zones. Agroclimatic potential and hot long summer make it possible to cultivate subtropical plants, including cotton and plants of temperate zone.

However, being the very northern zone of cotton cultivation, the Aral Sea basin has not quite sustainable conditions for cultivating cotton and obtaining guaranteed yields. Critical factors are spring frosts, heavy rainfall against low spring temperatures, and early autumn frosts.

The causes of land productivity losses, particularly last time, are deterioration of lands and socio-economic factors.

In terms of state of lands, only 52% of basin's irrigated lands is in satisfactory conditions, 21% is in unsatisfactory conditions and 15% is very poor. General area of medium- and heavy saline lands has increased over last 20 years and accounted for about 2.8 million ha.

Under such situation, mitigation of possible negative effects of climate change and use of positive changes will promote stable and productive agriculture.