Effects of changing water availability on agricultural profits: The Israeli test case

Mordechai Shechter, Iddo Kan and Naomi Zeitouni;

University of Haifa

Objectives and Methodology

The objective of this part of the research is to evaluate how the benefits of the winter agricultural production in Israel as a test case for Cukurova basin would vary with the expected changes in climatic variables in the EM.

A field-level economic model was developed, where variations in a single climate variable, annual precipitations, were considered. Given the annual precipitations, the model calculates the annual amount of irrigation water required for maximizing the field's net profits. Three winter crops were selected to represent three types of crop-groups: wheat for field crops, processing tomato for vegetables, and vetch (*leguminous plant Vicia*)for fodders.Profits associated with these crop-groups were considered with respect to climate conditions in the north, center and south regions of Israel. The effect of climate change on the net profit was evaluated by running the model according to various scenarios of annual recipitations.

Rainfall Gamma-distribution functions were used to describe present and future rainfall patters. Forecasts for future rainfall-distribution patterns were based on the assumption that the trend of changes in the distribution-functionsfound in the past (by Ben-Gai et al. for the years 1931-60 and 1961-90) will continue in the future; the estimated new distribution functions were controlled by the findings of Dayan and Koch (1999), who estimated that the average rainfall will decline relative to that of 1960-1990 in 2020, 2050 and 2100 by 1.5%, 3% and 6%, respectively. Fig. 5.26 presents annual precipitations-probability-density curves for two sites in (a) the North and (b) the South of Israel, for three periods: 1931-60, 1961-90 and the year 2100. rainfall in the North, Center and South areas of Israel.

Key Results

The simulations indicate a future decline in net-benefits relative to the latter part of the twentieth century. The conditions in the past (1945-1975) have increased winter-crops profitability, but then (since 1975) there is a steady reduction. The most sensitive region is the South of Israel with a reduction of 35% in net profits in 2100 relative to 1975. The most sensitive crop-group is field crops. Although most of the effect is seen in the semi-arid southern region, some reduced profitability is detected in the Center and the North of the country as well. Concomitantly, risks for annual economic losses increase because of the larger variability in rainfall events.

Outlook for the last year of the project

The continuation of this study is within the framework of socioeconomic determinants and consequences of water and land use. The aforementioned analysis focuses on the effect of one climate factor (precipitation) on a part of the agricultural activity (winter production) by a field level model in which there is only one adaptation tool (water application). The intention is to extend this model during 2006 along various directions. First, land allocation among crops as a decision variable and an additional adaptation tool will be incorporated; this requires the development of a regional scale optimization model, and application of a calibration procedure. Second,to account for the effect of variations in additional climatic and adaptation factors (e.g.temperatures and fertilizers), the appropriate response functions will be estimated.Third, summer crops will be incorporated into the model. To this end surface water constraints will be considered, where these will also be affected by climate conditions.