THE ECONOMIC IMPLICATIONS OF POTATO RESPONSE TO IRRIGATION: RESULTS FROM 1985 FIELD TESTS IN MAINE


Abstract

The economic value of potato yield and quality response to supplemental irrigation were shown to be dependent on the potato cultivar and the market destination. The results of on-farm tests in Aroostook County, Maine indicate the value of this response ranged from $-257.18 to $1057.46 per hectare in 1985. The annual variable and ownership costs, excluding the value of management time, of center pivot irrigation systems were estimated to be from $226.67 to $387.02 per hectare in 1985 and were found to be dependent on the long-term system plans of the producer as well as on the standard components of cost. The managers' time commitment was found to be quite large both in the planning stages and in the first year operation of the systems.

Introduction

On a global basis there is a delicate balance between the demand for and the stable supply of essential food commodities at affordable prices and because of this we have become even more sensitive to the fact that even year to year variability in "normal" climate can have major consequences. Even under conditions of optimal cultural practices, potato yield in the Northeast is variable and is functionally related to the growing season climate regime. Solar radiation, soil and air temperatures, and water supply are the variable environmental (climate) components which, when non-optimal, can reduce the physiological efficiency of the potato. Of these components, water supply is the only one readily managed by man.

Even in humid areas of the Northeast, potato production variability is a function of water supply. In Maine it has been shown that a highly significant negative correlation exists between a plant water deficit index and potato yield (6). There have been several studies relating potato yield response to supplemental applied water in Maine (1, 3, 5) and two studies relating the

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Maine Agricultural Experiment Station Publication No. 1177.

2ADDITIONAL KEY WORDS: Potato production, economics, net returns.
proportion of U.S. #1 grade potatoes to supplemental applied water (1, 4).

To estimate the economic value to the producer, however, additional information on the quality parameters is necessary as well as information on prices and market destination. Moreover, much of the yield response information is at least twenty years old and was compiled under far different technological and economic conditions than those that exist today.

The purpose of our study was to begin to translate potato yield and quality response to irrigation under current Northeast growing conditions into a relevant economic value for use in the irrigation investment decision. We investigated the changes in yield, specific gravity, size distribution, proportion of U.S. #1 grade for both tablestock and processing criteria, proportion of U.S. #2 grade for processing, and percent weight loss during storage from irrigation to more accurately estimate the actual value to the producer attributable to the supplemental irrigation. The return to irrigation was calculated for three market destinations; seed, tablestock, and french fry processing. To obtain estimates of the net benefit from irrigation, we then analyzed the cost of irrigation for 1985 including the annualized water source development costs, system purchase and set-up costs and system operating costs.

**Materials, Methods, and Conditions**

The field experiments were conducted on two farms in Central Aroostook County, Maine. The cooperating farmers and their staffs performed all production activities, thus, the results should be representative of those under actual field conditions. The Russet Burbanks were grown for the processing and tablestock markets, and the other cultivars were grown primarily for seed.

*Irrigation Equipment*

Irrigation equipment was owned and operated by the cooperating farms and included three center pivot systems. Detailed information on the systems is presented in Table 1. All three systems were electrically propelled by use of generators at each pivot point.

Pumps used were all of the centrifugal type. System number one utilized one pump located at the on-farm pond and was powered by a diesel

<table>
<thead>
<tr>
<th>Farm Number</th>
<th>System Number</th>
<th>Length</th>
<th>Design Discharge</th>
<th>Water Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>519 m</td>
<td>3,217 liter/min</td>
<td>pond</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>367 m</td>
<td>2,082 liter/min</td>
<td>river</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>192 m</td>
<td>1,419 liter/min</td>
<td>river</td>
</tr>
</tbody>
</table>

Table 1. — Information on the irrigation equipment used in the study.