The value of irrigation information for decision-makers with neutral and non-neutral risk preferences under conditions of unlimited and limited water supply

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Abstract

The purpose of this article is to determine the amount that could be paid by irrigation farmers in the Winterton area with non-neutral risk preferences for more sophisticated information on soil water, plant growth and the weather The maximum amount irrigation farmers with unlimited irrigation water supply on Hutton soil could pay for (he highest level of information varied between. R 136/ha and R33G/ha depending on their risk preferences. The value of information increased by at least 49% when irrigation water became limited. It is clear that information is a partial substitute for soil quality in terms of plant-extraetable soil water and the availability of irrigation water.

Introduction

The scheduling of irrigation water in the Winterton area is important to both farmers and irrigation boards. Frequent irrigation water shortages occur, because of an over-utilisation of water resources in the area. An irrigation scheduling service which provides highly sophisticated irrigation information was introduced in the research area in an attempt to increase irrigation efficiency. Bosch et al. (1987) noted that better information about the crop and its environment has potential to help irrigation farmers in improving the economic efficiency of water and energy use. However, irrigation farmers are stilt using a wide range of irrigation scheduling strategies which differ in terms of the type and amount of soil water, plant growth and weather information used.

Irrigation farmers are hesitant to use more sophisticated irrigation scheduling information, because of uncertainties about the economic value of better irrigation information, especially if the availability of irrigation water is uncertain. Farmers, farm advisers and research institutions need to know the returns from better irrigation information in ordertoevaluate scheduling services and/or to determine whether public expenditure on information systems should be increased (Bosch and Lee, 1988). This study-expands on previous work by using a comprehensive dynamic approach to value irrigation information for decision-makers with different risk preferences under conditions of limited irrigation water.

A previous study (Botes et al,, 1994b) presented a model using simulation and optimisation to value information for irrigation scheduling with neutral risk preferences. A study by Botes et al. (1994a) revealed that attitudes towards risk vary considerably about risk neutrality. This study examines the question of how varying risk attitudes affect the value of information.

The objectives of this study are the following:

- To determine how much irrigators with non-neutral risk preferences can pay to obtain more sophisticated information on soil water, plant growth and the weather under conditions of unlimited and limited water supply.
- To determine the extent to which factors such as the availability of irrigation water and the quantity of plant extractable soil water (PESW) influence the value of irrigation information for decision-makers with non-neutral risk preferences.
- To establish the extent to which changes in the absolute risk aversion coefficients (RAC) affect the value of irrigation information.
- To evaluate the effect of perfectly negatively correlated yields and product prices on the value of information.

Conceptual model

Calculating the value of information for risk-neutral decision-makers

It is assumed that risk-neutral decision-makers maximise expected profits. Profit 7t is given by a profit function, T(X,0), where x is inputs into the decision process and 6 is a probability distribution function of stochastic variables (Byerlee and Anderson, 1982). Information on 9 will affect the decision inputs (x), and consequently result in a change in T(x,9).

A decision-maker that uses little or no information will select decision variables in such a manner that expected profits from using the no-information strategy are maximised. Mathematically this is equivalent to;

$$\text{Max } E[7t(x,6)] = JjA(x^*,e)p(e)d(8) \qquad (I)$$

where x* is the set of decision variables which maximises expected profits, and p(8) is the probability distribution function of stochastic variables from using the no-information strategy (calculation procedures are in part adopted from Mazzocco et al. (1992) and Byerlee and Anderson (1982)).

More sophisticated information provides the decision-maker with a predictor which changes the probability distribution function of stochastic variables obtained from using little or no information, to p(Glk). The optimisation problem for the better-information strategy is now given by:

$$\text{Max } EU_k(x,e)l = y_{fl}7t(x_l,0)p(01k)d(0)d(k) \qquad (2)$$

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