Abstract. Crop yield projections made at planting time or during the growing season often ignore the fact that an unknown percentage of planted acreage is not harvested. As a solution, we present a model for 'acreage abandonment', based upon both economic and weather variables. Weather is shown to be a much more important determinant of the decision not to harvest than is the expected price. The explained variance in abandonment of spring wheat acreage by future delivery price is approximately 16%, but rises to over 60% when weather variables are added. In a similarly designed model for winter wheat in the southern plains, the price contribution is less than 5%.

The spring wheat model was tested on two extensive sets of withheld data: three-year successive deletions through the entire (1932–1975) data set, and a ten year block at the beginning of the modelling period that included substantial weather and price perturbations induced by the dust bowl, depression, and attendant market gyrations. Predictive capability was retained in both tests.

'Current' weather appears to weigh more heavily in the abandonment decision than does 'future' price.

1. Introduction

In response to a temporary oversupply, the U.S. Department of Agriculture (USDA) initiated the payment-in-kind (PIK) program for the 1982–83 crop year. The primary goal was a reduction in future supply resulting from a voluntary set-aside, with the secondary effect being an increase in prices.

In assessing production potential, USDA crop yield estimates at the beginning of the crop year are based upon the number of acres planted. In any year, a certain percentage of that land is not harvested, particularly in climatically marginal regions where stress-tolerant crops (such as wheat or sorghum) are grown in anticipation of the likelihood of bad weather. Figure 1 details the time series of wheat acreage not harvested for a region of the northern U.S. Great Plains with relatively harsh growing season climate.

National production projections based upon PIK would logically be founded on the assumption that an anticipated rise in prices should be associated with a low percentage of the non-harvest of planted land (hereafter referred to as 'acreage abandonment'). The purpose of this paper is to address the associated problem: what are the relative roles of weather and market conditions in determining the amount of land that is not harvested?

There is certainly considerable confusion in the public sector concerning this problem. For example, in recent years, the American Agriculture Movement, based in relatively arid eastern Colorado, has staged media oriented 'plowdowns', claiming that market conditions were so bad that it was more economical to abandon winter wheat crops rather than
bringing them to harvest. However, our results indicate it is much more likely that the abandonment was based on weather considerations.

2. Previous Work

With the exception of Michaels (1983), a search of the recent literature revealed no refereed publications germane to this subject. We found this surprising, particularly in light of the economic importance of the subject. At the same time, we note that we are preparing another manuscript based primarily upon econometrics (as opposed to the purely statistical methodology here) to address the problem.

In Michaels (1983), the study was confined to the winter wheat regions of Nebraska, Colorado, Kansas, Oklahoma, and Texas (Figure 2). Principal component analysis was used to isolate the major spatial modes of abandonment. As in this study, the most important oscillations were shown in the drier regions — the western portions and high plains. In that work, interannual changes in abandonment over those areas was related, with multiple regression, to weather and price factors. The overall statistical model, including constants, price terms, and weather variables, explained 77% of the variance in abandonment. 36.5% of the variation not due either to non-climatic or spatial factors was explained by the weather signal.

There was no significant loss of fidelity in a test consisting of sequential withholding of three year blocks of data throughout the entire model period (1932–1975). Depending upon model, only between 3% and 5% of the interannual variation was explained by price,