Insurance Based on Temperature

protection against citrus losses from frost damage involves solution of difficult actuarial problems

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Temperature insurance—as an alternative to frost insurance—might offer some protection to citrus growers against heavy losses from frost damage.

It is characteristic of all direct crop insurance plans that they provide the insured primarily with an opportunity to spread over a period of time his risk of losses from selected natural factors. The insurer can obtain a measure of protection against concentration of indemnity payments in any one year by wide geographic coverage. Heavy losses in one locality might thus be partially offset by premium surpluses in other localities. In a multiple crop plan an additional element of protection against concentrated losses is afforded by diversification of insured crops.

Inspection of temperature records for southern California covering the period 1926–27 to 1950–51 suggests that insurance during this period based on duration of critical temperatures would have exhibited a marked concentration of indemnity payments at two points: the single year 1936–37 and the two consecutive years 1948–49 and 1949–50.

The uniformity in temperature experience at the recording stations—in a relatively small geographic area such as southern California—makes concentration of payments inevitable under a temperature insurance plan. This substantial element of catastrophe hazard is evident. A sound insurance plan might still be developed, but it is questionable whether 25 years' data would be adequate for a sound actuarial base. Errors in rate determination might have serious consequences for the insurer. Substantial reserve funds with which to meet the loss claims of at least one and perhaps two years would seem essential.

A further possible characteristic of temperature behavior in a given area might cause a real obstacle to a workable temperature insurance plan. In the years predating the period analyzed, 1912–13 and 1921–22 were apparently years of heavy frost damage, while damage was light in the intervening years. It does not necessarily follow that indemnity payments would have been heavy in those two years and light during the other years. The possibility of some regularity over time in the occurrence of low temperatures must be recognized. The temperature data analyzed do not cover a period long enough to provide a strong test of whether such regularity characterizes temperature behavior in the area.

Whether or not a systematic pattern of temperature variation over time exists, the historical record might well lead growers to believe that such is the case. Under such circumstances, continuing participation—essential if a temperature insurance plan is to pay its costs—might be difficult to maintain.

A sound insurance program might require the specification of a minimum term of participation in the contract, a minimum perhaps approximating the average length of period between heavy frost damage years in the past. Based on information available for the period since 1912–13—including the years 1948–49 and 1949–50—a minimum term might be around nine years.

Illustrative temperature insurance plans based on the 25 years' records for selected stations have been constructed. In one such plan, the grower would insure himself against temperatures at the recording station below a selected level—27°F or 26°F or 25°F. To illustrate, with reference to a single station in the Pomona-Upland district, suppose insurance was written against temperatures 27°F or lower. The distribution of temperatures at this station over the period studied was such that, for an assumed fixed annual premium payment of $5 per acre, the grower should have received 42¢ per acre for each hour during the season that the temperature at the recording station was 27°F or lower. The premium payment in this illustration covers only insurance costs. Administrative costs would presumably need to be included, which would make the indemnity payment per hour correspondingly less. Total indemnity payments are greater than premiums in the colder years and less than premiums in the warmer years. In the example, total indemnity payments over the 25-year period are just met by total premiums, disregarding interest from investment.

From the grower's viewpoint, a private savings plan might afford comparable protection over an extended period of time. The fact that under temperature insurance the grower is eligible to receive payments in a particular freeze year greater than his accumulated premiums up to that date might be an advantage of insurance as compared with a private savings plan. This feature might be of real benefit to the grower in the event of heavy frost damage early in the insurance pragram or in the event of several closely spaced years of loss.

Among the distinguishing features of temperature insurance—as compared with direct frost insurance—is the absence of the problem of enforcing sound cultural practices, including frost protection. Eligibility for receipt of a claim under a sound plan of direct frost insurance would inevitably require certain minimum frost prevention practices by the insured. Under temperature insurance, decisions regarding frost protection are divorced from the insurance itself. Data recorded automatically and with relative precision render the determination of claims a straightforward operation.

The main difficulties in developing a workable temperature insurance plan for a relatively small geographic area would seem to stem from actuarial problems. If they could be resolved—without destroying the salability of the insurance—temperature insurance might provide growers substantial protection against loss from frost.

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