



Managing Risks in California Agriculture

by Steven C. Blank

The economic risk faced by agricultural producers is mostly captured by the variability of annual net income levels. This risk is a function of variability in output price, yield, input prices, and input quantities. Yet the financial tools available to manage some of this risk are under-utilized. For example, price risk tools (primarily forward cash contracting and hedging with futures or options) and yield risk tools (primarily crop insurance) are not widely used by producers in California. This raises the question, is the market failing to provide agricultural producers with effective risk management tools? If the answer to the question is "yes," it means that there are some attributes of the available risk management tools which conflict with the structure of agriculture and/or commodity markets within the state. This would be significant in light of the current trend toward placing responsibility for risk management on the producer and the market,

rather than on government, as illustrated by recent changes in federal crop insurance aimed at eliminating disaster aid programs.

The question of market failure was evaluated by comparing producers' demand for price and yield risk management tools with the actual tools available in a sample of California commodity markets. This article summarizes the major results of several studies involving numerous groups in California agriculture.

Survey Results Regarding Risk Needs

Agricultural producers were surveyed concerning their risk needs in studies conducted from 1993 to 1997. Producers were asked to rank sources of risk in order of importance. The results of this ranking, presented in Table 1, reveal that production risk concerns are second to market risk among producers in California. Producers ranked output price and input costs as first and second,

RISK—continued on page 2

In this issue...

Poverty Amid Prosperity

*Philip L. Martin and
J. Edward Taylor 3*

A Cost/Benefit Analysis of the Ash Whitefly Biological Control Program in California

*Karen Jetter, Karen
Klonsky, and
Charles Pickett 5*

ARE Faculty Profile

Colin A. Carter 10

Diary Operator Comments from the 1998 rBST Survey

L.J. (Bees) Butler 11

In the next issue...

China and World Wheat Markets: Assessing Supply, Demand, and Grade in China

*Scott Rozelle and
Jikun Huang*

Risk—continued from page 1

respectively, among their risk concerns. However, the significant number of responses received by each of the detailed types of risk listed in the table indicate the detail of producers' concerns; it is not just "price" or "yield" that worries individual producers. This, in turn, indicates a need for varied and detailed risk tools.

The concern for output and input price risk expressed in the surveys leads to expectations of high levels of use of price risk management tools. However, the data show that few producers use each of the risk management tools that directly affect price: 23% use forward contracting and 6% are hedging. Similarly, the rankings for the many sources of yield risk listed in Table 1 (disease, drought, etc.) make the low level of usage for crop insurance (24%) somewhat surprising. On the other hand, nearly half of all producers (48%) use the indirect risk management tool of diversification. These results indicate that the price and yield risk tools offered in the California market fail to meet the needs of most producers, so producers choose to "do it themselves" by using diversification. Diversification is a risk strategy that requires no use or knowledge of risk tools and their associated institutions (e.g., market brokers, insurance companies). Also, by definition, diversification is a risk strategy that involves actions on the part of individual producers that are tailored to their specific management needs.

Analysis of Risk Sources

To determine what producers' real risk management needs are, the first task is to establish the relative importance of price and yield risk. This was done by decomposing the variability of farm revenues to identify the percentages attributable to each primary source of variability. (Revenue, rather than net income, is used because data on input prices and use levels are not available.)

The revenue function is: $R(P,Y,A) = \text{Price} \times \text{Yield} \times \text{Acreage}$; where R = revenue, P = unit price for a particular commodity, Y = the yield per acre, and A = the number of acres planted in that crop (all for a given year or season). The variance of revenue may be viewed in terms of the three components of revenue. Analysis of these components focuses on their relative weight (contribution) to the overall variability of a grower's revenue. (Statewide acreages over time are evaluated making total acreage variation one source of systematic risk to individual growers.)

The values in Table 2 are estimates of the contributions of the three sources of variance as a percentage of the total revenue variance for the years 1972-91. The most notable result is the contribution of price variation to the total variation in revenue. For eight of the twelve crops analyzed it is clear that price variation is dominant over variation in yield or acreage

RISK—continued on pages 8 and 9

Table 1. Sources of Risk

| Sources of Risk | Rank (%) | | | | | | | | Total Number of Observations |
|-----------------|----------|------|------|------|------|------|------|------|------------------------------|
| | 1st | 2nd | 3rd | 4th | 5th | 6th | 7th | 8th | |
| Disease | 16.6 | 17.0 | 13.1 | 16.3 | 14.0 | 11.2 | 8.8 | 3.0 | 465 |
| Drought | 25.5 | 15.7 | 11.9 | 8.9 | 9.4 | 10.2 | 11.7 | 6.6 | 470 |
| Floods | 1.5 | 6.6 | 3.3 | 3.9 | 3.6 | 6.3 | 13.5 | 61.3 | 333 |
| Freeze | 19.9 | 16.8 | 8.9 | 7.6 | 7.8 | 11.2 | 14.8 | 13.0 | 447 |
| Input price | 12.5 | 21.3 | 21.1 | 13.6 | 14.9 | 9.7 | 4.6 | 2.2 | 445 |
| Labor cost | 8.9 | 12.4 | 13.5 | 13.1 | 15.7 | 16.9 | 11.3 | 8.2 | 451 |
| Output price | 32.0 | 25.9 | 14.6 | 11.1 | 7.1 | 4.4 | 2.9 | 1.9 | 478 |
| Pests | 12.4 | 17.9 | 20.4 | 14.3 | 17.2 | 8.8 | 5.9 | 3.2 | 476 |

Note: The first column lists a source of risk. The next eight columns list the percentage of respondents that ranked that source of risk as 1st most important, 2nd, etc. The percentages in each row are calculated on the total number of responses received listed in the last column.

Risk—continued from page 2

(as a percentage of total direct variation). Growers in California who produce any of these crops are experiencing price risk disproportionate to the other sources of risk in their revenue. This result indicates that growers should be using price risk tools like hedging or forward contracting.

There are two crops (peaches and wheat) which exhibit a dominant contribution from yield variability to total revenue variation, and another crop (oranges) which has significant yield variation. Growers of these crops may have a strong preference for a yield risk management tool such as crop insurance.

Only one crop exhibits a majority contribution from acreage variation, although a second crop has significant acreage variation. The acreage variation for processed tomatoes is high enough to allow neither price variation nor yield variation to dominate the total variation, although price variation appears to be more important. Rice acreage variation is also important as a possible indirect effect on price. These industries tend to be volatile in size, thus growers of crops like these may need varied pricing tools.

As a group, these results indicate that producers' needs for risk management tools vary across commodities. Neither price nor yield risk is always dominant and differences in the degree of importance between

price and yield can be large (e.g., alfalfa has a wide difference versus oranges, which do not).

Risk Tools In Commodity Markets

A market can fail producers who wish to manage risks in either of two ways. First, a market is missing if no tool is available for managing a producer's primary source of risk. California producers face missing markets for both price and yield risk management tools, as shown in Table 3. By comparing the results in Tables 2 and 3, it is apparent that half of the crop markets (alfalfa hay, almonds, table grapes, lemons, lettuce, and pears) are missing a tool for the primary source of risk faced. In general, there are relatively few price risk management tools available even though price is the primary source of risk facing most producers in California.

The second type of failure is when markets are incomplete in the coverage available. It is expected that producers would use a tool to manage their most important source of risk if such a tool was available and reasonably priced. However, if usage levels for that tool are low, it indicates that the tool is ineffective. For example, based on producers' risk needs shown in Table 2, crop insurance should be used by growers of oranges, peaches and wheat to manage their yield risk, but the survey data show that most of those growers are not insured (27, 4 and 17% are insured, respectively). This means that despite the government subsidy that reduces the price of federal crop insurance to growers, a majority of market participants believe the tool does not reduce their risk exposure sufficiently to justify purchasing it.

The survey data on use of insurance were aggregated into two categories of commodities: (1) tree and vine crops versus (2) vegetable and field crops. Totaling the responses from producers of these crop categories gives:

| Crop | Number of Growers | Number Insured | Percent Insured |
|-------------------|-------------------|----------------|-----------------|
| Tree & vine | 462 | 112 | 24.2 |
| Vegetable & Field | 337 | 30 | 8.9 |

These summary results indicate that tree and vine crop producers are nearly three times more likely to insure than are vegetable and field crop growers. To explain this result one needs only to recognize that perennial crops requiring multi-year investments are

Table 2. Estimated Revenue Variance Decomposition Percentages

| Crop | Price Variance % | Yield Variance % | Acreage Variance % |
|--------------|------------------|------------------|--------------------|
| Alfalfa Hay | 85.7 | 3.8 | 10.5 |
| Almond | 56.5 | 42.2 | 1.3 |
| Cotton | 85.5 | 4.4 | 10.1 |
| Lemons | 56.8 | 40.2 | 2.9 |
| Lettuce | 69.2 | 17.2 | 13.6 |
| Oranges | 50.9 | 48.6 | 0.5 |
| Peaches | 32.2 | 51.9 | 15.8 |
| Pears | 72.7 | 13.6 | 13.6 |
| Proc. Tomato | 38.3 | 8.7 | 53.0 |
| Rice | 56.1 | 3.1 | 40.8 |
| Table Grapes | 59.1 | 35.4 | 5.5 |
| Wheat | 10.6 | 65.1 | 24.3 |

Note: The percentages in each row total 100, except for rounding.

Table 3. Price and Yield Risk Management Situation for Selected Commodities in California Agriculture

| Commodity | Futures Contracts Available? | Forward Contracts Available? | Crop Insurance Available |
|---------------------|------------------------------|------------------------------|--------------------------|
| Alfalfa Hay | indirectly | no | yes |
| Almonds | no | some | yes |
| Cotton | yes | some | yes |
| Lemons | no | no | yes |
| Lettuce | no | rare | no |
| Oranges | indirectly | no | yes |
| Peaches (fresh) | no | rare | yes |
| Pears (fresh) | no | no | yes |
| Processing Tomatoes | no | yes | yes |
| Rice | yes | no | yes |
| Table Grapes | no | no | yes |
| Wheat | yes | rare | yes |
| Feeder cattle | yes | no | no |
| Fed cattle | yes | no | no |

being insured more often than are annual crops. Obviously, a larger investment is required for a perennial and that investment is “at risk” over a much longer period, meaning that there is a higher probability of suffering a significant loss with a perennial.

It is the low probability of suffering a yield loss large enough to trigger an insurance indemnity payment that makes federal crop insurance ineffective for most growers in California. Therefore, the markets for tools to manage yield risk of many commodities are incomplete because a significant number of growers find the tools unsuitable, as designed currently, and will not use them.

Concluding Comments

Market failure is readily apparent for tools to manage risks related to California commodities. The markets for tools to manage price risk associated with particular commodities produced in California are often missing. All of the pricing tools available are provided through private market mechanisms. Yield risk management tools, which are usually offered through public market mechanisms, are incomplete.

So, what should producers do to manage their income risk? Recommendations include: (1) develop a risk management plan, (2) evaluate all available risk tools, and (3) consider diversification. A risk management plan identifies all sources of risk faced and specifies how each risk is being managed. Multiple tools may be available for use in managing particular sources of risk, so producers should be familiar with each. Finally, diversification for economic, as well as agronomic, reasons is an effective tool for producers in California and can be used as part of any risk management plan.

Reference: Blank, S., C. Carter, and J. McDonald, “Is the Market Failing Agricultural Producers Who Wish to Manage Risks?” *Contemporary Economic Policy* 15(1997): 103-112.

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