

The latter plant is a widespread, toxic range weed in several of the western states.

Overwintering

Coleophora parthenica overwinters as mature larvae inside the stems of dead Russian thistle plants. The larvae pupate and the moths emerge in the spring. Mating occurs within 2-3 days. The small, straw-colored eggs are laid singly on the leaves near the tips of branches (see photo). The hatching larvae bore directly into the leaves and then into the branches and stems where they complete their development (see photo). The fully-grown larva cuts an exit hole in the stem, leaving only a thin layer or "window" of epidermis to cover the exit hole; it then retreats a short distance into its tunnel and pupates. At eclosion, the cream-colored moths force their way out of the stem through these windows. At least two generations are expected annually in the San Joaquin Valley. An additional generation may occur in parts of southern California. Mature larvae of the last annual generation overwinter inside the dead plant stems as noted.

Plants with moderate infestations of *C. parthenica* larvae observed in Egypt, Pakistan, and Turkey were somewhat stunted, had few branches, and had gnarled, thickened basal stems. Samples taken by Egyptian entomologists throughout the 1973 season showed an average of 44 larvae per 100 stems at two study sites. Released from its own natural enemies during its introduction to North America, *C. parthenica* should reach higher population densities in California, which hopefully will cause sufficient stress to severely stunt, if not kill, Russian thistle.

During the spring of 1973, field releases of moths reared from overwintering larvae collected in Pakistan were made near Bakersfield, Cuyama, Coalinga, and Tracy in the San Joaquin Valley and also in Nevada, Utah, and Idaho. Limited numbers of moths reared from larvae imported from Egypt were liberated at San Ysidro and Chino in southern California. The insects successfully completed two generations during 1973 at the Bakersfield, Coalinga, and Tracy sites, but establishment at Cuyama was not determined. The Egyptian material failed to establish at either southern California location.

In Idaho and Utah, the moths were liberated in the open. At the California and Nevada locations, the moths were released into large field cages containing immature Russian thistles. From 30 to

100 moths, about half of them females, were colonized at each site.

During the spring of 1974, larvae were found to have successfully overwintered at the Coalinga and Tracy sites in California. However, no *C. parthenica* were recovered at Bakersfield. Apparently one obstacle to the ready establishment of *C. parthenica* will be the scattering by the wind of the tumbleweeds that contain the overwintering larvae. The small, initial colonies thus become too widely dispersed to allow the newly emerged moths to readily find mates. This situation occurred at Bakersfield during the winter of 1973-74, when strong winds blew the infested plants away from the colonization site. Infested plants may have to be contained overwinter by enclosures at some locations until large field colonies have been established, but eventually the plant's tumbling habit will aid in spreading the moths.

Additional releases

Additional releases of *C. parthenica* moths from Pakistan were made by the first author and cooperators in the late spring and early summer of 1974 near Indio, Boron, Lone Pine, Bakersfield, Tracy, and Sacramento. Concurrent releases of Pakistani or Turkish moths were made at Chino, Colton, Moreno, Corona, Lakeview, and Rancho California by the second author and co-workers. An immediate goal of this project is to establish strong field colonies of *C. parthenica* at these and other selected locations in the state. Once this is accomplished (and if the insect continues to show promise as a biological weed control agent), it will be made available for general distribution to the many other areas where Russian thistle is a problem.

The California Department of Agriculture partially funded the early research and development phases of this program by the USDA; in 1974 the California Division of Highways (Caltrans) continued the partial funding. These two groups have also cooperated with the USDA in site selection and manpower needs.

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FOOD SYS

INVESTMENTS in the U.S. food and fiber system from production through final sales are so large that few of the individuals and firms comprising it can afford to leave their destiny to chance or individual whims. Large-scale retailers and food service firms require consistent supplies at predictably uniform prices, as do the food manufacturing firms that supply them. Moreover, individual farmers with large capital investments cannot gamble on future market outlets.

The food industry, which should be viewed as a system, consists of all stages in the production and supply of materials used in agriculture, the production of commodities on the farm, processing of commodities, and the distribution of finished products at retail stores and eating establishments. Because the system is so large and complex, improved coordination is badly needed. The use of contracts is essential for helping bring about this coordination.

Need for coordination

We have moved from a system of price-making at large terminal markets to prices based on decentralized or shipping point marketing. Large-scale buyers of livestock and fresh fruits and vegetables negotiate purchases directly at the shipping point and bypass the terminal market except for emergency shortages. Packers sell processed fruits and vegetables directly to large-volume purchasers, under somewhat loose terms of reservation bookings that later may become actual sales. Broiler prices are negotiated between large integrated operations and large-scale retailers or buyers. Grain prices are established in a complex mixture of organized exchange trading in spot and future markets. Thus different marketing practices have developed for different commodities.

As the agricultural and food industry has become industrialized, it has developed some common characteristics of industry, including trends towards separation of capital, management, and labor; specialization of farming enterprises resulting in purchase of production inputs; increased applications of capital as substitutes for labor; and increased dependence on science and technology. There is

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also a general trend toward reorganization of the industry, from focusing solely on production efficiency to achieving distribution economics. As these trends develop more completely, coordination of total resources will likely increase. But the fact that agricultural production is still on a small scale compared with industry hides an important fact. Most major decisions affecting farm production are being made or are influenced by very large agribusiness firms.

Contracting

Contract production is the most common method used in agriculture to coordinate production, processing, distribution, and marketing. The percentage of total production occurring under contracts for some commodities is estimated as follows: over 95% for broilers, fluid milk, sugar beets, and vegetable seeds; about 90% for potatoes and vegetables for processing, and hybrid seed corn; about 85% for turkeys; about 75% for citrus; and about 50% for fresh market vegetables and potatoes.

Changes in production contracting in recent years have been moderate. From 1960 to 1970 the amount of all farm output produced under contract is estimated to have increased from 15.1% to 17.2, or by 13%. One reason the change has not been greater is because most of the commodities with important potentials for coordination between the producer and first handler have been contracted for a long time. A second reason is that there have been surpluses of many products and government stocks of basic commodities. This has minimized the uncertainty of getting adequate supplies.

Advantages of contracts

Uncertainty about consistency of future supplies has been the main reason for production contracting in agriculture. Minimizing uncertainties by forward contracting has eased farmers' credit problems by assuring lenders that a market exists for the production being financed. It has also provided a sounder production planning base for farmers.

Contracting for processing of fruits and vegetables has been common in the west. At one time processing was consid-

ered a residual outlet, since the fresh market was considered to be the premium market. Processors often had to make do with poor quality products and erratic supplies. Because high fixed costs in plant and equipment required more stable sources of a given quality, processors became willing to contract with growers to reduce supply uncertainty. Growers also found they had high capital investments to protect. In fact, growers' capital investments—per case of finished product—in an orchard are about three times what they are for canneries. Thus, farmers who wished to reduce uncertainty of market outlets began to contract their crops. Today most California fruit and vegetable processing cooperatives have renewable contracts with provisions for annual withdrawal by members. Several years ago one of the large wineries offered 15-year contracts to grape growers to induce expanded plantings.

Contracts may be either forward (production) contracts, or marketing (sales) contracts. A forward contract is one entered into prior to planting, and therefore has an impact on future supplies. Contracts of this type serve three purposes. They reduce producers' market risks, reduce processors' risks by assuring a source and quantity of supply, and help to regulate product flow in line with expected demands. If price is a part of the contract terms, the producer's potential income is fairly well stipulated, and his financial planning can be more realistic.

Often a production contract may affect the decisions farmers make. For example, processors commonly prescribe the variety to be grown, set approximate planting dates for annual crops, decide on pesticide use, and supervise production. The farmer has access to processors' field specialists and technical experts, who raise the level of technical assistance available to farmers.

Purchase or sales contracts are common legal devices for transfer of title. In some cases price may not be stipulated, and the sales contract is merely an agreement to buy and sell at the prevailing price at delivery. The price-coordinating function of such contracts is negligible. Because they do not affect production decisions, their contribution to bringing

about a greater degree of market coordination is also negligible.

Limitations of contracts

Contracts have many advantages, but also some limitations. As contracting for production increases, both the producer and the contractor make firm commitments that may establish a long-term relationship, and as producers become more dependent upon their contracts it becomes important that the contractors stay in operation. Some California growers of fruits and vegetables learned this lesson a few years ago, when several long-established canners ceased operations. The farmers organized a cooperative to buy and operate the canneries, because they needed a home for their production.

The ability on the part of the producers to contract their products does not mean that contract terms will be equitable, since equity depends upon the relative bargaining strength and skill of the contracting parties. Therefore, where contracting is with general corporations, producers often have organized a cooperative rather than trying to negotiate as individuals.

Alternatives to contracting

There are several alternatives to contracting as a means of improving coordination. Some authorities believe that hedging production or sales on the commodity exchange may reduce price risks. As producers become more specialized in their operations, it is argued that they tend to use more commodity market hedging. While hedging may reduce price risks, it may not reduce uncertainty associated with quantity and product availability as required by processors and food manufacturers for consistent plant operations. It is for this reason that hedging, whenever possible, should be combined with a contracting program.

Diversification is also considered by some to be an alternative to contracting of production, because it reduces income risks of producers. However, any diversification must be on a scale of operations large enough to be efficient. Efficiency in capital use, labor, management, finance and in marketing must be considered before diversification can be a good alternative for contracting. Even then, it is a complement to contracting rather than an alternative.

Probably the most effective alternative to contracting has been federal price support programs. Under these programs, risk was shifted to taxpayers at the grower's discretion. However, federal policy has now shifted away from such pro-

grams, bringing market forces to the front.

Some believe that vertical integration by cooperatives might be an alternative to a system coordinated by contracts. But this is a fallacy. Cooperatives face the same types of risks and uncertainties as other general corporations.

With the strong demands that existed in 1973 and 1974 for nearly all crops, farmers may wonder whether they should take a secure price prior to production, or wait until prices are established at harvest time. Individual producers might contract production in advance, or speculate on market demand and price. Few studies have been made of the effects of these alternatives, but the consensus is that producers are better off in most years with production contracts rather than having to search for markets once their crops are harvested or produced.

Conclusions

Pressures for more coordination in production and marketing decisions will continue. For the most part, these pressures originate from marketing firms rather than from farmers. Contracts are the main method used for coordination, but they are not the ultimate answer, because unless farmers negotiate contracts from a position of strength they may become mere hired hands of big business. Cooperative activity—either through operating cooperatives or bargaining associations—is a viable approach to improving market coordination.

The individual farmer who must choose between contracting or producing independently should keep the following points in mind.

1. Contract rather than produce speculatively when trends indicate future difficulty in long-run access to markets.
2. Contract when doing so will increase the ability of your marketing firm to better represent itself in the marketplace.
3. Contract when the marketing firm must guarantee supplies to its customers.
4. Assume the worst will happen, if you are conservative regarding the future. Of the unfavorable results of each alternative available, select the one most likely to be favorable—or the least unfavorable.
5. Select the alternative with the best potential for highest income, if you are optimistic regarding the future.
6. Select the alternative which provides the largest expected money return,

Land use around the larger cities in California has changed as agriculture has given way to urbanization. From 1950 to 1970 this change was especially rapid in the Berkeley hills, which lie to the east of San Francisco Bay. Streamflow characteristics in the hills have changed significantly as a result. Since knowledge of these changes is important for responsible water planning and aquatic wildlife management, this report summarizes the results of a preliminary study of the impact of urbanization on periodicity of streamflow.

PERIODICITY OF STREAMFLOW refers to variation in discharge from a watershed over time. In this study both annual and daily periodicity were measured. On a wildland watershed annual periodicity of streamflow is largely controlled by precipitation. On agricultural and urban watersheds annual periodicity can also be influenced by the application of irrigation water. Daily streamflow periodicity on wildland watersheds is controlled by variations in evapotranspiration rates. On agricultural and urban watersheds daily streamflow can also be affected by irrigation.

Two streams in Contra Costa County were selected for study: Indian Creek, which drains an agricultural/wildland watershed between Moraga and Canyon, and Ivy Creek, which receives its water from an urbanized watershed in Moraga. The watersheds are 1.25 miles apart. Ivy Creek watershed was developed for single

providing net returns exceed a minimum disaster level. Use your best judgment to predict odds for each alternative.

7. Improve your strength through cooperative bargaining. The equity of contracts for each party is determined by the relative market strength of each party.
8. Contracts are vital to firms, as instruments for reducing uncertainty. Cooperatives, no less than corporations, require a firm commitment from growers.
9. Contracts are as important in coordinating nonperishable commodities as they are for perishables. The ability to store a product enhances the range for speculation, but does not contribute to reducing economic uncertainties.

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URBANIZATION STREAMFLOW in the

family housing in the 1960s. Before development it was used for livestock grazing and walnut production. The Indian Creek watershed is currently used for cattle. It also contains a large walnut orchard, which is no longer tended.

Annual periodicity of streamflow was determined by weekly observations of both creeks. Ivy Creek was observed where it passes under Moraga Way. Above this point its watershed has an area of 168 acres. Indian Creek was observed at a stream gauging station 1.2 miles upstream from where the creek passes under Canyon Road. Above this point it drains an area of 123 acres. While streamflow in Indian Creek occurred only from mid-October through July (graph 1), Ivy Creek flowed throughout the 1972-73 hydrologic year, because of lawn irrigation on the urbanized watershed.

Daily streamflow periodicity was measured on both creeks for a week beginning August 5, 1973, on the assumption that streamflow from the urbanized watershed would be sensitive to irrigation at this time of year. A portable 45° V-notch weir was installed in each stream channel to measure discharge. The Ivy Creek weir was located about 150 ft upstream from Moraga Way. The Indian Creek weir was placed approximately 400 ft downstream from Canyon Road, because flow had ceased to occur at the upstream gauging location. At the downstream location the area of watershed above the weir was 590 acres. Discharge from the weir was continuously recorded on strip charts for seven days using a Belfort water stage recorder.

A survey of irrigation practices during the period of streamflow measurement on the Ivy Creek watershed was conducted via a mailed questionnaire. Residents were asked to indicate the times and durations of watering. Of the 472 residents in the watershed area, 178 responded to the questionnaire. Averaging the quantity of water discharged each half-hour from midnight to midnight for the seven days of the study, Indian Creek showed a peak discharge at 12 a.m. and a minimum discharge at 1 p.m. (graph 2). This perio-