MECHANICAL POLLINATION OF DATE PALMS

Commercial mechanization of date pollination became a reality in 1973. Two men and a machine can service 60 to 80 acres applying pollen 12 times per season on a twice-weekly schedule. The unit is intended to supplement the decreasing labor force of experienced tree men while maintaining satisfactory grower returns on quality fruit. During other times of the year, the unit can be used to apply pesticide dusts.

MECHANIZATION of date pollination in the Coachella Valley became a reality last spring. After seven years of cooperative research by the Department of Soil Science and Agricultural Engineering, University of California, Riverside, and the Agricultural Research Service, USDA, a ground-level system for mechanical pollination was developed, and has been accepted commercially by the date industry. When pollination begins this spring there will be ten machines in the field capable of pollinating approximately 20% of the total acreage in the Coachella Valley.

The mechanization program for date palms was begun in the fall, 1961. At that time, with the impending termination of the bracero program, it was imperative that the large peak labor requirements be reduced (see graph). Over 700 men were required during pollination, and nearly 900 men were required during the peak of the harvest. The adaptation of a bunch cutting, mechanical shaking system for harvesting reduced the harvest labor requirement by nearly 75%.

In 1965, when the bracero program was terminated, the industry attempted to reduce the labor peaks further by lengthening the duration of some of the cultural practices. Since pollination could not be extended beyond six or seven weeks, labor savings were made by reducing the number of pollen applications from six to two or three. This reduced the peak labor requirement by about 50%, but further reductions would mean considerable loss in fruit yield because of poor pollination.

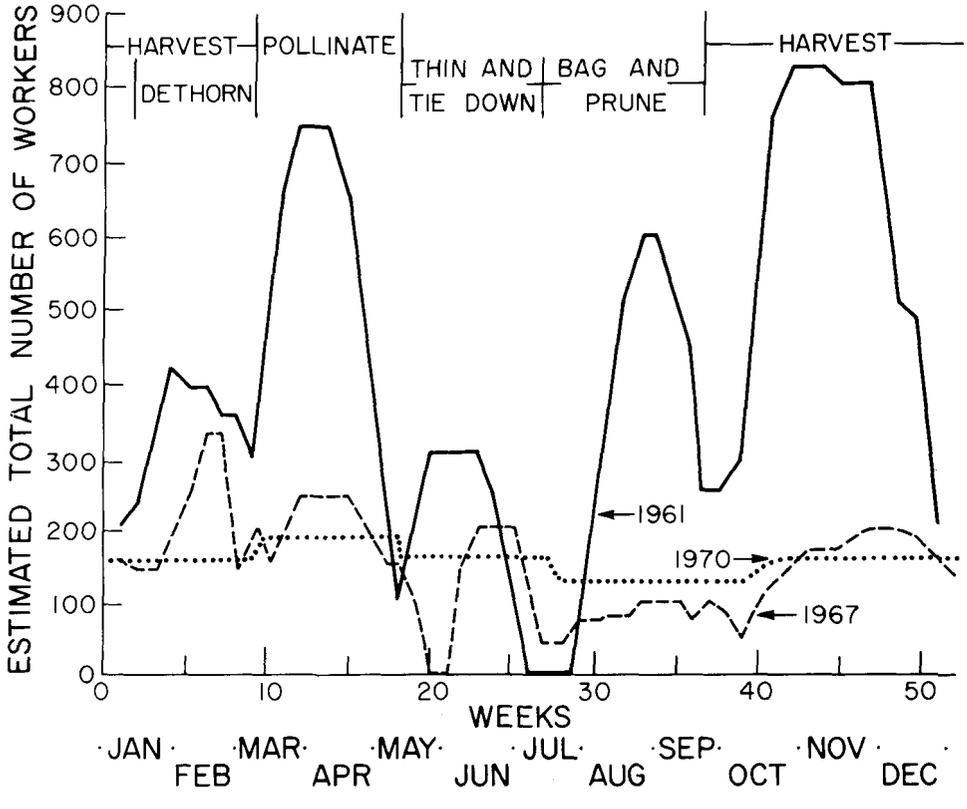
The first experimental attempts at mechanical pollination were in 1966, using helicopters and fixed-wing aircraft. Although results were very satisfactory, a large-scale commercial test in 1967 (nearly 500 acres) resulted in unsatisfactory yields. The difference in yields was caused by lower daily maximum temperatures in 1967 as compared with 1966. Since weather data indicated similar low temperatures could be expected at least once in every ten years, the helicopter program was discontinued.

In 1968, a ground-level duster for pollination was designed and built. The trailer unit consisted of a fixed-height platform, positive displacement blower, pressurized pollen metering equipment, and a counterweighted delivery tube. An operator stood on the fixed-height platform and directed the delivery tube at the bloom area. The pollen and flour mixture left the delivery tube in a 450 mph airstream. Initial results indicated that a variable-height operator platform was required to accommodate differences in down-the-row palm heights.

A new duster, constructed for the 1969 season, had the platform and delivery tube attached to a forklift mast which provided 15 ft of vertical adjustment of the nozzle height. From 1969 to 1971 this unit was used on small experimental blocks to establish the required frequency and rate of pollen application. With proper thinning, and application of 1½ quarts of pollen per acre per season in 12 applications, the results equaled or exceeded hand pollination.

During the same three years, the machine was used during the late spring and summer to apply pesticide dust. Conversion from pollen to pesticide application was accomplished easily, and dual use reduced the operating cost of the machine. In addition, results as an insecticide duster were superior to the con-

LABOR REQUIREMENTS FOR DATE CULTURAL PRACTICES, COACHELLA VALLEY, 1961, 1967, 1970



YIELDS AND RETURNS IN COACHELLA DATE TESTS WITH MECHANICAL POLLINATION, 1972–73

Table 1. Results of 1972-73 Mechanical Pollination Tests.

Garden	Treat.	Net yield /acre*	% Poll.	Ave. No. bunches /palm	Gross returns $/acre*
Sungold	Mech	9,550	93.5	12.7	768.50
	Hand	7,300	96.3	10.5	555.00
Narbonne	Mech.	12,950	94.7	13.3	1,233.50
	Hand	11,100	98.8	13.2	1,017.50
Fairacres	Mech.	11,600	94.2	12.6	1,020.00
	Hand	10,900	97.4	13.3	1,083.50
Parker Ranch	Mech.	10,500	94.5	12.0	1,014.50
	Hand	10,400	92.8	12.7	846.00
Valley Center	Mech.	9,550	93.7	13.0	797.00**
	Hand	10,350	99.4	12.2	902.50

* Net yields and gross returns per acre based on 50 palms per acre.

** Returns adjusted for difference in mite damage between hand and mechanical treatments.

Typical design for new, combination pollination and pesticide duster being used in Coachella Valley date gardens.

ventional dusters, while requiring less pesticide.

In the spring of 1972 a cooperative group of five growers contributed 62.5 acres for a commercial-sized test of the experimental machine. A weekly application schedule was selected since the gardens were about 15 miles apart. This test was designed to determine the capacity of the unit and also to establish whether ordinary field labor could successfully operate the system while maintaining satisfactory grower returns.

The results of the 1972–73 test (see table) show that the gross returns to the grower from the mechanically pollinated palms were higher in 4 of the 5 gardens. Comparing gross returns, the average of all mechanically pollinated blocks ($942 per acre) exceeded that of the hand checks ($881 per acre) by $61 per acre (weighted average of individual gardens taken from the table) based on packinghouse receiving grade slips and present payment schedule.

The cost of machine pollination per acre should range from 50 to 70% of hand pollination, depending upon the amount of acreage pollinated and the amount of overhead charged to the system. The 1972–73 crop was generally lighter for the entire valley, with bunch counts per palm down about 25%. The test also demonstrated that the machine could maintain an adequate schedule on at least 62.5 acres and that this could probably be expanded to 80 acres if the gardens were larger or located closer to each other.

Six machines were commercially built and used during the 1973–74 season. Because unusual spring weather extended the pollination season, hand labor was able to cover more of the acreage than had been expected—and machines were not used as extensively as anticipated.

Mechanical pollination is intended to bridge the gap between the number of experienced tree men available and the number required for obtaining a good fruit set. The machine can do this by reducing the labor requirements by 50 to 70%, at the same time substituting tractor drivers and other laborers for the experienced tree men now required to do the pollination. The 1970 line on the graph shows the estimated available labor force for that year. This force fluctuates due to factors outside the growers' control, such as migration out of the valley during the summer months and migration to other crops during parts of the year. The 1967 graph lines show the approximate labor force required to complete the necessary operations. If the 10 new machines are used to their maximum capacity this year, there will still be a small gap between the required, and available, labor force for good hand pollination. Therefore, it would be expected that a few more machines will be built in the coming years to create a more stable and balanced year-round labor force.

R. M. Perkins is Associate Specialist, Department of Soil Science and Agricultural Engineering, University of California, Riverside; and P. F. Burkner is Agricultural Engineer, Agricultural Research Service, USDA, Riverside.