Need for redesigning pear trees for greater ground clearance of limbs is indicated in photo showing catching frame and shaker at work during mechanical harvesting trials in Santa Clara County.

A PROGRESS REPORT:

Redesigning Pear Trees for Mechanical Harvesting

L. B. MC NELLY • L. C. BARNARD

MECHANICAL HARVESTING of Bartlett pears was attempted in 1960 using a block of sixty-year-old trees, designed specifically for hand harvesting, at the George and Walter Brown pear ranch, Santa Clara County. The lower limbs were so near to the ground that a catching frame could not be driven beneath the trees and the fruit had to be dropped onto straw in the initial trials. After a month in cold storage the fruits were peeled and then graded for mechanical damage, including bruising (brown spotting). An average of 48% of the fruit was damaged and unacceptable for processing. Brown spot bruising accounted for 32% of the damage. This damage was presumed to be from fruits hitting twigs, branches and other fruit while falling.

After these preliminary trials, it was decided that mature Bartlett trees in the Santa Clara Valley would have to be redesigned if they were to be mechanically harvested. The skirt or lower limbs would have to be removed to permit a 36-inch clearance for a catching frame. The number of scaffold limbs would have to be reduced and limbs that were superimposed, one over the other, would have to be retrained or removed. Presumably such a rearrangement would allow dislodged fruit a free fall.

The trees selected for redesigning were typical of the orchard. Yield and harvest data were obtained from trees that had been paired according to similarity in size, shape and general vigor. Extensive pruning was done in both 1960 and 1961 to redesign the trees.

Extensive pruning in 1960 and 1961 and rather severe pruning in 1962 caused a large amount of new growth. It was quite apparent that the redesigned trees had suffered no shock from pruning but instead had been invigorated.

In 1963 all redesigned trees and all conventionally shaped trees within the experimental area were mechanically harvested. Harvesting was all done in one day at the time of the second picking of the main portion of the orchard. The fruits averaged 2.04 pounds in firmness.

The catching frames and shakers were designed for stone fruit harvesting by the John Bean Division—FMC Corp. The frames maneuvered easily under the redesigned trees, but it was necessary to literally force the catching frame beneath conventionally shaped trees. Numerous limbs were broken in the conventionally shaped trees during the maneuvering and shaking process with some loss of fruiting spurs. The frames were partially equipped with decelerator strips and extra padding to reduce the chance of fruit bruising.

After harvest the various lots were belt-sorted to remove fruits with skin breaks, and then separated into three size groups. The culls and smaller fruit were weighed and discarded.

The remaining fruit was placed in cold storage for one month and then ripened for four days. The fruits were processed by the Tri-Valley Packing Corporation. After peeling and coring, each fruit was examined for brown spot damage. The bruised fruit was divided into two categories: (1) "major" damage, or fruits

MECHANICAL HARVESTING TRIALS OF CONVENTIONAL AND REDESIGNED PEAR TREES, AUGUST 1963, SANTA CLARA COUNTY

Tree Design	Harvest Method	Total Yield (tons/acre)	Harvest Loss* %	Mechanical Damage %	Processing Loss††		Cullage	
					Major %	Minor %	Major %	Total %
Conventional	Mechanical	11.7	14.2	7.9	15.4	4.5	37.5	42.0
Redesigned	Mechanical	9.4	8.4†	4.3	8.2	9.0	20.9	29.9
Conventional	Hand	11.7	12.7	2.8	6.0†††	--	21.3	21.3

* Fruit lost to the ground during harvest and undersize fruit.
† 5.6% of this damage is loss of fruit to the ground. Most of this loss occurred in adjusting equipment at the first tree shaken.
†† Weights adjusted by 27% to compensate for peel and core.
††† Tri-Valley records for Santa Clara County Bartletts, 1963.

requiring trimming, and (2) "minor" damage or fruits with only small brown spots. Most of the minor damage would have been overlooked in a normal cannery inspection. Periodic pressure tests taken of the peeled fruits indicated no wide fluctuations and an average firmness of 2.7 pounds. The results from these trials are shown in the table.

To obtain information on yield reduction from trees that were redesigned, harvest data has been taken since 1961. In that first year, conventionally shaped trees produced 3.8 tons per acre more than the redesigned trees. In 1962 there was a difference of 2.2 tons per acre. Data in 1963 —although a short tonnage year—showed that the conventionally shaped trees produced .53 ton more per acre than the redesigned trees.

This yield data indicates the potential loss by the orchardist during the stage of redesigning. Under commercial conditions it is probable that all redesigning would have to be accomplished in one year. Yield losses, unless permanent, would be over a correspondingly shorter period of time. Data from at least one more season is needed to determine if any permanent reduction in the yield results.

A more realistic way for the processor to evaluate the possibility of mechanical harvesting of pears is to compare the yield of choice grade fruits. These data are available only for the 1963 season. Hand harvested, conventionally pruned trees, with a field-delivered tonnage (tonnage delivered to cold storage by grower) of 10.2 tons per acre, yielded 9.3 tons of processed fruit. Mechanically harvested, conventionally designed trees, with a field-delivered tonnage of 10.0 tons, yielded 7.3 tons of processed fruit. Redesigned trees that were mechanically harvested yielded 7.5 tons of processed fruit from a field-delivered tonnage of 7.86 per acre.

The data so far developed does not offer a final solution to the problem of the horticultural or economic feasibility of redesigning mature pear trees for mechanical harvesting, but the direction for further study is indicated.

L. B. McNelly is Farm Advisor, and L. C. Barnard, former County Director, is now Agriculturist Emeritus, Santa Clara County.

LYGUS BUG CONTROL DURING FLOWERING IN DRY LIMA BEANS

THERE HAS BEEN some doubt in the minds of agronomists as to the advisability of controlling lygus bugs at flowering time in order to enhance the pod set in dry limas. The two general reasons for this doubt have been the ability of the lima bean plants to produce large numbers of flowers; and even with control, flowers may dehisce due to high temperatures.

Temperatures in the last two growing seasons (1962, 1963) in the interior lima bean areas of California have been optimal for pod set; however, pod set was observed to be spotty, with some fields almost completely devoid of any crown-set beans. Samples of floral racemes brought to Davis from fields not setting pods had the entire spectrum of lygus damage symptoms. That is, damage ranged from some buds which were aborted at a very early stage of development, with the result that no flowers were produced, to racemes with visible lygus damage on juvenile pods. Observations made over the years at Davis indicated that reduction in yield by lygus was more severe with large than with baby limas.

During the summer of 1963, a field comparison of control, versus non-control in a late planting (June 4) of large and baby limas was made. The control plots were treated once with toxaphene at the rate of 4 lbs. per acre. The treatment was made at the mid-flowering stage when a population of three lygus per sweep was encountered. Treated large limas yielded 300% of the non-treated, or four sacks per acre vs. 12 sacks per acre. The treated baby limas had a yield advantage of 112% of the non-treated, or 26 sacks per acre vs. 29 sacks per acre. Both increases in yield were more than enough to pay for the treatment. The treated plots were significantly different from the non-treated plots at the 1% level.

Detailed study of the action of lygus on lima beans is being carried out by University of California entomologists. With the information that has been gathered and the future combined efforts of University scientists, a better understanding of lygus bug damage at flowering time and the effect of their control will be used to make new recommendations.—*R. L. Sanchez, Assistant Specialist, Department of Agronomy, University of California, Davis. Experiment Station Project 772A, B.*

PHOSPHORUS-DEFICIENCY-INDUCED DORMANCY SYMPTOMS IN ALFALFA

THE EFFECTS OF NUTRIENT deficiencies on some facets of crop production such as yield and rate of maturity have been well documented. A recent project to determine nutrient requirements of alfalfa grown for seed has shown that phosphorus deficiency may induce dormancy symptoms. Moapa variety alfalfa, a non-dormant type, was transplanted into pots of phosphorus-deficient (less than 3 ppm P) and phosphorus-sufficient soils. The pots were left outside and given no care except for watering. With the advent of winter weather, the plants in the phosphorus-sufficient soil retained their foliage while those lacking adequate phosphorus died back and then started regrowth from the crowns. As facilities become available at West Side Field Station, this observation will be followed up as part of a program to relate the nutrition of seed alfalfa to some aspects of its physiological behavior. —*Verle Q. Hale, Assistant Agronomist, University of California, Agricultural Experiment Station, Davis.*