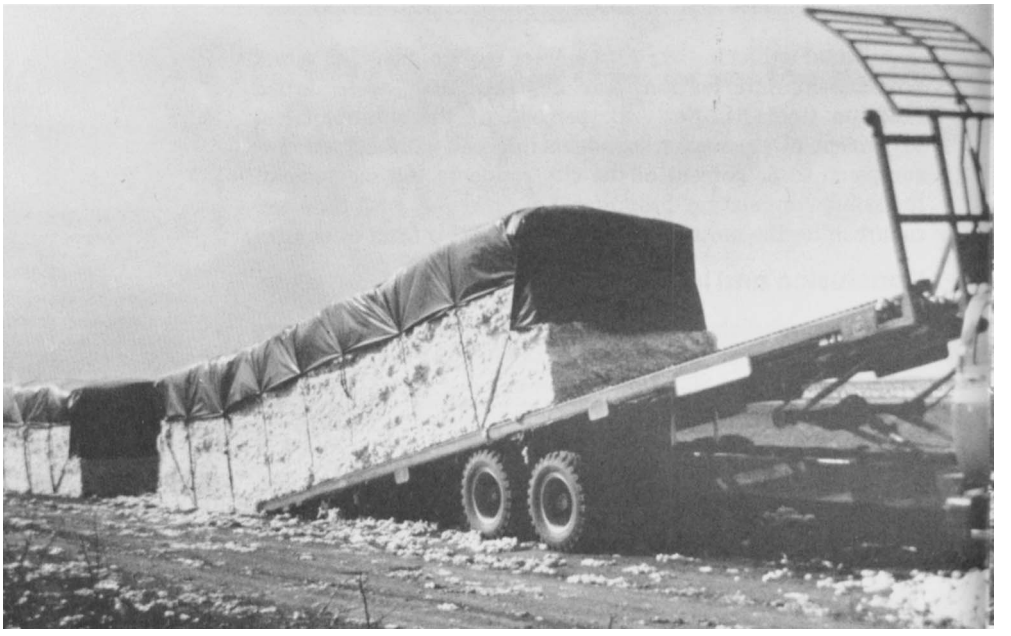
*A new type of module transport unit that became commercially available in 1975 picks up and hauls cotton modules made directly on the ground, thereby eliminating the need for pallets. Total loading time in the field averaged about 8 minutes less for a palletless module than for a pallet module. The palletless system eliminates the problems associated with handling, storing, and repairing pallets, and requires a much lower total equipment investment than the pallet system. But without pallets, the bottom cotton is more likely to get wet from rain or moist soil. When the one-way hauling distance is not over 10 miles and the annual use per mover is greater than 400 modules, total field-to-suction costs are substantially less with the palletless system than with the pallet system. For less than 300 modules per year per mover, the pallet system is more economical.*



# Handling seed cotton modules without pallets

Robert A. Kepner • Robert G. Curley

Pallets used in the module system for handling and storing seed cotton are awkward to manage, are easily damaged, and represent a large capital investment. The Reynolds module mover, which first became commercially available in 1975, picks up and hauls cotton modules made directly on the ground. It is similar to haystack movers that have been available for several years. Palletless modules will remain intact through several loading and unloading cycles with the Reynolds mover.

Basically, the Reynolds module mover is a specially built tilt-bed truck with 12 parallel roller chains running lengthwise of the bed to support and convey the module. When loading, the forward speed of the chains relative to the truck is synchronized with the rearward speed of the truck so that the chain legs on top of the bed essentially stand still with respect to the ground as the tilted bed moves under the module. When unloading, the chains move rearward as the truck moves forward. The current models are designed primarily for 32-foot modules but could also haul shorter modules. At least one other manufacturer expects to have a similar palletless module mover available for the 1976 season.

The module system, first used in California in 1972, involves handling and storing the seed cotton in high-density, free-standing stacks that are 7 to 7½ feet wide, 24 or 32 feet long, and usually 6 to 7 feet high. The 32-foot length usually averages 10 to 12 bales per module. The modules are made by dumping the seed cotton from the picker baskets into a four-sided form having a mechanical compacter and an openable rear door. When a module is completed the rear door is opened, the module builder is raised on its wheels, and the tractor that operates the module builder pulls it forward. Modules built on wood or metal pallets are subsequently winched onto a specially built tilt-bed trailer for transport.

At least six Reynolds module movers were sold in California in 1975, and at least six in Texas. One of the California units was used to haul about 400 modules from the field to storage and from storage to the gin suction station. Two other California units, owned by one grower-ginner, each moved 900 to 1,000 modules from field to storage to suction station. A fourth California unit hauled about 1,400 modules from the field directly to the suction station. The latter three units were operated on a two-shift basis, about 22 hours per day.

Time-and-motion studies were made on three of the Reynolds movers, and the results were compared with studies previously made for hauling pallet modules. A cost analysis, based on the time-study results, other information obtained from several sources, and various assumed cost factors, was made to compare the palletless and pallet systems. Values for all the cost factors used in the analysis, as well as additional comparative information, are included in a more detailed report available from the authors.

## Hauling from field to storage area

In these studies, total field loading time, including positioning the hauling unit, averaged only 2½ minutes with the Reynolds palletless module mover, as compared with 10½ minutes for loading pallet modules onto a trailer. The driver of the Reynolds mover can do the entire loading operation without leaving the cab.

Primarily as a result of the faster loading, a Reynolds mover can haul 25 to 30 percent more modules than a truck and trailer hauling pallet modules when the one-way travel distance is 5 miles (0.55 hour round-trip time per module versus 0.71 hour). The productivity difference decreases as the hauling distance is increased, because the 8-minute difference in non-travel times becomes a smaller portion of the total time per module. With a 20-mile haul (one way), the estimated round-trip times are 1.17

**Palletless module being loaded (left), and loaded module mover, ready to travel (right).**

hours and 1.33 hours for palletless and pallet modules, respectively (14 percent difference).

Costs of hauling from field to storage area are shown in the graph as a function of the number of modules per year per hauling unit. The curves shown for the pallet system include $31 per module for pallet overhead and repair costs, assuming each pallet is used only once per season. If 25 percent of the pallets are used twice per season, the pallet cost and total costs are reduced by $5.50 per module.

Because of the high annual overhead costs for the Reynolds mover ($11,000), high annual use is essential to minimize the cost per module. When the hauling distance is 5 or 10 miles (or less) and the annual use is at least 400 modules per hauling unit, the palletless system (Reynolds mover) has a lower cost per module than the pallet system. For less than 300 modules per year, the pallet system is more economical than the palletless system.

As the hauling distance is increased, the advantage of the faster loading time with the Reynolds mover is counteracted by the greater cost per mile of hauling with a $60,000 truck as compared with a $12,800 pallet-module truck and trailer combination. Costs for the two systems are about equal when the hauling distance is 20 miles and the annual use is at least 350 modules per hauling unit. With a 30-mile haul, the palletless system is substantially more expensive than the pallet system, regardless of the amount of annual use.

## Total handling costs

Calculated costs for moving pallet modules from the gin storage area to the suction station with a farm tractor and yard trailer ranged from $11.49 to $7.73 per module for 200 to 1,000 modules per year. If the same Reynolds mover is used to haul a given number of palletless modules per year to the gin storage area and then move them from the storage area to the suction station, the additional operating costs for moving the modules at the gin total $5.59 per module. Costs for both systems are for an assumed ginning rate of 1¼ modules per hour and in both cases would be $1.29 per module less if ginning two modules per hour.

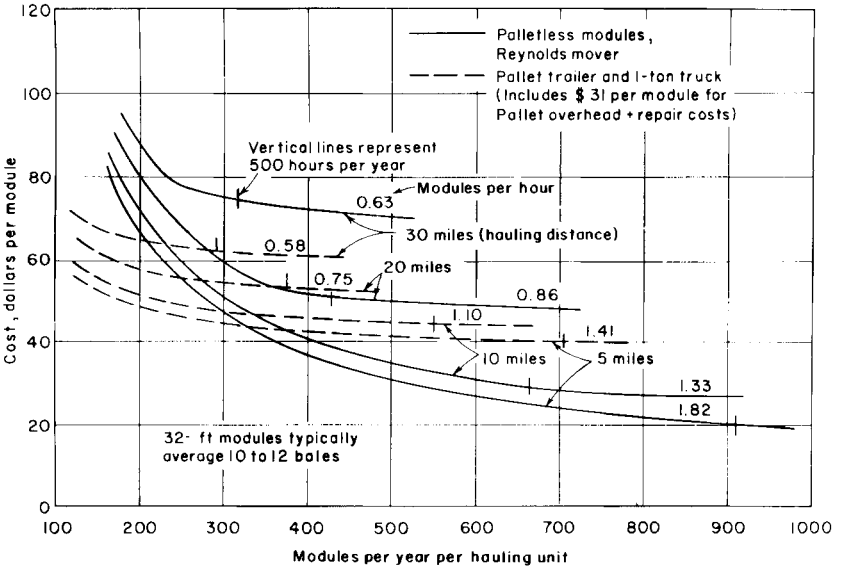
When the costs of handling at the gin are added to the costs of hauling from the field to the gin storage area, the relations between the total costs for the two systems are about the same as described for field-to-storage hauling costs.

If either pallet modules or palletless modules are hauled directly from the field to the suction station, the total cost equals the field-to-storage hauling cost (as shown in the graph) plus the labor cost for the time waiting at the gin. The waiting time is the difference between the ginning time per module and the round-trip time on a continuous hauling basis.

The total direct field-to-suction cost is substantially less than the field-to-storage-to-suction cost, but the waiting time decreases the maximum seasonal capacity of each hauling unit. The feasibility of direct hauling is influenced by the extent to which field-stored modules are likely to be inaccessible because of adverse weather or soil conditions and by how closely the potential hauling rate matches the ginning rate.

In these comparisons, pallet-module total costs do not include any allowance for extra costs incurred in handling and stacking empty pallets at the gin (usually done by the gin crew) or hauling pallets to the field and distributing them. Likewise, no allowance has been made for the

**Cost of hauling from field to storage area plus cost of providing pallets for pallet modules, in relation to the amount of annual use.**



cost of gleaning the cotton left by the palletless module mover on the ground area that had been beneath the module (usually 20 to 30 pounds of seed cotton per module).

### General conditions

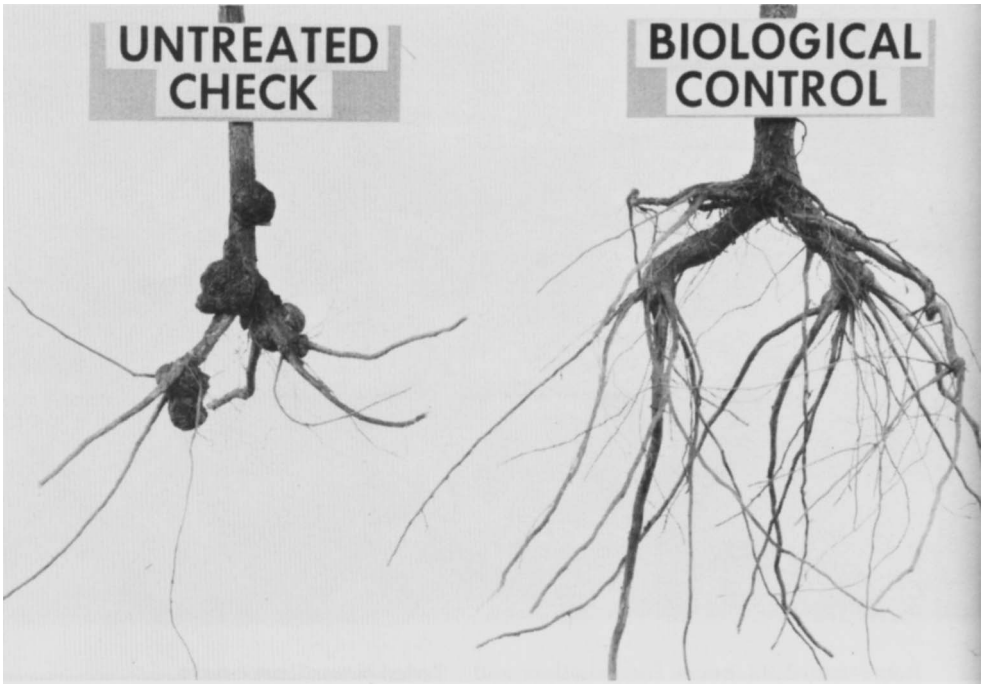
The palletless system eliminates handling, storing, and repairing pallets, and the total equipment investment is much less than with the pallet system. With no empty pallets in the field, there is greater flexibility in positioning the module builder for each new module to best fit the picking progress. There are no pallets (or conventional trailers) to be relocated because of wrong predictions as to where they would be needed. The palletless module mover truck is easier to maneuver and position for loading than is a pallet-module trailer towed by a truck.

With palletless modules, the bottom cotton may get wet from rain unless each module is stored on a raised area having good drainage away from the module (whether stored in the field or elsewhere). More planning and care are needed in preparing a central storage area for palletless modules than for pallet modules, especially if the soil in the storage area is fairly heavy and substantial rains are likely to occur during the storage period.

Firm compacting of each module near the ends is especially important with the palletless system. The top and at least the upper 2 feet of the sides and ends of both palletless and pallet modules should be covered during transport. If the modules are to be stored, each module should be covered in the field within a day after being built. If some modules are left uncovered because they are to be hauled directly to the suction station within a few days, a tarp should be installed as part of the loading operation.

To maximize annual use, module movers should be owned and operated by a gin. This is especially important with the palletless mover. A gin should either own more than one palletless mover or have temporary access to a second unit so the ginning operation is not dependent on a single mover. Night operation of palletless movers is feasible and is desirable to increase the annual use.

*Robert A. Kepner is Professor of Agricultural Engineering, and Robert G. Curley is Extension Agricultural Engineer, University of California, Davis.* *This study was partially supported by a grant from Cotton, Incorporated.*




**Effect of biological control treatment on Marianna plum compared with an unprotected check.**

# Biological control of crown gall

William J. Moller • Milton N. Schroth

*A non-gall-forming bacterium may provide the much-needed biological method of controlling this serious disease in new deciduous fruit orchards.*

Spectacular biological control of crown gall was achieved last year in an experiment carried out on young almond, peach, plum, and apricot trees in a California nursery. This new approach to control of a difficult disease is of interest to West Coast nurserymen producing woody perennial plants, and also to growers planting new deciduous fruit orchards.

Crown gall is a bacterial (*Agrobacterium tumefaciens*) disease of worldwide importance on many woody plants; it can be especially serious in deciduous fruit nurseries. Heavy, rough overgrowths develop on the basal trunk, the roots, and occasionally the aerial parts of plants following entry of the bacteria through wounds made during planting or other cultural practices.

Gall formation can disrupt food- and water-conducting tissues of the plant so that infected young trees become stunted and grow poorly. On older trees, the galls can also serve as entry points for secondary wood rots, which weaken the tree.

An Australian researcher, Dr. Allen Kerr, recently reported on the effectiveness of a non-disease-producing form of the crown gall bacterium for protecting seeds and seedlings against the gall-forming strain. Kerr found that, by dipping seeds or seedlings in a suspension of this biological agent before planting, healthy trees could be grown, even in crown-gall-infested soil. Dr. Larry Moore of Oregon State University tested this approach in the field and obtained spec-