Modern developments in bulk handling of apples

J C. Rowbotham
One of the results of mechanisation replacing physical labour has been the development of bulk handling of many commodities. Apart from the saving of time, effort and cost, bulk handling of agricultural produce enables quicker harvesting at the right time.

By J. C. ROWBOTHAM, Horticultural Instructor, Bunbury

FROM the early efforts of growers such as Sewell of Northam, Grist of Donnybrook, and Crouch of Kendenup, who were the first in this State to prove that it was both practical and profitable to move fruit from tree to packing house in bulk containers, the use of bins, trailers and allied equipment, has increased greatly in the past five or six years.

A few orchardists followed the lead of the pioneers in the use of the wheeled trailer-bin, but the main trend has been towards standard sized bins handled by the many types of lifting and moving equipment.

This development, which started in the central sheds at Donnybrook, was quickly adopted by other centres and in a few years bulk handling was an accepted practice in all the main southwest and Great Southern centres. Ideas of bin size and construction which originated in Donnybrook quickly led to a standard bin being adopted elsewhere.

Once the advantages became apparent, not only to growers but also to exporters, use of bins for delivery to sheds increased so rapidly that today about 75-80 per cent. of the State's crop of apples is handled in bulk bins. In the Donnybrook district the percentage would be higher, although there the picture is somewhat marred by variations in types and sizes of bins.

In this area many pears both for export and local markets are also picked in bulk bins together with a large proportion of the citrus crop, mainly Valencia oranges. Quite apart from the actual picking operations and the movement and storage of apples in sheds and cool stores, the transport of fruit to local market and wholesaler-distributor is another sphere for the use of bins.
To cope with this development, special cool stores are being erected to handle fruit in bulk, new packing houses are planned to facilitate the movement of bins, and the Railways Department is introducing special vans and equipment to accommodate and transport bins as well as pallets of boxed fruit. A limited quantity of apples is being exported in bins each year. Expansion of this method depends upon the ability of importers to handle fruit in this form.

Bulk handling developed on a large scale earlier in the Donnybrook district than elsewhere and resulted in wide variation in bins used in orchards and sheds there. Growers from other districts, saw the success of these earlier attempts and were able to choose the best for themselves. This has resulted in a degree of standardisation of materials and sizes of bins. The standardisation has many advantages particularly in relation to equipment for handling, as this can be tailored to suit circumstances. Economics involving mass production and repairs are also involved. The present standard type bins, of wood and steel, have a capacity of about 25 bushels are 6 ft. 4 in. long, 3 ft. 9¾ in. wide and 2 ft. 7½ in. deep.

This type of bulk container is used by the majority of exporting agents and by many growers, both for transporting to the central sheds and also to their own private sheds.

Both jarrah and karri hardwoods are being used in bin construction, some growers use pine, mainly pinus radiata, and a few have tried pressed fibre boards successfully.

Whatever the timber, care must be taken to ensure a smooth finish, especially on the floor of the bin on which the fruit slides when being tipped. In some of the earlier bins, including trailer bins, linoleum was used to achieve this smoothness, but a glossy paint applied to a well dressed board achieves the required result. The dressing and painting must be well done to prevent the grain from standing out under changing weather conditions. Varnish has been tried with bad results. Badly scarred apples, suffering from what has become known as “Bin Scald” result from using bins with roughened bottoms and sides.

Another smaller type of wooden bin is also being used, particularly in the districts nearer to Perth. This container,
which is usually reinforced with steel, measures 44 in. by 42 in. by 27 in. deep and holds about 20 bushels. When empty it can be handled by one man. This box can be used not only for harvesting and transporting to packer or wholesaler, but is a handy size for cool storage.

The strongly built steel and hardwood bin with a hinged flap opening at one end is undoubtedly the best proposition for the exporter who deals with a large number of growers. Although the initial outlay may be greater than for the lighter types, their solid construction ensures a reasonable length of service, even when treated roughly. This bin in the standard size of 25 bushels together with the same size bin of pine is the most serviceable container suitable for the movement or storage of fruit in bulk.

HANDLING BINS IN ORCHARDS

Much initiative has been displayed by fruit growers in devising means of moving empty and filled bins in and around their orchards, and in loading them on to transport trucks for delivery to packing houses.

Methods are many and varied. A simple hoist consists of a wire rope slung from a pulley block fastened to a stout pole wedged between the forks of two convenient trees—one end hooked to the loops of the bin, the other to a tractor draw bar. A more elaborate type consists of steel H beams fastened between heavy poles or railway irons, usually fitted with a hand or electrically operated hoist.

A few apple growers who do not pack any fruit in their own sheds, have installed hoists on overhead beams under cover. Some of these have elaborate electrically operated outfits mounted on small gantries which travel in four directions. Filled bins can be stacked four high, out of the weather, to await the carrier.

Some growers use long wooden or steel framed trailers behind tractors, others prefer a forklift attachment on their tractors.

The trailers used for transporting up to 3 full bins are necessarily of strong construction, fitted with heavy duty tyres—often discarded aeroplane wheels. As these are of large section they not only prevent bogging in soft conditions, but iron out bumps on rough tracks.

Some of these trailers are constructed with timber frames, but the better class make use of old truck chassis, or lengths of railway iron.

The construction of the latter type is simply a matter of cutting, bending and welding the steel rails, fitting of lugs to prevent movement of bins and bolting on suitable axle and wheels.

The type of trailer illustrated, to carry two or three full bins, can be used in the orchard to cart to a central loading point where fruit is collected by motor truck.
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It can also be used where the packing house is not too far from the orchard to allow the carrying of bins from tree to shed.

The forklift, fitted to the front or rear of the orchard tractor, is popular with many growers. While it costs about twice as much to fit the lift to the front of the tractor, it is more convenient and easier to operate as the driver can see from his seat all movements of his forklift. Tractor forklifts are very useful to the apple grower who wishes to pack at home and also deliver part of his crop to a central shed, because he is able not only to move more bins from his trees to his own shed, but can stack bins under cover to be subsequently lifted onto a motor truck for carting to an exporter's shed.

When packing at home, the forklift is useful for lifting full bins on to the tilted table and removing them when empty.

If a grower has to deliver only to his own shed the forklift will be cheapest as it can both lift and transport; in an emergency he can load his filled bins on to motor trucks for quick despatch to a central packing shed.

Using multi-bin trailers may appeal to some, but it must be remembered that to move from trailer to grader, in the case of the grower who packs his own fruit, means of lifting them is still necessary. A forklift, or an overhead hoist must be used.

Whatever the outfit used, certain precautions must be observed.

When using tractors, either with fork lift or trailer, speed is not the essence of the contract when orchard surfaces are loose and dusty. To obviate bruising, only the simplest precautions are necessary in the orchard; careful emptying of filled picking bags, no over-filling of bins, and careful driving over ruts and drains in orchards or on roads.

Many growers pick straight into bins, mounted on trailers. A small, stout box makes a handy step for a picker with a full bag and saves bumping when lifting a bag over the side. Some cover should be provided for fruit in bins, on both hot days and frosty nights. This can be either a cover of clean bags, or a tent fly, or the heavy shade of a convenient tree. On occasion, bins of fruit arrive at packing sheds with top layers sunburnt or tinted a shade of pink, through being left uncovered on the night of an early frost.

Another way to soil good fruit is by moving the bins around the orchard with the forklift carried too close to the ground, the slightest ridge of soil will be picked up. Not only do the bottom layers of fruit collect a coating of dirt, but so do the topmost layers of the lower bins during stacking.

**TRANSPORT TO PACKING SHED**

The choice of equipment to carry bins to and from packing houses will be governed by two major factors:

The quantity of fruit to be harvested and carted in a given time and distance from orchard to private or agent's packing house.
For the grower who produces 2,000 to 8,000 bushels and either packs his own fruit or is situated within 3 or 4 miles of a central packing house, the multi-bin trailer towed by tractor would be the most economical proposition. Even with a greater production packed at home, this would prove the cheapest means of transportation.

For the grower in the 8,000 to 20,000 bushel range these trailer units would involve the tying up of too many tractors on transport work, not to mention the manpower to drive them. Here a larger type of motor truck, carrying 6 or 8 bins, either private or operated by a general carrier is the obvious answer.

The higher road speed of the truck compared to the tractor-drawn unit is of first importance when big quantities have to be moved over medium to long distances. The wheeled tractor-bin is better suited to the man who prefers to pack his own crop in a shed situated in or quite close to his orchard. This type also needs special receiving equipment on the fruit sizer—in the major sheds the equipment is built to deal with the standard portable bin.

Many of the larger apple growers have converted their two-bin trailers to three-bin trailers by adding cross bearers to the front part of their two-bin outfit. These are long enough to accommodate 2 bins lengthwise side by side.

The main disadvantage of the 3-bin trailer is its width when picking among very big trees. However, they cut the time used in transporting from orchard to shed by at least one third and this saving can be quite important when long distances have to be covered.

One advantage of the multi-bin tractor trailer when used for delivering to exporter's sheds is that no hoisting gear is needed at the orchard. The empty bins are placed on the outfit by the shed operator, left on the trailer while picking is in progress, and lifted off when full by the packing house hoist or lift.

However, some major exporters are unable, through the design of their sheds, to deal with bins delivered on trailers, and they are limited to receiving fruit in bins carted by road truck.

**SHED LAYOUT AND OPERATION**

The introduction of bulk handling to apple packing sheds has necessitated many changes in layout and operations of sheds originally designed to handle fruit in picking boxes. This has applied particularly to the central sheds.
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To take full advantage of mechanical bulk handling it is essential to have very free access to all parts of the shed and also adjoining loading areas. The system of raised floors and loading ramps designed to handle picking boxes at truck tray height does not lend itself to large scale bulk handling, because it curtails the operation of forklift trucks. For efficient use of these machines a good solid floor at ground level is necessary to enable the forklift to work anywhere inside the shed as well as on the unloading apron outside.

Where, for various reasons, an existing raised floor must be used there are alternative methods of operating. If the shed floor is of concrete this can be extended in the form of an expansive outside ramp large enough to permit the use of a forklift for off loading and also for stacking empties outside the shed. However this method is limited to delivery on vehicles of truck tray height and will not cope with bins on low slung trailers.

A wooden floor will not carry a forklift truck and in these sheds an overhead electric lifting device is required. This
Electric hoist on traveller lowering full bin on to tilted table

method limits the area of operation as bins can only be handled within the scope of the overhead gantry system.

With this restriction of space congestion will occur where a number of growers' fruit is to be handled and various varieties are involved. The limited height of stacking, particularly of empty bins will further limit the capacity of this type of shed.

The overhead gantry system is however, very useful in the small sheds including growers sheds, particularly where the use of a forklift would not be economical.

For the grower packing his own fruit a system of bulk bin trailers unloaded by an H beam overhead lift at the shed works very well. Tractor forklifts can be used in some circumstances, but it is necessary for the tractor to be able to enter the shed and place the bin on the tilting cradle for discharge on to the grader.

Once the bins of fruit have been stacked in the shed they are moved to the hopper of the sorting and sizing machine by forklift truck, hand operated hoist, or electric hoist. Here they are lowered on to a tilted frame or table, the angle of which is designed (mostly by experience) to give a steady flow of fruit on to the moving belt which transfers it to the foot of the elevator. Some of these frames are not fixtures and can be manoeuvred into position adjacent to the grader. In the more advanced sheds the hoppers are built to accommodate two filled bins, two on one side or one on the end and one on the side. This is useful in controlling the rate of flow of fruit. A good line can be fed at a fast rate by feeding two bins together, thus speeding up the sorting rate and delivery to the packers, while a rough line can be fed one bin at a time to allow more careful sorting. Being able to place bins in position in pairs leaves the forklift hoist operator more time for receiving fruit at the door. One man usually does both jobs in both large and small sheds and much running around is avoided by using the multiple side and end delivery hopper.

Some shed operators have found that the fixed angle bin does not ensure an even flow of fruit into the hopper from start to finish. This is overcome by gradually increasing the angle of tilt during discharge. Various devices have been tried to vary the angle, some hydraulic, some manual; they all work fairly well within limits. Some sheds employ an operator to control the flow of fruit from the bin by hand.

New designs are being developed at the time of writing to deal with this problem.

In any shed design it is essential for maximum efficiency and pack out to have a free flow of fruit from the delivery point through to the despatch and any consideration of design must incorporate this basic principle.

A plan of a growers packing shed which is considered ideal for handling export apples is shown in the accompanying diagram.

It consists essentially of an electric gantry hoist running the full length of the shed.

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The same overhead hoist is used for removing, stacking, or loading empty bins on to transport and at the other end of the shed for loading out palletised packed boxes or cartons. A truck bay is provided for this purpose. Palletising assists transport to the export assembly point where off loading can be accomplished by a forklift. The truck bay is also useful for off loading packing materials into the sheds.

The layout illustrated is recommended as a basic plan for growers where the packing shed is not combined with a cold store.

**BULK HANDLING ADVANTAGES**

In these days of rising costs perhaps the first advantage to be considered is the saving in labour.

This saving is quite obvious when one compares the labour involved in moving fruit about in single bushel containers, both in the orchard and the packing shed with handling 20 to 30 bushel bins. One man operating a forklift hoist can look after the receiving of bins and feeding the hoppers of several graders. Under the bushel box system one or two men are needed for receiving and one man per grader for tipping on. Rapid handling of large quantities of fruit is another advantage of bulk containers. Loose fruit in bins can also be stacked safely to greater heights than can loose fruit in bushel boxes. Floor space is thus freed for other phases of packing operations.

Some critics of the bulk handling method point out that the cost of equipping an orchard or shed with bins and the means of handling them offset the saving in labour costs. However, the labour cost is a recurring expense. The equipment cost, although it may seem heavy, is spread over a number of years. Well constructed bins if kept under cover and painted occasionally, have a useful life of many years—even the cheaper all-pine containers should last well with care. The extra machinery, H beams and hoists, forklifts and trailers are only used for short periods each year and will give many years service. It is mainly a matter of proper care and maintenance.

Quite a number of fruitgrowers who engage in other pursuits have found the bulk handling equipment useful in moving other products and necessities on the farm. Some handle potatoes in bulk, to convenient sites for grading and bagging, and others move bulk fertilisers in their bins, after lining the bins to prevent
spillage of the contents. The long trailers can be used for transporting irrigation spray lines, props for laden trees, and many other awkward loads. These extra uses spread the cost of the equipment over more avenues of income.

With the marked swing to fibre-board containers for fruit packaging, and the reduction in the use of the dump box, it would seem that the bulk bin appeared at an opportune time. Many export boxes were previously used by orchardists as picking boxes and a proportion of these always turned up in the packing lines stained and dirty, often containing trash and soil, causing much concern to export fruit inspectors.

With fewer export boxes being used each year for picking, this problem is disappearing, and less bruising occurs in fruit picked into bins than handled in dumps or similar boxes.

Probably one of the greatest boons of bulk handling is yet to emerge; the cool storage of loose Granny Smith apples, picked during the optimum period and held for packing when time and shipping is available.

In the very near future it may be that two million bushels of Granny Smith apples will have to be picked in the same few weeks now needed to pick about a million. There will undoubtedly be some difficulties in packing them as quickly as they can be harvested with bulk facilities. If these apples in prime long-keeping condition can be held in bin storage for short periods, before packaging, it may well be one of the answers to the problem.
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