Adjusting to Technological Change in Strawberry Harvest Work

by

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A machine used by many Ventura County strawberry firms in 2003 holds economic promise for adopters throughout California. While significantly reducing the amount of labor needed in the harvest, it alters the jobs of crew members and raises several key questions for human resource managers. Ê

California has long relied upon technological innovation to retain its place as a world leader in farm production. New methods based on biological, chemical, mechanical and information processing advances have been designed for various purposes, such as to improve the output quantity and quality of output, conserve natural resources, reduce exposure to workplace hazards and control runoff of fertilizers and pesticides. Almost always, however, a key objective for mechanical innovations in agriculture is to increase labor productivity.

Use of a recently developed machine by many strawberry growers in Ventura County this year exemplifies the potential of new technology to substantially reduce work hours and costs. The machine will not have an impact comparable to that of the tomato harvester or cotton gin, but it can cut the amount of human work time needed in strawberry harvest, which is one of the most labor-intensive operations in agriculture, by one-third or more. While not reducing the need for human eyes, judgment and hands in the most critical strawberry harvesting tasks, it eases the lower-skill part of the harvester's job.

As with all innovations, intended benefits of the new machine are not assured, and its use may have unexpected effects. The machine-aided system raises issues beyond the classic economic question of whether future labor savings provide a sufficient return to an immediate investment. Growers contemplating or already adjusting to the move face interrelated decisions about harvest crew configuration, work pace, pay scheme, ergonomic risk control and overall choreography of introducing the change.

Producing Berries in California

Strawberries are the fourth most valuable fruit crop produced in the United States, and they rank second only to apples in fresh market sales. California growers produced 1.4 billion pounds of strawberries, 83 percent of the nation's total, worth some $800 million in 2001. About three-fourths were harvested for the more lucrative fresh market, the rest for freezing and processing.

Strawberry production is expensive and labor-intensive. Total production costs are around $25,000 per acre, of which harvesting accounts for about 63 percent. Harvest labor expense alone is more than 40 percent of the total. Statewide employment in berries peaks at nearly 30,000 in May and June.

California strawberry shipping starts each year in south coastal counties and proceeds northward in overlapping regional seasons. San Diego, Orange, Los Angeles and Ventura counties begin in January and continue through June, their fresh-market shipments peaking in April and May. Harvest in the Santa Maria area runs from March to August. The Watsonville and Salinas areas (Santa Cruz and Monterey Counties), home of almost half the state's strawberry acreage, produce from April through October, with about half their total volume in June and July. Ventura ships again during a short autumn season.

Strawberry plants continuously produce new fruit that is harvested in a three-day rhythm over the season. Harvest crews of 25-35 members customarily retrace an itinerary through planted acreage twice during a six-day work week.

The harvester job entails a cycle of tasks that require concentration, dexterity and stamina. Tasks of selecting, picking and packing ripe berries are performed with both hands in rapid sequence. Interspersed with them is the task of cleaning the plants of berries that are misshapen, bruised, moldy or otherwise unmarketable. The final task in the job cycle is delivering full trays, or "flats" weighing 10.5-12 pounds, to a collection point on a road bordering the field, and then returning to the row with an empty flat.

A checker at the collection point controls quality and records individual output, and a stacker piles the flats for loading on a truck that goes to a cooler.

To fill flats, a harvest worker selects and picks from plants on both sides of a furrow (row), covering the nearest half of each adjacent bed. Furrows are about one foot wide and 300 feet long with beds 14 inches high. A small wire cart, or "carrito" resembling a mini-wheelbarrow, facilitates packing by holding the flat above bed level and inclined toward the worker, who advances it down the row periodically when moving to pick from new plants.

Harvest workers traditionally carry each packed flat an average of 120 feet from where they pick. Photos by H. R. Rosenberg.

Workers take their finished flats, one at a time, back up the furrow and then laterally on the road to the collection station. A station is set up at each end of the field, so that the maximum one-way walk in the furrow is about 150 feet, the average 75 feet, and the average round trip between picking area and delivery table is 240 feet. Managers report that a majority of harvest injuries are due to slips and falls near the end of the row, where workers turn sharply as they hurry in with a full flat or back out with an empty one.

Core tasks of picking and plant cleaning are performed by workers while bending, kneeling (one knee on the raised bed), or crouching. Although workers shift from side to side of the row, occasionally stand for a breather, and change positions in various other ways, they spend most of their work time in "non-neutral" postures. Union leaders and other worker advocates have expressed concern about the long-term effects of these positions and repetitive task motions on workers.

Harvest System Changes

The new machine serves as a mobile station for receiving and accumulating packed flats of berries close to where they are picked. It slowly creeps down the field just ahead of where harvesters are picking. By allowing for immediate delivery within every row, it eliminates bottlenecks at a central collection point on the road as well as the need to walk or run down the row with a full flat to get there, which amounts to more than two miles per day.

Conceived by a Ventura County grower, a prototype was fabricated and first field-tested in 2000. A few second-generation machines entered the field in 2001, and additional units evolved from that design in 2002. Breakdowns sometimes disrupted berry production and forced reversion to the traditional harvest system, but lessons from experience led to a much-improved, third generation of machines. Some 50 of the new units served reliably to help harvest 30-40 percent of the Ventura County strawberry acreage in the 2003 spring season. Safety-oriented adjustments (e.g., hazard warning signs, protective gear for machine operators, remote engine-kill switches and additional first-aid kits) were made during the 2003 season, and further refinement is likely for 2004. A few machines were used briefly in the Santa Maria area this year, and some are now in Monterey County.

Workers in a machine-aided system pick and pack berries exactly as in a traditional harvest. However, they walk their full flats only a short way to place it on a shelf that runs along the machine "boom," which extends across 15 rows. There, they write on the flat a number that identifies it as theirs, adjust berry placements, insert stacking guide wires and then move the flat forward to a conveyor belt. Two belts, one each on the left and right halves of the boom, move flats from all rows to an open area at a center, where one of two operator/stackers lifts them onto a platform for checking, crediting to the worker and intermediate stacking. From there, the flats are stacked onto pallets that are directly offloaded by a

forklift and taken to a truck bound for the cooler. This machine continues the substitution away from manual conveyance in strawberry harvest. Only within the past several years have forklifts become commonly used to load stacks of finished flats onto trucks. Previously, the lift/load operation mostly taxed human arms, legs and backs.

Delivery to a machine in the field is faster and less hazardous, and it leaves more time to pick berries while bending or kneeling.

Outcomes to Watch

How will a move to machine-aided harvest play out for growers and workers? Growers can, of course, expect to incur new expenses of purchasing (or leasing) and operating the machine and to save on harvest labor cost. They also may realize gain or loss from changes in berry pack quality, capacity to meet unexpected surges in demand, employee absenteeism and turnover, ease of recruitment, and injury experience and related workers' compensation premiums. While the projected return on the $125,000 investment for a third-generation machine looks good, actual results will depend on many decisions in the field and office.

Reducing the time and burden of carrying full flats can translate into harvest worker-hour savings of one-third or more. In one firm, a machine crew of 15 pickers performs the work that a traditional crew of 25 had in previous years. So in a 50-hour workweek, the machine effectively replaces 500 worker-hours there. Using $10 as a conservative estimate of direct and indirect hourly labor costs, those hours saved are worth a gross of $5000 per week—$70,000 over a 14-week Oxnard spring season, or $130,000 over 26 weeks in Watsonville.

Offsetting this gross cost savings are investment opportunity costs and current expenses for fuel, maintenance and repair. Setting aside the opportunity cost, if the weekly machine operating expense is around $1200, net system savings come to $53,200 for a 14-week season, or $98,800 for 26 weeks. A key managerial decision is how to allocate portions of this savings to the machine purchase, worker wages and operating margin.

The Deal for Workers

Workers' central interest is their individual earnings per hour and over the season. Although the number of jobs and the total wage bill are smaller in a machine-aided system, remaining harvest workers could achieve much higher earnings, depending on the pay system. Most pay plans in the industry include a piece-rate component. Many firms pay an hourly rate plus an output-based supplement, such as $4.60 per hour plus $.80 per flat, and many pay totally on a piece-rate basis. All guarantee workers $6.75 or more per hour for all time worked when piece-rate earnings would not meet that California legal minimum wage.

By reducing the time needed to complete a flat production cycle, the machine enables harvesters to turn out more units in a given time period. The more that pay is based on output (i.e., a piece-rate applied to number of units) and the closer the piece rate is to the non-machine rate, the greater the increase in individual earnings. The straight piece rate at a firm I visited is 80 percent of its former level, but the machine enables workers to produce 167 percent as many flats as they used to, so their average piece-rate earnings are one-third higher in the new system. More detailed discussion of pay parameters and effects is in the August, 2003 issue of *California Farmer.*

Other important effects to monitor are workers' physical and mental reactions to changes in the work environment and the job itself, particularly the decrease in time spent carrying flats and the increase in picking and packing. The moves (bending,

required to perform the latter tasks are linked more with risks of musculoskeletal injury. Carrying is performed upright but involves more risk of slips, falls and twisted joints while hustling down narrow, sometimes uneven or slippery rows. Time formerly-spent delivering full flats may have been valued as a respite from the stress of working in a bent posture. It remains to be seen whether workers will find comparable relief in the shorter walk to a machine, perhaps supplemented by more frequent stretches in place.

More subtle considerations are the noise emitted by the machine and the place the machine has for each worker to take completed flats. That place might be customized as a kind of work station at which water containers, clothing and personal items can be stored.

More Management Choices

The decision to adopt a different technology is clearly not the only important choice affecting results. Costs, benefits and ultimate success of the transition to machine-aided strawberry harvest depend on synchronizing the use of the machine with the attributes of the people whose labor remains the most essential factor of production. Human resource management issues to consider include:

• *Crew Configuration and Membership.* Does work in a machine crew require a different orientation or set of abilities than in conventional crews? Will employee recruitment, selection and assignment be designed to create crews who tend to work at a similar pace? Will crew members rotate through the stacker and machine operator jobs?

• *Speed of the Machine.* How fast will the machine creep down the field? More importantly, who decides?

• *New Pay Rates.* What share of efficiency gains will be allocated to compensate for the increased volume of berry handling and to raise individual worker earnings? How much will pay be based on time and how much on output? What is a fair relationship between old and new piece rates?

• *Scheduling, Rest Breaks and Safety Training.* Are any adjustments needed to explain or alleviate possible ergonomic risks of increased picking time?

• *Introduction of the New System Itself.* When and how will workers be informed about the machine system and the changes around it? Will they have a choice of working in a traditional or a machine-aided crew?

In time, worker responses may drive grower decisions about using the machine, because as much as or more than in any other crop, humans make the strawberry production system run. As one grower recently told his business partners, "without the skilled people who work for us out there, we're nothing."

For additional information, the author suggests the following references and sources:

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