CALIFORNIA FARMER
MARKETPLACE
EXTRA

Harvesters walk a short distance to place their pack on a shelf that runs along this "boom" which extends across 15 rows.

Machine aids in strawberry harvest

An early take on new technology in strawberry harvesting. ■ *By Howard Rosenberg*

Strawberry harvesting, one of the most labor-intensive operations in agriculture, is becoming less so. A recently developed machine has altered the harvest system in a sizable share of Ventura County acreage this year, and it appears headed for wider adoption.

The technological change this machine brings is not as dramatic as that of the tomato harvester or cotton gin. But it can reduce the amount of human work time needed by one-third or more.

Machine-aided berry harvest raises issues beyond the classic return-on-investment question. Growers adjusting to the move face interrelated decisions about harvest crew configuration, pay scheme, work pace, ergonomic risks and choreography of introducing the change.

University of California studies show total operating costs around $25,000 per acre, of which harvesting accounts for about 63%. Harvest labor expense alone is more than 40% of the total. For more information visit this Web site: *coststudies.ucdavis.edu./outreach/crop/crop/strawberries.htm*.

HARVEST RHYTHM

Strawberries produce new fruit that is hand-harvested in a three-day rhythm over the season. In the traditional technology, harvest crews of 25 to 35 members retrace an itinerary through planted acreage twice during a six-day workweek. Workdays normally last seven to nine hours depending on weather and field conditions.

Harvesters pick from plants on both sides of a furrow, covering the nearest half of each adjacent bed. Furrows are typically 1 foot wide and

Continued on page M5

Workers place trays on nearby shelf without needing to walk them to the end of the row.

Continued from page M1

300 feet long, and beds 14 inches high. A small wire "carrita"or mini-wheelbarrow facilitates packing by holding the flat above bed level and inclined toward the worker.

Workers deliver full trays, or "flats," weighing 10.5 to 12 pounds, to a collection point outside the field, and return with an empty flat — a roundtrip walk averaging about 240 feet, mostly in the furrow. A majority of reported injuries are from falls near the end of the row, where workers turn as they hurry in with a full flat or back out with an empty.

A collection point checker controls quality and records individual output, and a stacker then piles the flats for loading to a truck to be taken to a cooler.

Picking and plant cleaning are performed while bending, kneeling (one knee on the raised bed), or crouching. Although workers alter positions and occasionally stand up for a breather, a majority of time is spent in these postures. Unions and worker advocates express concerns about long-term effects on the body (see related story on page 8).

MACHINE-AIDED HARVEST

The new machine is a mobile station for receiving and accumulating packed flats close to where berries

Two operator/stackers check and record individual output in this center stage.

are picked. It slowly creeps down the field just ahead of where harvesters are picking. By allowing for immediate delivery in every row, it eliminates bottlenecks at a road collection point and the need to walk or run all the way there and back, which amounts to more than two miles per day. Its function is similar to that of machines long used in lettuce and celery harvest, but it changes jobs differently.

Conceived by a Ventura County grower, a prototype was fabricated and field tested in 2000 and found to have bugs. Initial lessons were applied to three second-generation machines in 2001. Better units evolved from that design in 2002. A third generation of machines served reliably through the four-month spring season in Ventura County starting February 2003.

Observers estimate that 50 machines harvested 30 to 40% of the 2003 Ventura County strawberry acreage, up from 10 machines in 2002.

Workers in a machine-aided system pick and pack exactly as in a traditional harvest. Once completing a flat, however, they walk only a short way to put 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 the center, where one of two operator/stackers lift them onto a higher platform for checking, individual crediting and intermediate stacking. From there the flats are stacked onto pallets that are directly offloaded by a forklift and taken to the cooler.

DOLLAR RETURNS

Theoretical returns to the $125,000 investment for a third-generation machine look good. Utilization of the machine can translate into harvester work-hour savings of one-third or more. In an operation I observed a machine crew of 15 pickers performed the work that a traditional crew of 25 used to. So in a 50-hour workweek, the machine replaces 500 worker-hours there. Using $10 as a conservative estimate of hourly labor cost, those hours saved are worth a gross of $5,000 per week.

At that rate, system savings in a 14-week Oxnard spring season would amount to $70,000. Over a 26-week Watsonville season, gross savings would come to $130,000. If a machine follows the berry harvest for even 38 weeks of the year, the estimated saving is $190,000. And the machine cost will probably ease as more units are produced.

Savings are partly offset by the machine investment opportunity cost and current expenses for fuel, maintenance and repair, but may be en-

Continued on page M9

Continued from page M5
hanced by an investment tax credit. An engineer estimates the operation and maintenance cost as equivalent to that of a daily rental, about $200. Six days of rental would cost $1,200, making the net savings roughly $3,800 per week, $53,200 for a 14-week season or $144,400 for nine months.

WORKERS' ANGLE

Key for workers is what share of the system savings ends up raising their earnings per hour and over the season. Also important are physical and mental effects of job changes, particularly the cut in time spent carrying flats and the increase in picking and packing. The moves required to perform the latter tasks are linked more with risks of musculoskeletal injury. Carrying is performed upright but involves more risk of falls and twisted leg joints while hustling down narrow, uneven or slippery rows.

Although the total wage bill is less, remaining harvest workers can earn more if pay is structured to share efficiency gains. By reducing flat completion time, the machine enables harvesters to turn out more units in a given time. So the more that pay is based on a piece-rate applied to number of units produced and the closer the piece rate is to the nonmachine rate, the greater the increase in individual earnings. If pay is based entirely on hours worked, and the hourly rate and length of workday remain the same, individual harvesters earn exactly the same under both technologies and the grower would reap all the efficiency gain to cover machine costs and improve margins.

Most pay plans include a piece-rate component. A company that had paid a piece rate of $1.50 per flat offered an hourly + piece ($6 plus 50 cents per flat) combination when introducing the machines in 2002. After 2003 machine improvements eliminated downtime and workers had their say, the firm went back to a pure piece rate, subject to the $6.75 hourly floor (California legal minimum).

If total crew wages in that firm had been kept at the nonmachine level, the 15 harvesters would earn an average 67% more (the 15 remaining workers dividing the earnings of the 10 no longer needed), but then none of the efficiency surplus would be left to cover machine costs. This would be the case if all pay was based on output and the piece rate remained at $1.50.

Management opted to split the system savings between harvesters and the grower by setting the machine-aided piece rate at $1.20, 80% of the old $1.50. Since harvesters produce an average of 67% more flats than without machine, their piece-rate earnings are one-third more (167% x 80% = 1.33) than before.

The harvestable fruit does not support piece-rate earnings, however, every day of the season. When the harvesters do not produce enough flats to earn at the minimum wage rate, their pay is calculated on a time basis (rather than output) at the legal minimum or a higher company guarantee. Not only the rate of earnings but also the work pace fluctuates, as pickers do not go full speed when they see little chance of output-based pay exceeding the hourly guarantee.

Potentially countering higher earnings are physical effect and equity concerns. If 15 people perform the work formerly done by 25, they pick an average of 67% more berries and tend to 67% more plants while bending. Extra time spent delivering full flats under the traditional system may have been valued as a respite from stress of working in a bent posture. Will the shorter walk to the machine or more frequent breaks provide comparable relief? ◆

Rosenberg is a UC Human Resource Management specialist.

Management decisions

Successful adoption of machine-aided harvest depends on synchronizing the attributes and use of the machine with those of people whose labor remains the most essential factor of production. Among management choices:

- **Worker-machine interface.** How high should the staging shelf be and how close to the conveyor belt? What modifications could be made for personalizing delivery shelf points and adding safety warnings?
- **Crew configuration.** How large should the crew be, and will recruitment and assignment be designed to find people who work at similar paces? Will more than two crewmembers rotate through the stack and operator jobs?
- **Machine speed.** How fast does the machine creep and who decides? Workers at one firm were uneasy with an externally determined pace, and management turned control over to the crew without problem.
- **Pay rates.** What share of efficiency gains will be allocated to compensate for increased volume and to raise worker earnings? How much will pay be based on time and on output? What is a fair relationship between old and new piece rates?
- **Safety training and rest breaks.** Are adjustments needed to explain or alleviate ergonomic risks?
- **Machine introduction.** How will workers be informed about the machine system? Will they have a choice between a traditional or machine-aided crew? One firm offered that choice to employees upon their recall this year. Further, it guaranteed machine crew earnings would not be less than for traditional crews and said it would give a cash bonus for completing the machine season.

Answers to these questions could spell the difference between a smooth and rocky transition. Humans make the strawberry system work. As one grower told his partners, "Without the skilled people who work for us out there, we're nothing." ◆