

kinds of forage as the season advanced. In nitrogen-fertilized grass, statistical analysis showed mildly negative relationships between nitrogen and sulfur; higher levels of nitrogen accumulated in the grass when sulfur levels were low enough to limit growth, but nitrogen concentrations tended to be lower when sulfur levels were high. In subclover-grass forage, the relationships were stronger and positive; increasing sulfur was accompanied by a corresponding increase in nitrogen, reflecting higher nitrogen levels in the subclover and a greater proportion of subclover in the forage.

**Forage yield.** Forage production on the nitrogen-fertilized grass pastures, averaged over four years, showed a strong response to sulfur fertilization (fig. 2). Maximum yield resulted from annual applications of about 40 pounds per acre of sulfur as gypsum. A water-soluble source of sulfur, gypsum is absorbed

readily by roots but is also subject to leaching loss and has little residual value in high-rainfall areas. The subclover-grass pastures also responded well to sulfur fertilization, but production was lower and maximum forage yields occurred with 10 to 20 pounds per acre sulfur. With the self-reseeding clover providing the nitrogen, the subclover-grass pastures supply a more economical forage of high quality.

Lambs available for the project in 1982 were not vigorous because of poor breeding and wintering conditions. The weather was cool and wet during March and April, and some of the lambs carried a heavy parasite load and were scouring (dysentery). This combination of conditions put the animals under some stress. Lambs in the sulfur-fertilized pastures scoured more (table 4) and gained less during this period than those grazing the pastures with no added sulfur. Scouring can be a symptom of selenium deficiency. Lambs in the plus-sulfur treatments had selenium blood levels below 0.05  $\mu\text{g}/\text{ml}$  after the first month on pasture (table 2).

### Conclusions

The Sutherlin soil series (Ultic Haploxerolls) is one of many California annual rangeland soils that are often deficient in sulfur, and large responses to sulfur can occur if nitrogen is supplied by either legumes or fertilization. The objective of this study was to determine the effects of the sulfur level in pasture forage on lamb gains, and to relate these gains to forage sulfur and to blood sulfur and selenium.

Sulfur fertilization increased forage production and sulfur concentrations in the forage (and nitrogen in subclover-grass forage). Applied sulfur also increased blood-serum reducible sulfur levels but decreased blood selenium in lambs.

Gains per lamb were greater on sulfur-fertilized pasture when other factors such as low selenium, low nitrogen, or heavy parasite load did not limit growth. On sulfur-fertilized pastures, lambs that were not given selenium boluses had blood selenium levels below 0.05  $\mu\text{g}/\text{ml}$ , which is considered the minimum for lamb health. Lambs on unfertilized pastures had blood selenium values above the minimum. Treating the lambs with selenium increased gains on sulfur fertilized pasture.

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## Testing to predict

Gregory Encina Billikopf

**A**gricultural employees in general, and harvest workers in particular, usually are not hired through a careful selection process. Most get jobs on a first-come-first-hired basis. Harvest crews often develop into very skilled teams on which workers who are not productive drop out. In many other cases, however, wide ranges in crew member capabilities remain.

This study of a tomato harvest crew was conducted to determine whether a work-sample test, when workers would be doing their best because they know they are being studied, could be used to predict work performance when they do not think they are being observed. Such a test, if it helped to predict employee performance on the job, could be an improvement over chance-hiring and might result in the selection of fewer, more productive workers.

There are at least two reasons to hire workers carefully rather than hire indiscriminately and later fire those who do not work out. First, legally, it is a complicated process to fire workers. Second, and perhaps more important, no matter how poorly workers perform, mass-firing of the unsatisfactory workers may create morale and productivity problems among those who stay.

Benefits to the farmer from hiring fewer, more productive workers may include: (1) reduced paper work; (2) fewer supervisors needed; (3) lower overhead for costs not associated directly with performance (such as vacation, health insurance); (4) a stabilized work force as a result of increasing the length of the working season for those who are hired; (5) not having to pay the difference when workers do not pick enough to make minimum wage; and (6) less likelihood of workers setting very low production levels to avoid working themselves out of a job, protect slow workers from being embarrassed or fired, or prevent their employers from lowering the piece rate.

### The study

This study took place in the summer of 1986 on a San Joaquin Valley farm, where the green tomato harvest is done by hand. Farm workers pick into two buckets, which they carry to trailers with bins; they are given a chip for every pair of buckets delivered and are paid according to the number of chips they collect in a day. To avoid possible damage to the tomatoes, picking cannot begin until the fruit is dry, so the starting time varies with weather conditions.

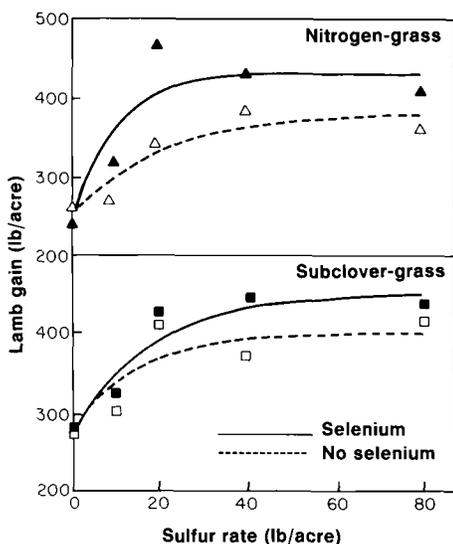


Fig. 1. On both types of pasture, selenium increased lamb gain per acre over the increase from sulfur fertilization alone.

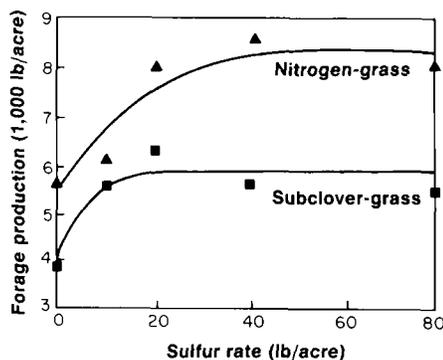


Fig. 2. Forage production responded well to sulfur. The percentage increase over four years was roughly equal on both pastures.

# tomato harvest worker performance



Green tomatoes are harvested by hand in the Central Valley. Pickers get a payment chip each time two buckets are delivered and dumped into a bin. During a 2.5-hour period, workers picked an average of 21.8 pairs of buckets with a range of 8 to 41.

The study used a "concurrent" test, in which the work of present employees during trial period(s) is compared with their work on the job. If such a test proved to be a valid indicator of employees' actual productivity, the testing procedure developed would then be used to test new applicants.

The study took place between 9:00 a.m. and 12:45 p.m. and consisted of three consecutive time periods: trial 1 (half hour); trial 2 (half hour), and a regular work period (about 2.5 hours). The goal was to determine if a statistically significant relationship could be established between the trial periods and the regular work period.

Workers were informed that this was an experimental test. Participation was voluntary. More than a hundred workers, mostly Hispanic, both men and women, and of widely varying ages, took part during one or more components of the study.

Participants were asked to pick tomatoes during two half-hour trial periods and count the chips (one chip for every two buckets) they collected during this time. The beginning and end of these half-hour periods were signaled by a shot from a starting gun. Picking began at about 9:00 a.m. Right after each of the two half-

hour periods, each worker wrote his or her name and the number of chips collected for that period, on a card provided for this purpose.

A third group of chips was counted and reported by workers at around 12:45 p.m. They did not know their regular on-the-job performance was being measured during this period, until the last 15 minutes.

## Results

Workers picked an average of 6.5 pairs of buckets during the first half hour, with a range of 3 to 12 pairs (table 1). Results of the second half-hour trial were the same. During the 2.5-hour regular work period, the average was 21.8 pairs of buckets, with a range of 8 to 41.

TABLE 1. Statistical analysis of trial results

Trial	Validity analysis		Buckets	
	r	r <sup>2</sup>	Range	Mean
1	.44***	.20***	3 - 12	6.5
2	.57***	.33***	3 - 12	6.5
1 + 2	.55***	.30***	—	—

NOTE: Test trial correlated against job performance period (67 pairs).  
\*\*\*p < .001 using Pearson's product-moment "r" and two-tailed table.

Statistical analysis of trials 1 and 2, using data from 97 pairs of observations, resulted in a correlation of  $r = 0.73$ , indicating that the two half-hour work periods gave reliable (consistent) results.

Analysis of the test's validity in predicting performance on the job gave respectable results in comparison with other similar tests; in this analysis, using 67 pairs, each trial period and the combination of the two periods (table 1) were compared with the regular work period. The study results suggest that the use of a work-sample test could be an improvement over the chance hiring of tomato harvest workers.

## Discussion

This study had limitations. One was the data collection process, in which workers filled out their own results and turned in cards stating how much they had picked in the time period. Also, the number of chips collected per worker reflected the number of bucket pairs turned in at the end of the half-hour test; partially filled buckets were not counted. Finally, it was difficult to control so many workers and demand precision in starting and ending each test period.

Several questions remain for future research: What results would be obtained by a test in which applicants were tested? How well would a short work-sample test such as this one predict performance of workers in other crops, such as strawberry workers, lettuce pickers, or grape pruners? How well can a test predict performance of hourly-paid crews?

A worker's performance is related to both ability and motivation. Prediction of on-the-job performance is difficult because it has to account for changes in ability and in motivation. It is likely, however, that workers who can pick 6 to 8 pairs of buckets an hour when they are trying their best will not be able to pick 15 to 20 pairs per hour, no matter what pay or other incentive is offered.

An employment test is only a partial predictor of performance. Once able workers are selected, the employer can then try to motivate them through effective supervision, incentive pay, worker involvement efforts, and the like.

While this test for tomato pickers was successful in accounting for a portion of employee performance on the job, the validity of employment tests in other areas of agriculture still remains to be studied.

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