Mechanical injury to

Potato Tubers

during harvesting

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Damage to potatoes during field harvesting and hauling operations often amounts to 40%–50% before the tubers reach the packing shed.

To determine the extent of the injuries and at what points they occurred, a recent study was concentrated on field harvesting operations in six Kern County fields.

Four samples of potatoes were taken at five different points of the harvest operation: from the ground after digging, out of the stub sacks, from the end of the loader, out of the truck bed, and after the load was dumped at the shed. Conditions of the drop from the loader to the truck bed were duplicated at the Shafter Field Station.

All samples were stored in a shed for seven days before the potatoes were examined for injuries. Tubers damaged by small cracks, less than ½″ in length, and by very small bruises would not cause any appreciable market loss and were classified as slightly injured. The classification of moderate injury included tubers with cracks between ½″ and 1½″ long and tubers with medium sized bruises. Tubers with cracks or cuts longer than 1½″ and tubers with severe bruises were classified as severely injured.

Four of the six fields included in the study, especially Field III, were cloddy. Field IV was sandy and relatively damp. Field V was sandy and dry. In Field III, numerous clods and a digger with a high speed digging chain caused a large percentage of injured tubers.

Totals of Injured Tubers Found at the Different Stages of Harvesting (Cumulative percentages)

Operation	Injury	Field I	II	III	IV	V	VI
Digging	Moderate	6	18	29	18	29	17
	Severe	12	10	15	2	1	3
	Total	18	28	44	20	30	20
Picking	Moderate	10	24	50			
	Severe	12	16	5			
	Total	22	40	55			
Loading	Moderate	17	28	52	17	29	56
	Severe	15	15	8	5	7	3
	Total	32	43	60	22	36	59
At shed	Moderate	18	26	61	18	54	50
	Severe	30	22	4	6	10	7
	Total	48	48	65	24	64	57

L.S.D. at 5% = 8.8
L.S.D. at 1% = 11.6

Tubers Injured in Each Harvesting Operation (Percentages)

Operation	Field I	II	III	IV	V	VI
Digging	18	28	44	20	30	20
Picking	4	12**	11**			
Loader	10*	3	5	2	6	39**
Picking plus loader	14**	15**	16**	2	6	39**
Drop, haul, unloading	16**	5	5	2	28**	..
Handling to shed, except digging	30	20	21	4	34	37

* Significant 5%
** Significant 1%

The loading machine can do a good job without causing too much injury. However, in Field VI, the damage by the loader increased the injury from 20% to 59% and caused 60% of the total injury for the field. In Field VI, the potatoes were dumped directly onto the conveyor chain, but the short pad in the loader was not long enough to protect the tubers.

The above table presents the percentages of tubers injured in each harvest operation. The height of drop into the truck and the care taken in loading affect the amount of injury. The drop was 4′ in Field I, 2′ in Field II, and 3′ in the other four fields. The increased percentages of injury in samples taken at the shed after unloading showed the injury caused by the drop from the loader to the truck, by hauling, and by unloading. Lowering the end of the boom of the loader down into the truck would prevent some of the injury.

Occasionally a man walks on the potatoes in a truck to facilitate unloading at the shed. Moderate injury was caused to 19% of the potatoes unloaded in this way and severe injury to 11%, a total of 30%.

Bumping the stub sacks with the loader in the picking-up operation caused a 4% increase in injury. A ¾″ thick rubber pad in the bottom of the hopper of the loader reduced dumping injury by 12%.

PROCESSING

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mercial processing and marketing of products manufactured from California potatoes. Such a contract arrangement would disclose valuable information on processing and marketing costs as well as the need for modification of processing techniques and products under operational conditions.

An alternative to a contractual arrangement—or as a follow-up—a pilot type of plant, probably in the Bakersfield area, could be established to test the commercial feasibility of processing and marketing products made from potatoes grown in California.

If the results of the contract experimentation—or the pilot plant—indicate that California-grown potatoes can not be processed successfully in competition with potatoes grown and processed elsewhere, the California industry should accept this situation and direct its attention to alternative adjustments.

Even if the results indicate that from the standpoint of product quality and costs a potato processing industry is feasible in California, it may not be wise immediately to establish such an industry if there are indications there is already an overexpansion of processing facilities —nationally and especially in Idaho— and an unbalanced supply-demand situation for processed potatoes. Such an overexpansion of facilities and product supply could result in severe price competition, thereby increasing investment risks and making it desirable to postpone the development of processing facilities in California.

If all relevant factors are satisfactory, however, California growers and shippers should support the establishment of a potato processing industry in or near the Kern County area. Financial participation by growers and shippers would indicate their intention to supply the raw material for processing.

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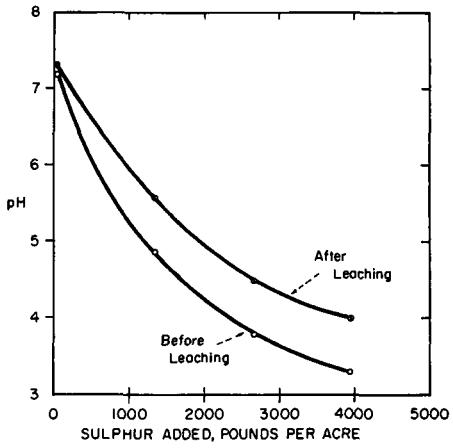
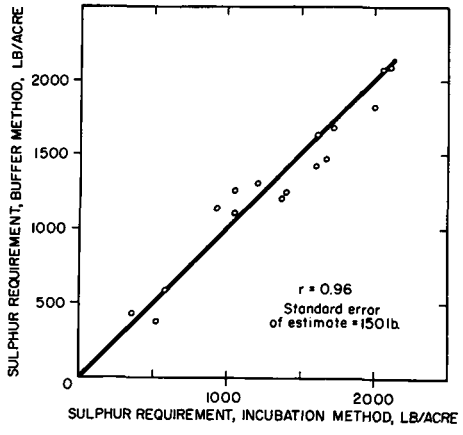
The above progress report is based on the detailed Giannini Foundation Research Repart No. 243, An Economic Analysis of the Feasibility of Processing Potatoes in California, *by the same authors.*



Relationship between pH and the rate of application of sulfur to an alkaline noncalcareous soil before and after salts were removed by leaching with water. All pH determinations were measured following a three-month incubation period.

Relationship between sulfur requirement measured by the buffer method and by the incubation method.



Sulfur requirement of soils for control of

Scab Disease of Potatoes

estimated rapidly by new method

P. F. Pratt

Coarse-textured noncalcareous soils of southern California often require the addition of sulfur to acidify the soil for the control of scab disease of potatoes.

Below a comparatively narrow range of pH—relative acidity—values, toxic concentrations of soluble manganese or aluminum, or both, seriously reduce the growth of the potato plant and above this range the scab disease is not adequately controlled. The upper and lower limits of the control range depend on the sensitivity of the potato variety to the disease and the manganese and aluminum properties of the soil, but the usual desired range is between 4.8 and 5.4.

A method of estimating the correct amount of sulfur to add to the soil is necessary to avoid adding too little or too much.

For the purpose of having a specific target for developing a rapid evaluating method, the sulfur requirement was arbitrarily selected as the sulfur needed to bring the soil pH to 5.2 measured on the saturated paste of the salt-free soil. Since salts depress the pH, and most growers use acidifying fertilizers, the pH of the soil in the field will be below 5.2 if the sulfur requirement is accurately measured and the irrigation water used is free of bicarbonate.

Sixteen soils were incubated with measured amounts of sulfur until pH values no longer changed with further incubation, which required about three months for most soils. Each soil was treated with four levels of sulfur, the amounts of sulfur depending somewhat on the original pH and the cation-exchange capacity of the soil. After the incubation period the soils were leached with a volume of water equal to five times the volume of the soil sample and the pH was measured again. The pH of the leached soil was plotted against the amount of sulfur added and the sulfur required to acidify to pH 5.2 was estimated from the resultant graph. The sulfur requirement obtained by this method was used as a standard with which to test the more rapid buffer method.

A number of acid buffers were prepared and tested by adding a given volume of buffer to a given weight of soil and measuring the change in pH of the buffer at various intervals of time. The change in pH of the buffer was plotted against the sulfur requirement by the incubation method to learn how well the two were correlated.

The buffer solution which gave the best correlation was prepared by dissolving 2.0 grams of calcium acetate monohydrate, 1.8 grams of p-nitrophenol, 3.0 grams of potassium chromate, 4.7 grams of potassium acid phthalate and 1.0 milliliter of 88% formic acid in about 800 ml—milliliters—of water. The p-nitrophenol dissolved best when added separately to about 200 ml. of hot water. The pH of the solution was adjusted to 2.0, using 6 *N* hydrochloric acid, and then diluted to 1.0 liter. When 5.0 ml. of the solution are diluted with 35 ml. of water the pH should be 2.50.

Forty grams of air-dry soil were put into a beaker and 35 ml. of water added followed by 5.0 ml. of buffer. Then the wet soil and the mixture were stirred thoroughly. After 30 minutes the pH of the soil-buffer suspension was measured. The estimated sulfur requirement is equal to 100 pounds sulfur per 2,000,000 pounds of soil for each 0.10 pH unit above pH 3.70. For example, if the pH of the soil-buffer suspension were 4.70 the sulfur requirement would be 1,000 pounds per 2,000,000 pounds. At all times the pH meter was adjusted to pH 2.50 using a solution made by diluting 10 ml. of buffer with 70 ml. of water.

The difference in pH before and after leaching to remove salts was relatively large for the soil represented in the upper

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Covering the bottom of the truck bed with a ¾" rubber pad could reduce the injury for the 2', 3', and 4' drops by 5%, 10%, and 18%. Increasing the drop to the truck bed from the conveyor chain of the loader increased the amount of injury. Dropping tubers from a 4' height caused 20% more injury than dropping them from 3'.

Each time the potatoes were handled some injury occurred, but the digger and the loader caused the largest single increases in injury. In field IV the injury after digging was less than 4%. Slower operation of the diggers and loaders, thorough padding, and careful handling could eliminate much of the mechanical injury to potato tubers during harvesting.

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