FRESHPACK AND HARVEST TUBER DAMAGE IN WASHINGTON

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ABSTRACT

New field-to-storage bruise sampling shows a harvesting damage decrease of 20 percent since 1978, with most of the improvement in the truck and piler. Damage is nearly equally divided between moderate and severe bruise.

Basic fresh pack processes are unloading, washing, accumulating, chain sizing, roll sizing, weight sizing, packaging, and transport. The bottom 1/3 of 90-count cartons sampled averaged only 30% bruise-free, with most of the damage severe. Though the data are quite variable, preliminary estimates show that roll sizing and accumulation cause the most blackspot and shatter damage, followed by unloading and chain sizing.

FIELD-TO-STORAGE TUBER DAMAGE

The field-to-storage bruise sampling was a follow up to see what changes have occurred since we last did such sampling in 1978. Table 1 shows that damage has decreased by about 20 percent, and that most of the improvement is in the truck and piler. The damage is nearly equally divided between moderate and severe bruise, where moderate was one bruise that could be removed with two slices of a potato peeler and severe was two or more bruises or one bruise that could not be completely removed with two passes of the peeler. The data also show that larger tubers tended to have more damage than smaller tubers.

Table 1. Field-to-storage tuber damage, 1978 and 1986.

	Damage levels by year (percent)			
	1978	1986		
Sampling Location	Total	Moderate	Severe	Total
Harvester boom	18	7.0	6.5	13.5
Truck out	29	6.7	9.0	15.7
First piler conveyer	35	8.5	10.5	18.9
Piler boom	-	12.4	14.3	26.7
Storage pile	45	12.1	13.5	25.5

This Presentation is part of the Proceedings of the 1987 Washington State Potato Conference & Trade Fair.

Figure 1 shows the same data in graphical form. The cross-hatched bars show moderate and severe bruise for 1986, and the blank bars indicate the total damage for 1978. Note the considerable decrease in damage in 1986, especially through the truck.

FRESHPACK TUBER DAMAGE

The purpose of the fresh pack bruise survey was to determine damage levels in these operations and to estimate which parts of the process may be causing the most difficulty. The basic fresh pack processes were categorized as: unloading, washing, accumulating, chain sizing, roll sizing, weight sizing, packaging, and of course transport between these processes (Table 2).

Table 2. Basic freshpack processes.

Unloading	**Conveying**
Accumulating ("evenflow"bin)	**Washing**
Chain sizing	**Roll sizing**
Singulating (weigh size, hollow scan)	**Weigh sizing**
Packaging	

The freshpack processes do not necessarily occur in the order shown, and the sequence, numbers of conveyors and numbers and types of accumulators ("evenflow" bins) vary from one packer to another. Figure 2 is a sketch of one of the freshpack sheds sampled. It mainly shows that such operations are rather complex. A simplified diagram (Figure 3) shows the number of steps in handling count-carton potatoes in a different shed.

It is important to remember that the potatoes coming into the freshpack process have more variability in damage level than when sampling the harvester-to-storage part of the operation. This variability can mask the change in damage level caused by any given process. Also, if a particular process, e.g., accumulation, occurs in a different place in the sequence in one operation compared to the others, the effect on the sampling results of earlier damage also varies and is unknown.

Three methods for solving the sampling problem are:

1. Use samples of bruise-free tubers, run them through the process under study, catch them and evaluate the bruise level.

2. Run the process normally with whatever tubers are coming through, catch many samples before the process and many after the process, evaluate the bruise levels before and after the process, and see if the variation in bruise levels before and after the process masks the effect of the process.

3. Find some non-destructive method of determining bruise levels in tubers caught ahead of the process, then run those tubers through the process and evaluate the increase in damage.

All of these methods have their difficulties. Non-destructive bruise sensing (method 3) has been accomplished by Karl Norris at the USDA Instrumentation Research Lab in Beltsville, but it has not been developed yet for production work. Method 1 requires large numbers of very low damage tubers, and it does not take into account the effects of damage caused earlier in the packing operation.

Method 2 is the one used so far. It treats the process in the most realistic way, but the required number of samples to get consistent results is unknown until after the fact. The method is valuable for assessing the general damage levels in fresh packing operations, but the variation in bruise does tend to obscure the amount of damage caused by each device or process. Therefore, the results will be presented two ways: first, the overall damage levels at several comparable locations in three packing operations; then the preliminary estimates of damage caused by selected processes.

In the three packing sheds sampled, the bottom 1/3 of the 90 count cartons averaged only 30% bruise-free, with most of that severe and occurring before weight sizing (Table 3). Samples from the input hopper on the bagger had more bruise than tubers from the bags, meaning we need many more samples to get a good estimate of damage from these machines. Notice that bruise levels at the truck were 43 percent damage, which was high for direct-from-field potatoes.

Table 3. Freshpack tuber damage overall (percentage by weight).

Location	Damage levels (percent) Moderate	Severe	Total
1. Truck out	13.	30.	43.
2. 1st conveyor	15.	30.	45.
7. Weight size in	17.	53.	70.
8. 90 ct carton	14.	56.	70.
9. Bagger in	21.	45.	66.
10. Bag	17.	42.	59.

Figure 4 graphs accumulated moderate and severe damage through the freshpack process for the three shed averaged together. The sample locations in Figure 4 corresponds to those in Table 3. Locations 3-6 varied with packer, but locations 1,2,7 and 8 were the same for all three.

Though the data are quite variable, preliminary estimates of damage caused by some of the processes (Table 4) show roll sizing and accumulation to cause the most damage, followed by unloading and chain sizing. When methods are developed to do more precise sampling and to sample more operations, we can get better estimates.

Table 4. Freshpack tuber damage by process.

Process	Bruise increase(percent)	Description
Unloading	2.5	Mostly moderate bruise
Chain sizing	1.6	Mostly severe bruise
Roll sizing	5.0	2 moderate to 3 severe
Accumulation	8.7	Half and half

The freshpack sampling results varied greatly from one packer to another. For instance, truck sample averages showed 47, 52, and 20 percent total damage for packers 1, 2, and 3, respectively. Thus two of the operations need more attention to harvesting damage. Within the packing operation, accumulators and roll sizers appear to need the most attention regarding blackspot and shatter bruise, especially for count carton potatoes. Skinning and other surface damage was not directly evaluated in this study.

Figure 1.

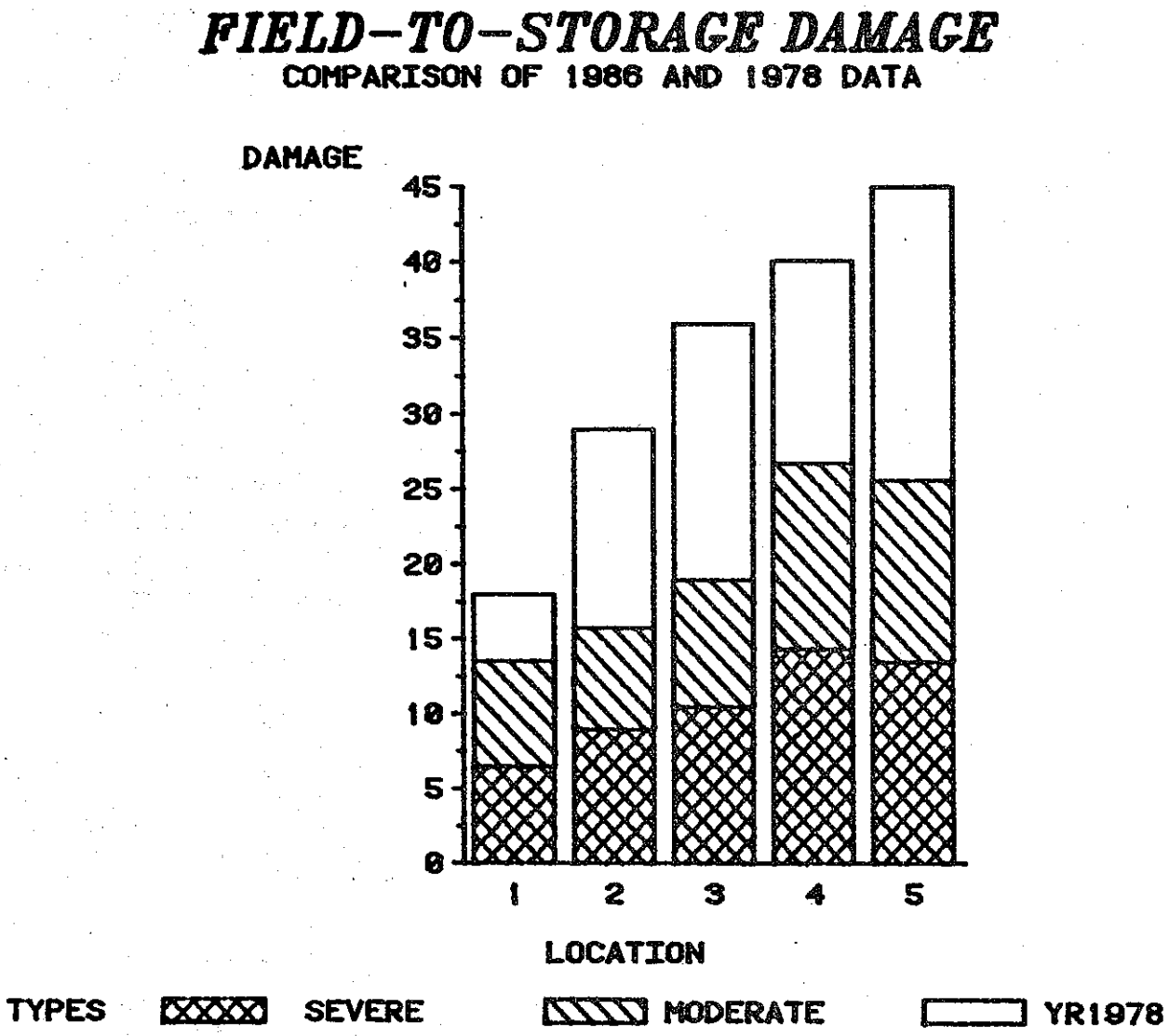


Figure 1.

Figure 2.

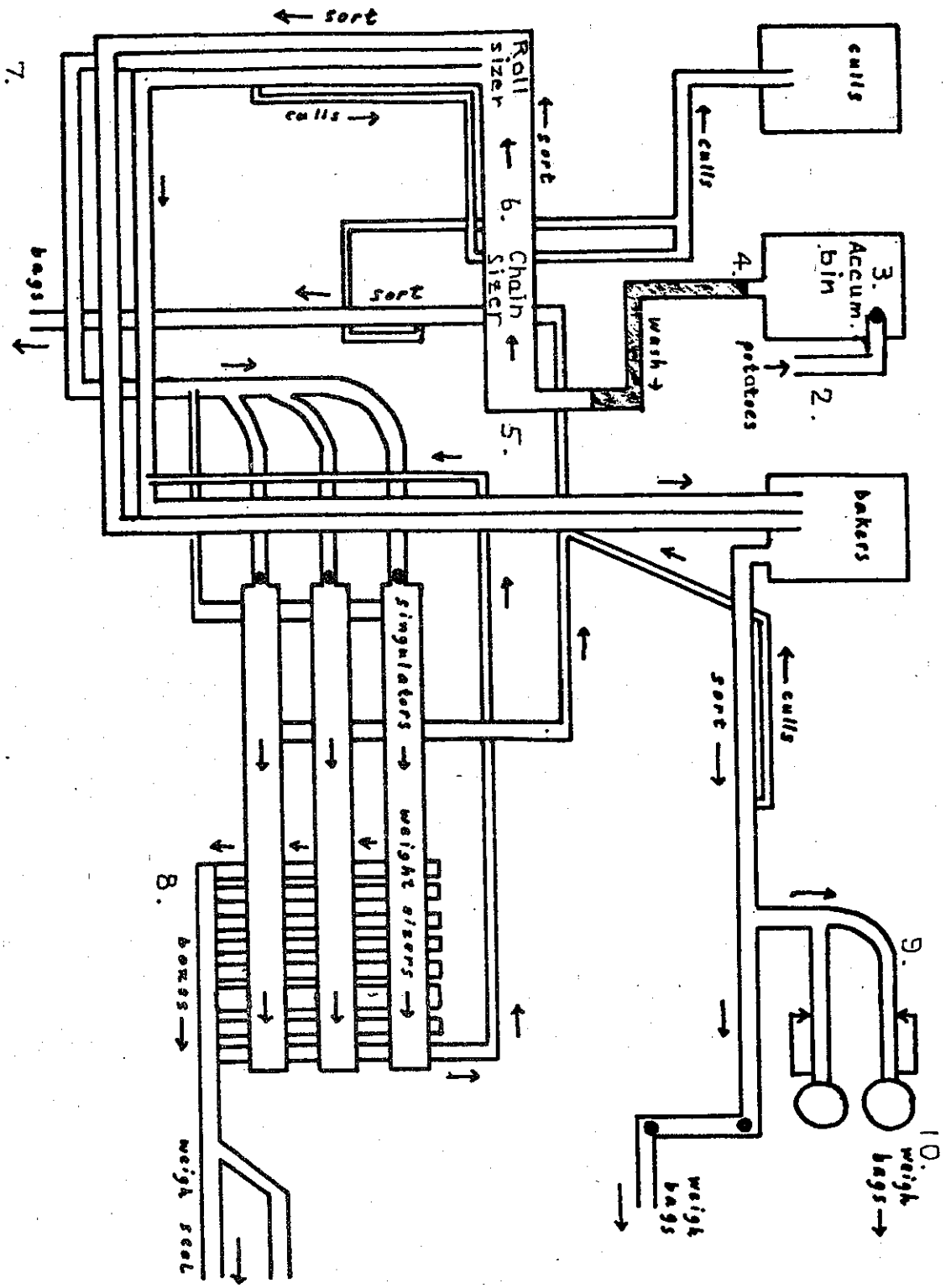

sort
culls
Roll sizer
6. Chain sizer
3. Accum. bin
4.
wash
potatoes
2.
5.
bakers
singulators
weight risers
boxes
weigh scal
7.
8.
9.
10. weigh bags
weigh bags

Figure 3. Path for count carton potatoes in one fresh shed.

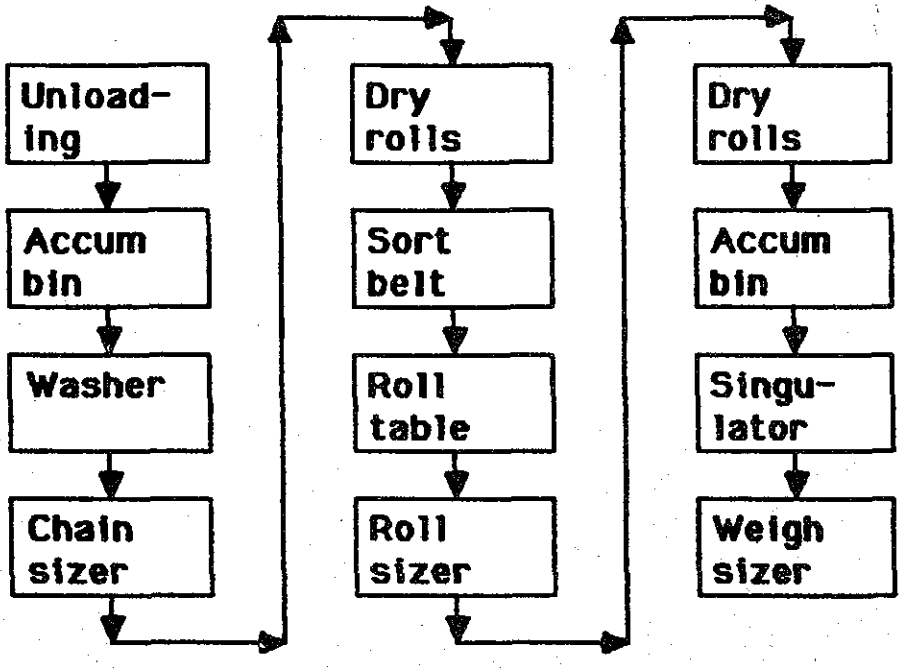
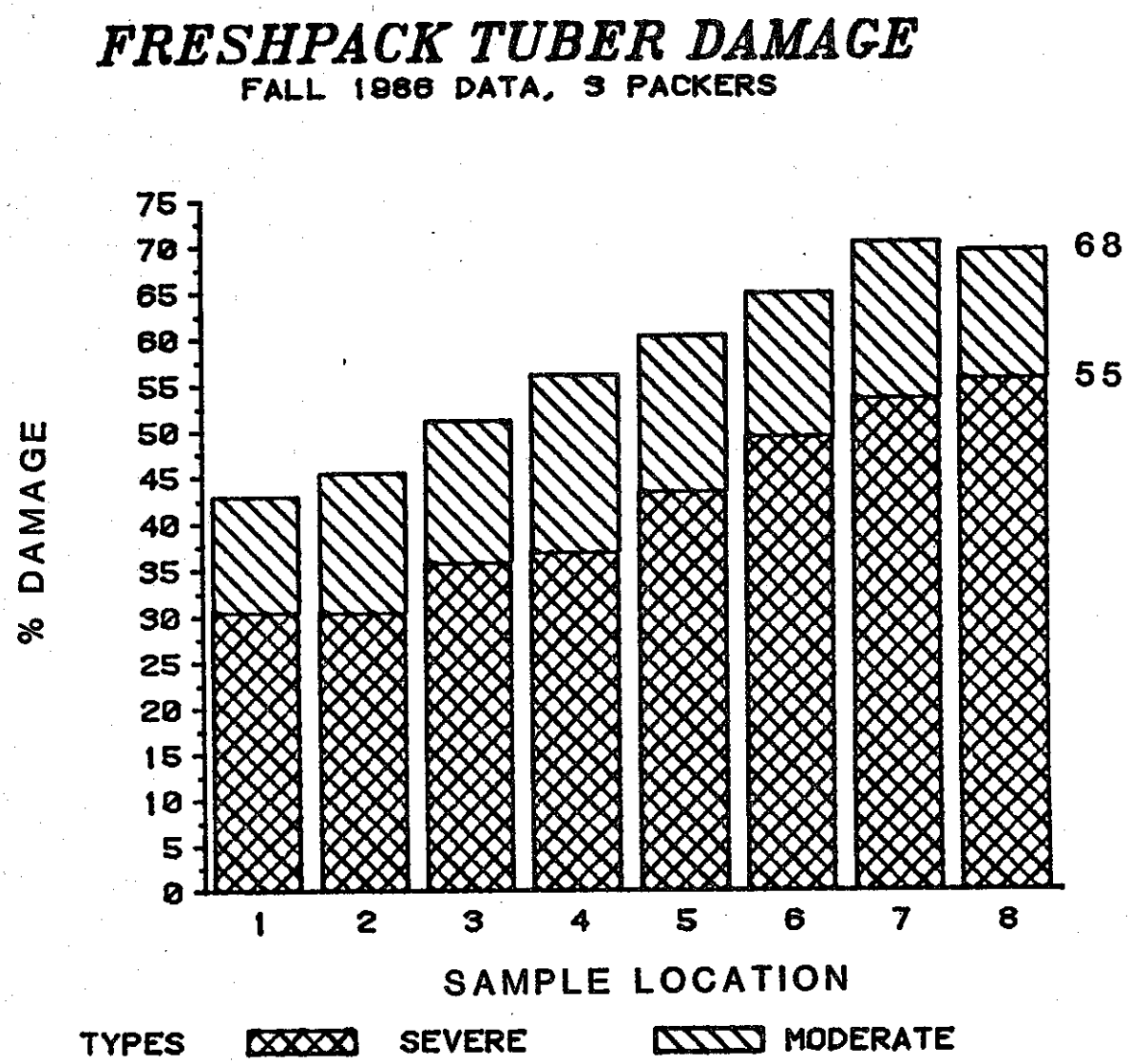


Figure 4.


FRESHPACK TUBER DAMAGE
FALL 1986 DATA, 3 PACKERS
% DAMAGE
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
68
55
1
2
3
4
5
6
7
8
SAMPLE LOCATION
TYPES
SEVERE
MODERATE