SEED TUBER AND SEED PIECE HANDLING

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Recently information from several studies in Idaho indicate that a significant loss of yield potential occurs as a result of the seed tubers passing along the path from seed grower to cut seed pieces (Table 1).

There is a loss of 21% of the yield potential by the time seed tubers become seed pieces. Part of this loss can be attributed to the resultant seed piece size (seed pieces less than 1.5 oz. in size have been shown to severely limit yield potential). There is, however, a significant loss in yield potential due to the handling process alone - the 7% loss between the seed storage and the grower storage (Table 2).

If this same loss occurs to the seed tubers handled by the Washington potato industry it amounts to a significant factor limiting potential grower return. If production of a grower is 30T/A the information from this study indicates that the cut seed that produced the 30T/A was in fact capable of 38 T/A at the seed storage (Table 3).

This loss in potential yield has a sizable impact on the Washington potato industry. Two assumptions are: 1) a reasonable estimate of the cost to produce an acre of potatoes in Washington is $2,000 and, 2) a reasonable return for a ton of field run potatoes is $80. Using these assumptions and the figures in Table 3 the lost income associated with this loss for an acre of potatoes is shown in Table 4. Based on this information an estimate of the loss due to seed handling by the Washington industry in 1992 is shown in Table 5. Total loss due to handling and cutting is $80,000,000 while the loss after it is received by the final seed handler is $50,000,000.

Thirty-eight per cent ($240/A) of the loss in return due to handling occurs between the seed storage and the grower storage. This loss is entirely due to the handling process. The remaining 62% ($400/A) loss includes that due to handling and cutting.

What is there about seed tubers that causes this loss in potential? Another recent study in Idaho sheds some light on some factors that are involved. Seedlots arriving at commercial grower locations were evaluated for the amount of damage that was present. Of the eleven lots evaluated eight had less than 10% of the seed tubers bruise free and the best lots had less than 50% of the tubers bruise free (Figure 1).

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Individual tubers in these lots were examined to determine the number of severe bruises that occurred on each tuber. Six lots were found to have over two severe bruises per tuber and only four had less than one severe bruise per tuber (Figure 2).

Seed tubers from these same lots were further evaulated for the presence of Fusarium dry rot (Figure 3). All were found to have 10% or more of the tubers with detectable dry rot. Five of the 11 had 30% or more of the tubers with dry rot and in four lots over 40% of the tubers had dry rot.

One might ask if there is any evidence that tubers with dry rot have less yield potential than those that do not. In another Idaho study the performance of seed pieces with and without dry rot were compared (Table 6). Although there was an effect on total and U.S. No. 1's yield, there was an even more severe effect on tuber size distribution - a decrease in percent of the tubers >10 oz. and an increase in the percent of tubers <4 oz. in weight.

In Washington Holland found that there was an average of eight damaged areas on cut surfaces of seed pieces in addition to the bruise that was present on the seed tubers (Table 7). As a result a trial was set up to determine whether or not the presence of bruise on the seed piece influenced cut seed performance. The trial also evaluated whether seed pieces cut with sharp knives performed differently than those cut with dull knives (Table 8). There was no affect on the percent of plants that were missing due to the cutting blade condition but there was an effect from the amount of bruise (Table 9). Eighty-five percent of all missing plants resulted when the seed pieces were damaged. The percent of missing plants was nearly equal whether the seed piece had four or eight bruises. There was, however, an effect of knife condition on the number of weak plants that occurred (Table 10). More weak plants were produced by the seed pieces with eight bruises than with the lower damage level and no damage. Seed pieces cut with sharp knives and bruised eight times had nearly twice the number of weak plants as seed pieces with zero and four bruises. The same trend was shown with seed pieces cut with dull knives but the effect of eight bruises versus zero and four bruises was not as great.

Plants and seed pieces were examined 60 days after planting. Seed condition, fresh plant weight and number of stems per plant were determined. The only factor that was influenced by the seed cutting and damage treatments was seed condition (Table 11). Condition of seed pieces cut with dull knives are rated lower than those cut with sharp knives. Those seed pieces with no damage on the cut surface were in better condition than those with either four or eight bruises regardless of the knife condition. Those with four and eight bruises cut with dull knives were in the worst condition. Seed pieces cut with sharp knives were not seriously damaged by either bruise level. There was no significant affect of the knife condition or seed piece damage level on total yield or tuber size distribution. Kleinkopf, however, found that when he selected 2 oz. cut seed pieces from a commercial cutting operation and imposed additional damage by tumbling until the seed was wet from the water from damaged tissue there was an affect (Table 12). Both total and U.S. No. 1 yield was reduced but tuber size distribution was even more severely affected.

If the loss of yield potential is to be reduced all equipment used to handle seed tubers and cut seed pieces needs to be managed to implement everything that has been successful in the reduction of tuber damage. That is, the concept of "volume equal capacity" must be utilized and the reduction of drop height and tuber roll back must take place. Equipment management is the essential key to solving this problem.

References:

Holland, Steve. 1988. Maximizing potato seed cutter and planter performance. Proceedings of Washington State Potato Conference, Moses Lake, Wa. pp. 93-109.

Kleinkopf, G. E. and J. L. Barta. 1991. Seed quality for commercial and seed growers. Proceedings of Idaho Potato School, Pocatello, Id. pp. 255-257.

Thornton, Michael, and Jim Torell. 1992. Incidence of seed tuber damage on selected seed potato samples. Unpublished.

Table 1.

Seed Handling vs. Yield (CWT/A)

Sample Location	A	B	C
Seed Storage	466	481	431
Grower Storage	421	442	415
Cut Seed	382	307	354

Source—G. Kleinkopf University of Idaho

Table 2.

Percent Yield vs. Handling

Sample Location	Lot A	Lot B	Lot C	Ave.	% Loss
Seed Storage	100	100	100	100	
Grower Storage	92	92	96	93	7
Cut Seed	81	74*	82	79	14
Total % Loss					21

*73% of seed Pieces <1.5 oz. in size.

Table 3.

Yield per Acre

	Cut Seed	Grower Storage	Seed Storage
% of Potential	79	93	100
Yield (Tons/A)	30	35	38

Table 4.

Return per Acre

	Cut Seed	Grower Storage	Seed Storage
Yield (Tons/A)	30	35	38
Value $	2400	2800	3040
Production Costs $	2000	2000	2000
Profit/A $	400	800	1040
Loss/A $	640	240	0
		400	240

80 Dollar/Ton Field Run

Table 5.

Potential Industry Value

		Loss per Acre		Industry Loss	
Year	Acreage	Cut Seed	Grower Storage	Cut Seed	Grower Storage
1992	125,000	640	240	80,000,000	30,000,000
			400		50,000,000

Figure 1.

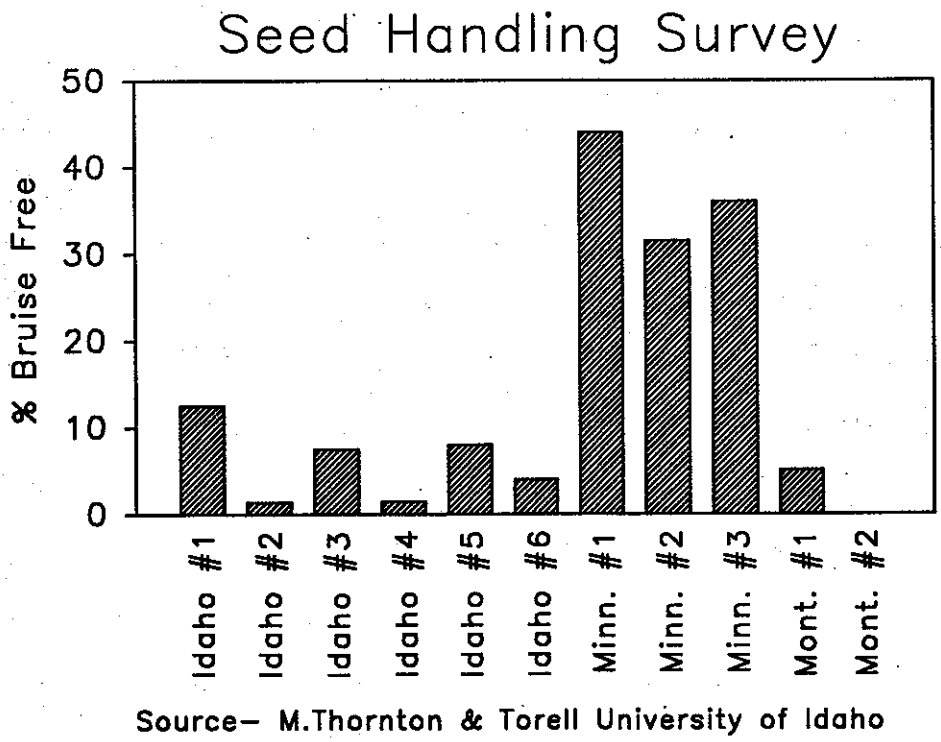


Figure 2.

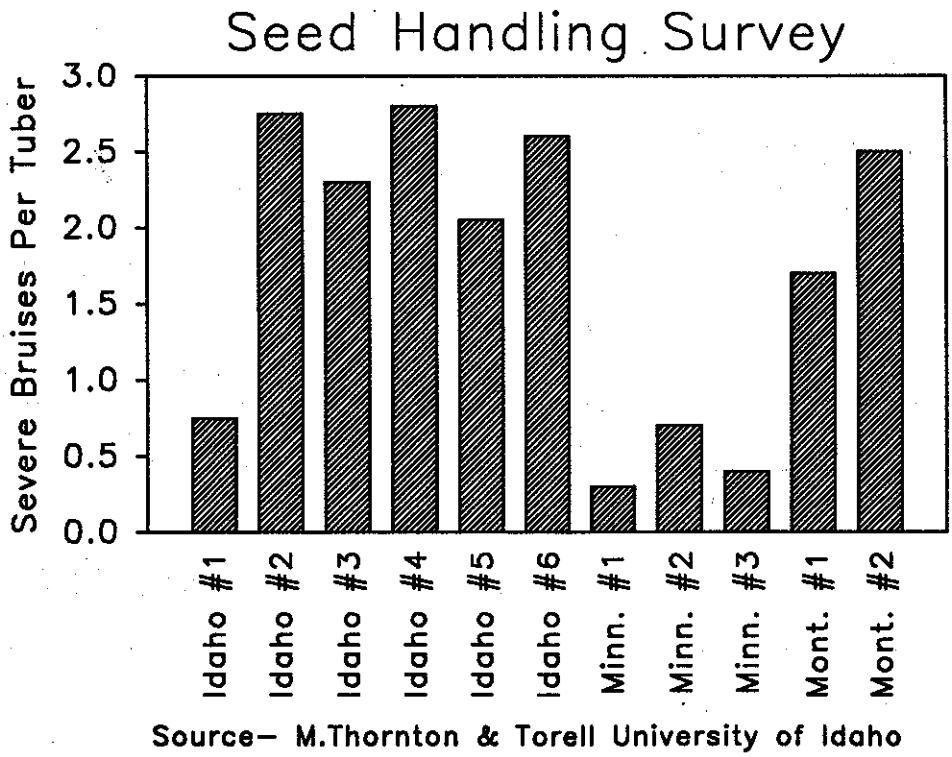
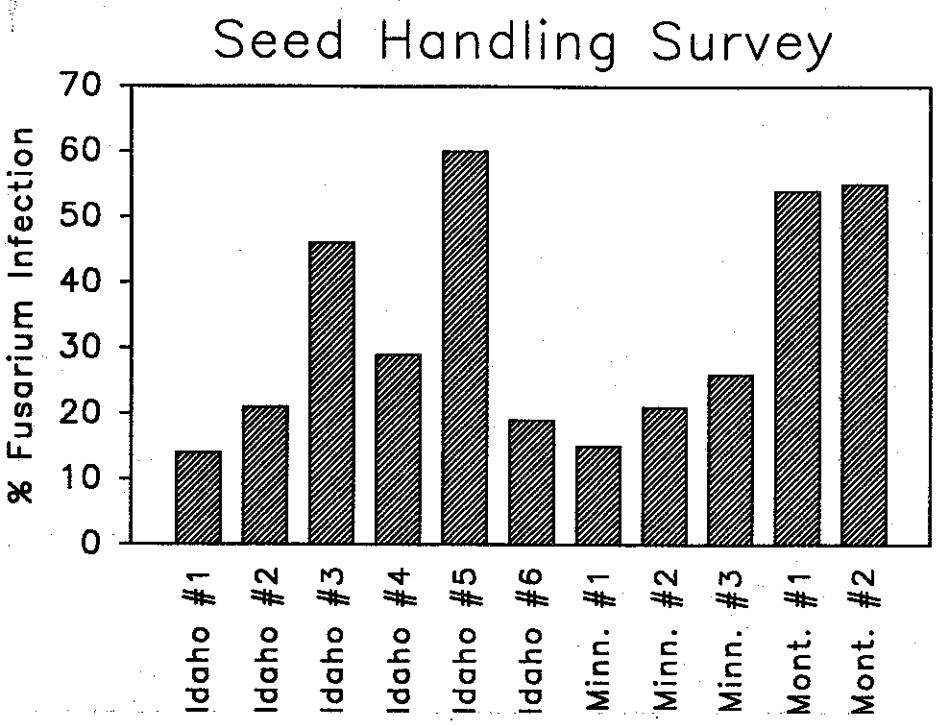


Figure 3.



Source– M.Thornton & Torell University of Idaho

Table 6.

Effect Of Diseased Seed Pieces On Productivity

Yield ↓5%	% >10 oz. ↓48%
% 1's ↓12%	% Undersized ↑24%

Source– Kleinkopf University of Idaho

Table 7.

Cut Seed Damage Observed

Lot	1	2	3	4	Ave.
# Bruises	8.00	7.96	7.84	8.52	8.08

Source– S. Holland

Table 8.

Bruised Seed Study

Treatments

Knife Condition	# of Bruises
Sharp	0, 4, 8
Dull	0, 4, 8

Source– R. Thornton/S. Holland 92

Table 9.

Cut Seed Damage vs. Missing Plants

Bruise Level	Percent of All Missing Plants
0	15
4	46
8	39

Source– R. Thornton/S. Holland 92

Table 10.

Cut Seed Damage vs. Weak Plants

Number of Weak Plants

Bruise Level	Knife Condition		
	Sharp	Dull	Total
0	37	41	78
4	37	40	77
8	63	57	120
Total	137	138	

Source– R. Thornton/S. Holland 92

Table 11.

Cut Seed Damage vs. Seed Piece Condition*

Bruise Level	Knife Condition		
	Sharp	Dull	Ave.
0	9.5	8.1	8.8
4	8.5	6.3	7.4
8	8.5	6.8	7.7
Ave.	8.8	7.1	

(Rating 60 Days After Planting 1–10=Best)

* No Yield Effect Measured

Source– R.Thornton/S. Holland 92

Table 12.

Effect Of Bruised Seed Pieces On Productivity

Yield ↓2.5%	% >10 oz. ↓ 24%
% 1's ↓10%	% Undersized ↑ 30%

Source– Kleinkopf University of Idaho