EFFECT OF HANDLING ON SEED PRODUCTIVITY

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Careful handling of seed potatoes can go a long way towards ensuring high yields at harvest. Recent studies (3) have shown that significant yield reductions can occur during handling operations (Table 1). Yield potential was reduced each time the seed was handled in three out of four lots. Yield losses in excess of 100 cwt. per acre due to poor seed handling have been recorded. Part of this handling-related yield reduction may have been due to seed cutter management. However, at least part of this reduction was probably associated with physical injury of the seed during the handling operations. Bruising of seed potatoes during handling is one factor that contributes to low yield potential of seed pieces.

BRUISE SUSCEPTIBILITY

Seed potatoes are vulnerable to handling injury because of two situations: (1) Seed potatoes are handled numerous times between harvest and subsequent planting the next season. Both the seed grower that harvests, stores, and sorts the seed and the commercial grower who receives, cuts and plants the seed can contribute to the level of bruising. (2) Seed is generally stored at low temperatures. Seed potatoes handled without warming will be very susceptible to bruising. Bruising, regardless of when it takes place, increases the rate of physiological aging and provides ideal sites for infection by soft rot and dry rot organisms.

SEED DECAY

Gudmestad et al. (1) reported that Norgold Russet seed potatoes were more likely to exhibit seed-piece decay and reduced stands when bruising occurred during the cutting operation. Careful handling of seed lots that had a high decay potential (surface contamination with the soft-rot organism) was especially important to avoid stand problems (Figure 1). Temperature was also an important factor in determining the amount of seed-piece decay. Cold potatoes exhibited much more seed-piece decay than warm potatoes when bruised. (Figure 2).

PHYSIOLOGICAL AGE

Bruised potatoes have increased respiration which results in physiological aging and an increase in stem number. Iritani and Kunkel (2) found that bruising or scarring tubers with a knife increased stem number by almost two stems per hill. High stem number in Russet Burbank is associated with high tuber set, increased undersize tubers at harvest and reduced marketable yield.

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BRUISING AT HARVEST

Seed growers can severely injure seed at harvest if they handle it in a rough manner. A field trial was initiated in 1987 to measure the effect of bruising during harvest on subsequent yield potential of seed potatoes. Tuber samples were collected from a seed grower in Arco, Idaho before, during and after the harvesting and storage filling operations. An additional sample was taken in storage and dropped from a height of 24 inches to simulate seed that had been abused. In the spring of 1988, the samples were hand cut and suberized at Kimberly. The seed was hand planted in replicated trials in Arco and Kimerbly, Idaho. At harvest, potatoes were hand dug, and total yield and grade were determined. Abused seed tended to produce the lowest yields at both Arco and Kimberly (Figure 3 & 4). Seed sampled at the harvester or storage produced yields similar to the hand-dug seed. At Kimberly, the abused seed tended to have a much lower yield of over 10 oz. tubers than any other treatment.

BRUISING DURING CUTTING AND PLANTING

The cut surfaces of seed pieces may be very vulnerable to bruising. Therefore, commercial growers could cause a lot of injury to seed during the cutting and handling operation. Trials were conducted in 1990 and 1991 to determine how bruising during cutting affects seed performance. Cut seed of Shepody (1990 and 1991) and Russet Burbank (1991) were bruised three times on the outside surface, cut surface or cut edge. Seed pieces were treated with fungicide and planted in replicated plots at Parma, Idaho. Emergence, stand and stem number were recorded during the season. At harvest, tuber number, yield and grade were measured.

Bruised Shepody seed pieces had similar emergence, stand, stem numbers and yield as unbruised seed in 1990. In 1991, bruising significantly reduced early emergence of both Shepody and Russet Burbank (Table 2). Final stand was reduced by bruising of the cut surface in Shepody, but not in Russet Burbank. Bruising also significantly increased stem and tuber numbers in Russet Burbank. This trend was not significant in Shepody in either year. Shepody seed bruised on the cut surface produced less total yield than unbruised seed in 1991 (Figure 5). Tuber size distribution also tended to be changed, with more under 4 oz. and less 4-10 oz. tubers produced by bruised seed. Bruising significantly increased production of under 4 oz. tubers in Russet Burbank, but did not affect total yield.

SUMMARY

Emergence and final stand were reduced by bruising seed tubers in one out of three years. Stem and tuber number per plant were generally increased by bruising in Russet Burbank, but not in Shepody. There was a trend for bruising to reduce total yield in three of the trials (Arco 88, Kimberly 88, Parma 91). Yield reduction was statistically significant only for Shepody at Parma in 1991. In that trial, the largest difference in total yield between bruised and unbruised seed was 41 cwt/acre.

This yield reduction was measured on seed that had been bruised three times. Anyone who has watched a commercial planting and cutting operation knows that it is not uncommon for seed to be dropped several feet during each loading phase from cutter to planter. These types of rough handling practices appear to have a great potential to reduce stands and lower yield potential of seed.

There was also a trend for altered size distribution, with more undersize and less over 10 oz. tubers produced by bruised seed. A reduction in over 10 oz. tubers would further reduce grower returns.

There was no evidence that bruising of cut surfaces or edges was more detrimental than bruising the outside surface. While the cut surface may be more vulnerable, bruising of any seed surface increases respiration and speeds physiological aging.

These results are consistent with the theory that bruising increases physiological aging and reduces yield potential of seed. There is likely to be a significant interaction between initial physiological condition, bruising at harvest, storage conditions, and bruising during cutting and planting. More research is needed to clearly define the influence of each factor on seed productivity.

REFERENCES

1. Gudmestad, N. C., P. Nolte and G. A. Secor. 1988. Factors affecting the severity of seed-piece decay, incidence of blackleg, and yield of Norgold Russet potato in North Dakota. Plant Disease 72:418-421.

2. Iritani, W. M. and R. Kunkel. 1974. Potato seed -- what's in it? Proceedings of the Washington Potato Conference and Trade Fair 13:79-82.

3. Kleinkopf, G. E. and J. L. Barta. 1991. Seed quality for commercial and seed growers. Proceedings of the University of Idaho Winter Commodity Schools 23:255-257.

Table 1. Effect of seed handling on yield of four seed lots planted at Kimberly, Idaho in 1990.

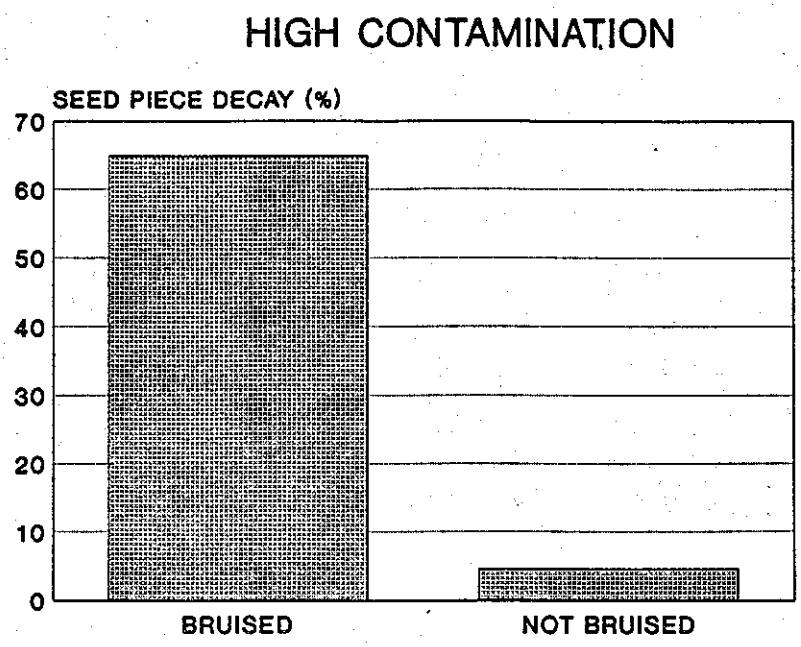
Sample Site	Seed Lot A	B	C	D
	Yield (cwt/acre)			
Seed Storage	492	464	455	483
Commercial Storage	465	461	478	477
Seed Cutter	430	441	455	415

Source: Kleinkopf and Barta, 1991.

Table 2. Effect of bruising on stand, stem number and tuber number of Shepody and Russet Burbank at Parma, Idaho in 1991.

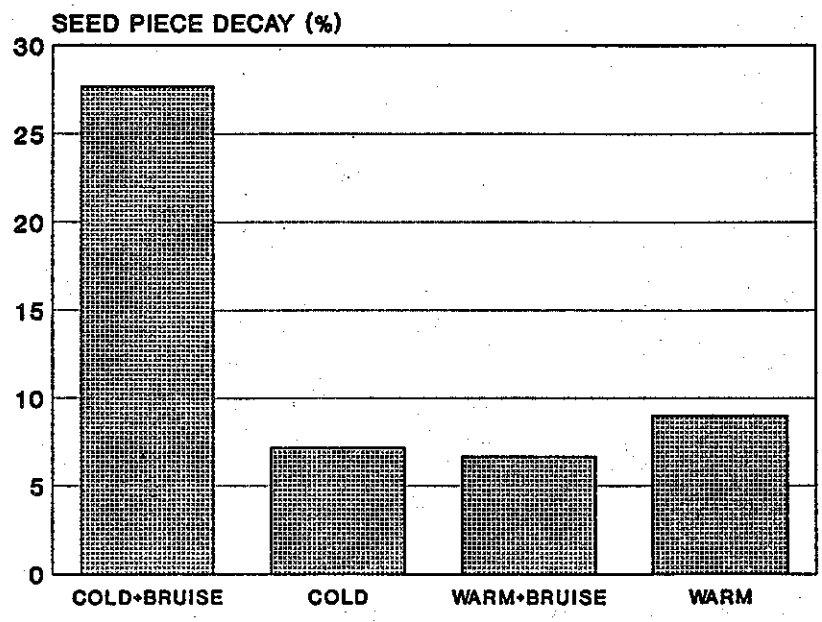
	Stand 5/21	Stand 6/10	Stem/ Plant	Tubers/ Plant
Shepody				
None	22c	55a	2.0	4.5
Out surface	13d	52ab	2.2	4.8
Cut surface	19cd	52 ab	2.0	4.7
Cut edge	16d	49b	2.0	5.3
Russet Burbank				
None	41a	50	3.1b	8.5b
Out surface	42a	50	3.5ab	9.9a
Cut surface	38ab	50	3.4ab	9.6ab
Cut edge	34b	50	3.7a	9.3ab

Figure 1. Effect of bruising on seed piece decay of Norgold Russet.



SOURCE: Gudmestad (1988)

Figure 2. Effect of bruising and pulp temperature on seed piece decay of Norgold Russet.



SOURCE: Gudmestad (1988)

Figure 3. Effect of handling on yield and grade of Russet Burbank at Arco, Idaho in 1988.

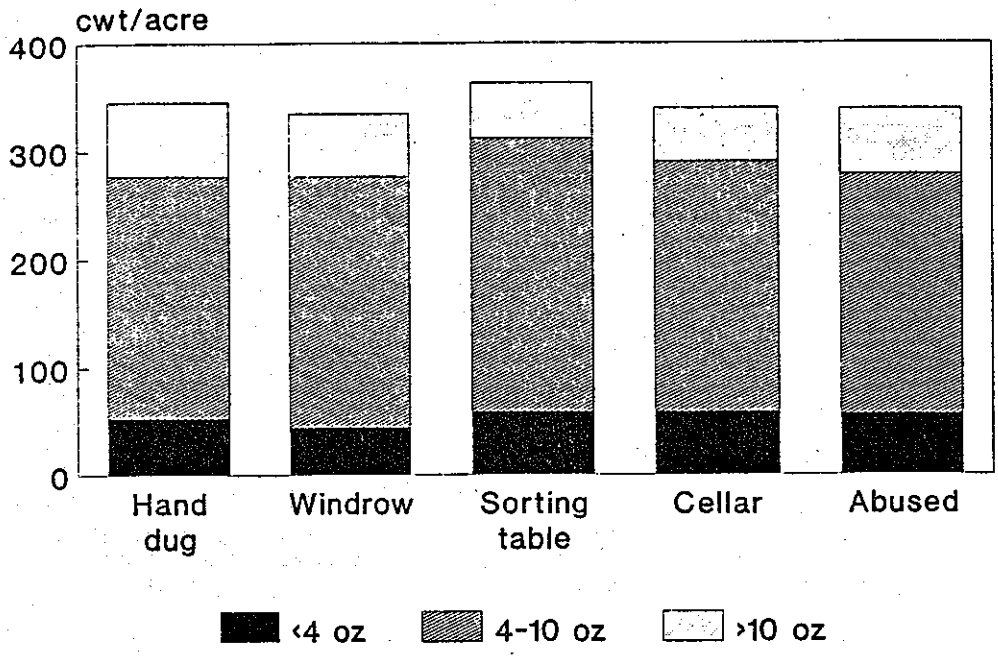


Figure 4. Effect of handling on yield and grade of Russet Burbank at Kimberly, Idaho in 1988.

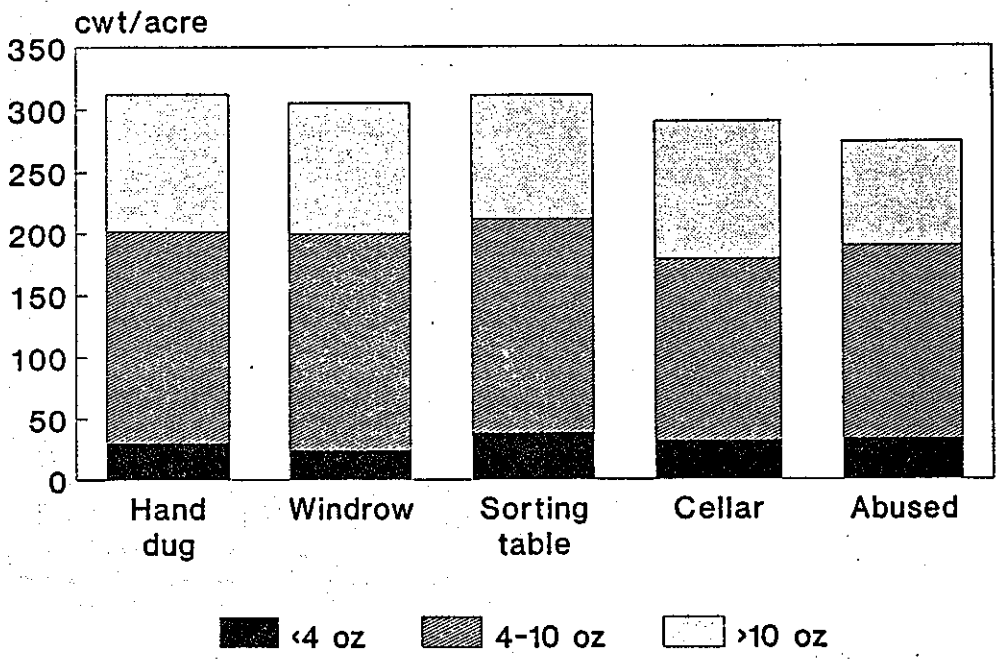


Figure 5. Effect of bruising on yield and grade of Shepody and Russet Burbank at Parma, Idaho in 1991.