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BETTER POTATO STANDS

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Good potato stands are an important factor in producing high yields of quality potatoes. In a special survey of 683 eastern Idaho farms only 15.7% of the fields had stands 90% or better (table 1).

Surveys conducted by the Idaho Crop and Livestock Reporting Service from 1965 through 1971 show that, by the time of harvest, stands across the state average only about 86 plants per 100 feet or 1 plant approximately every 14 inches. Research indicates that while the yield of a plant adjacent to a gap is increased by lack of competition, this increased yield is **not** sufficient to compensate for the zero yield of the missing plant. Obviously, many potato growers in Idaho are suffering serious losses because of poor stands.

Yield reduction resulting from poor stands is only part of the story. Per unit cost of production is higher in fields having poor stands since essentially the same inputs are required for growing the crop, regardless of stand.

Percent stand is calculated by determining the number of plants per 100 feet of row and dividing by the number of plants that should be present for the drop spacing used (table 2). For example, 90 plants per 100 feet of row is a 90% stand if the drop spacing was 12 inches (one seedpiece per foot), but is only a 68% stand if a 9-inch drop was used (90 divided by 133, the number of plants required for a perfect stand on a 9-inch drop).

Table 1. Total and U.S. No. 1 cwt. per acre yields for 683 eastern Idaho potato fields over a 4-year period grouped according to percent stand.

Percent stand	Number of fields	Percent of fields	Average Yield Total (cwt./acre)	Average Yield U.S. No. 1 (cwt./acre)
< 70	106	16.6	160.4	94.4
70-79	178	27.9	181.2	109.2
80-89	254	39.8	197.5	122.1
90-99	100	15.7	216.1	135.7

Fig. 1. This seedpiece has been decayed by blackleg bacteria, a disease organism that can result in loss of stand either before or after emergence.

The first step in correcting a stand problem is to determine what is actually causing the problem. Dig up gaps and dead plants to determine why there is no plant or why it died. Poor stands or loss of stand may be caused by such factors as exposure of the seed to a sprout inhibitor, mechanical errors during planting, seedpiece decay or insect damage, "cultivator blight," and loss of plants to blackleg or other disorders. Poor stands are most frequently caused by mechanical errors associated with operation of the planter.

Table 2. Number of seedpieces or plants that should be present per 100 feet of row for various drop spacings.

Drop spacing in inches	6	7	8	9	10	11	12
No. seedpieces or plants per 100 ft. row	200	171	150	133	120	109	100

Seed Factors

Disease Content

Some seedborne diseases (e.g., ring rot, blackleg) may directly or indirectly cause loss of seedpieces or plants. Certified or Foundation seed should be used by all potato growers.

Physiological Condition

Avoid using seed that has been exposed to chilling, field frost, or cellar heating. The cut surface of such seed may not heal properly. Seedpiece decay, then, is more likely, particularly if the seed is subjected to moisture or temperature stress after planting. Sprouting is more likely to be affected by heating or frost than by chilling. Severely chilled or frosted tubers show internal flesh discoloration, dark spots, textural changes, and, when warmed, "weeping" (watery breakdown). Tubers that have heated in the pile may be pitted and have weak sprouts.

Sanitation

Store, cut, and handle seed under sanitary conditions to reduce losses from rot organisms. Thoroughly clean out and disinfect the seed storage area. Scrape the cellar floor down to fresh earth. Using a chemical disinfectant, thoroughly wet the walls, floor, timbers, and any other surface that comes in contact with the tubers. Chemical disinfectants are listed in table 3.

Steam clean or wash all potato cutting, handling, hauling, and planting equipment. You may need to partially dismantle certain equipment (cutters, planters, pilers, conveyors, etc.) to clean it thoroughly. Disinfect metallic surfaces with any of the chemical disinfectants listed **except** copper sulfate, which is very corrosive.

Cutting and Handling Seed

1. If sprouts are not showing on the seed, warm it for two weeks at 50° to 55° before cutting.
2. Cut seed in an area free from drafts, with the floor wet down and doors closed to provide a high humidity for rapid healing of the cut surfaces.
3. Losses due to seedpiece decay may be avoided by planting whole (uncut or single-drop) seed. To retain the maximum number of single drops and to reduce the number of undersized seedpieces, avoid cutting seed tubers weighing less than 3 oz. Screen out slivers. They interfere with proper operation of the planter and, if planted, fail to produce or support a plant. "Blind" seedpieces, resulting from cutting seed tubers that have few or widely spaced eyes, also reduce stand.
4. Increasing the average seedpiece size often lowers the proportion of undersized seedpieces that are more subject to seedpiece decay and likely to produce week plants. When cutting seed, strive for a **minimum** average seedpiece size of 1¾ oz. Minimize the proportion of chips and slivers reaching the planter and, particularly if the planter is a cup-type, minimize the production of oversized and slab-shaped seedpieces. A 1¾ oz. average seedpiece size means no more than 109 seedpieces in a 12-lb. sample or 91 seedpieces in a 10-lb. sample of cut seed. For further information on seedpiece size see your county extension agent and University of Idaho Current Information Series 207, "Potato Seedpiece Size."
5. Consider seedpiece treatment strictly as insurance against adverse conditions. You must cover the cut surface completely for maximum effectiveness. Dusts are usually preferred to sprays or dips.
6. Plant immediately after cutting unless special precautions are taken to suberize (heal) the cut surface in storage.
7. If cut seed is to be stored, treat and "cure" it to heal the cut surface. Best healing takes place at 45° to 50° and 95% or higher relative humidity. Aeration as well as temperature control is important. Both may be accomplished by repiling, placing ducts under the cut seed or using forced-air ventilation with humidification.
8. Protect seed from sun and wind by keeping the seed covered with a tarp when hauling to and handling in the field.

Table 3. Chemical disinfectants for potato storages.

Chemical	Amount to add to 10 gal. water	Amount to add to 100 gal. water**
Copper sulfate (very corrosive)	2 lb.	20 lb.
Chlorine (Chlorox, B.K., Purex, etc.) 5% solution	1 gal.	10 gal.
Lysol—50% solution in soap	1 gal.	10 gal.
Formaldehyde—40% solution (Avoid breathing vapors)	3.2 cups	4 gal.
Quaternary ammoniums* (Roccal, Hyamine, Purina, Sanital, etc.) 10% solution	1.6 cups	1 gal.

* Used mainly for ring rot control.

** 100 gallons water will cover to run-off an area in the cellar approximately 40 by 100 feet, depending on how moist the soil is to begin with.

Sprout Inhibitors

Be cautious when storing seed in a cellar that has been treated with a post-harvest sprout inhibitor* such as Chlorpropham (CIPC). CIPC, when applied through the storage ventilation system, crystallizes onto fans, humidifiers, plenums, mixing chambers, air ducts, etc., and may penetrate into wooden surfaces. Sprout-inhibiting vapors are released for an indefinite period of time.

Seed has been stored in treated storages with no reported ill effects but there is a definite risk involved. Delay in emergence and possible reduction in stand can result if seed is exposed to residual vapors of the chem-

* Sprout inhibitor information was provided by Walter C. Sparks research horticulturist, University of Idaho Aberdeen Branch Experiment Station, and Warren Shillington, representative of PPG Industries, Inc.

ical. The manufacturer of the chemical recommends that seed not be stored in a treated cellar for at least 6 months. If seed must be stored in such a cellar, thoroughly remove the powdery or caked off-white or gray residue of the chemical from the cellar. Scrape the cellar floor, sweep or wash down the air plenum and air ducts, and remove the chemical from fans and other equipment with an alcohol solvent. Airing the cellar out during the summer is also helpful.

Mechanical Factors

The most frequent cause of poor stands, mechanical factors, is the one over which you have greatest control, through careful operation and maintenance of the planter.

The two major mechanical factors responsible for poor or uneven stands are failure to plant a seedpiece, and incorrect spacing, resulting in gaps and bunching. Bunching may be as undesirable as skips. These errors tend to become more frequent as planting speed increases.

Planter Condition

Condition and management of the planter is extremely important. Keep planter in good mechanical repair. The planter shoe should make a sharp groove in the soil to hold the seedpiece in place when it hits the ground. Rounding the forward edge of the shoe may reduce trash buildup. Do not make radical changes in the planter without first consulting the manufacturer's representative. Employ only the most responsible and competent people for planting.

Pick-type Planters

If the planter is a pick-type, replace all picks before starting to plant. Check picks frequently each day of use and replace the worn or damaged ones. If many of the seedpieces are large, adjust the number and position of the picks in the picking arm to increase the number of seedpieces planted. Make sure picker mechanism

Fig. 2. Chips and slivers are responsible for loss of stand. These seedpieces either produces no plant or, as in the middle above, a very weak plant that eventually dies.

Fig. 3. Planter errors are most frequently a major cause of poor stands either through failure to plant a seedpiece or non-uniform spacing of the seedpieces planted—the gaps and bunching above.

(including cams and picking arm springs) is in good condition, well-adjusted, and operating smoothly. The picker arm must open far enough to allow the seedpiece to be stripped off the picks properly. Check springs frequently as they may weaken or break.

The planter should be cleaned as needed to permit free flow of the seed from the seed hopper through the hopper chutes and into the picker bowl. Maintain proper level of seedpieces in the bowl. If the seed level is too high, the seedpieces may be knocked off the picks before the picker arm clears the seed. The seed should flow freely down around the picker arm assembly. Be sure there is proper clearance between the seedpiece and the shield on front of the picker bowl. If the seed is knocked or scraped off before the picker arm opens, improper seedpiece spacing will result.

Cup-type Planters

If a cup-type planter is used, use the cup size suitable for the majority of seedpieces to be planted. Uniform seedpiece size is required for best results with a cup-type planter. Avoid producing seedpieces too large for the cup to pick up and hold, or that are slab-shaped and inclined to fall off. If seedpieces are too small, a large number of doubles may be planted.

Keep cup chain vibrators properly adjusted. On some planters the seed level in the cup hoppers should never be higher than the bin chain, never lower than the middle of the cup chain agitator. Match speed of planting to field conditions, seed characteristics, and drop spacing. Go faster if the field is smooth and the drop spacing is wide. Go slower if the field is rough and spacing is close. Keep the cups clean. A sickle section is a convenient tool for this purpose.

Planter Operation

Before starting to plant, count the number of seedpieces dropped in 100 feet. Check against drop spacing in table 1. Make adjustments, if necessary, to obtain the number of seedpieces required for the drop spacing used and to obtain uniform spacing of the seedpieces.

Dig in the field occasionally to see how the planter is doing. Walk behind the planter to better observe its operation.

Planting depth should be at least 4 inches but no more than 6 inches from field level. Deeper planting is usually helpful in reducing greening under sprinkler irrigation. Planting too shallow may place the seedpieces in dry soil and lead to seedpiece decay and late emergence.

Soil Factors and Cultivation

Prepare the soil to produce a smooth, mellow seedbed. Planters operate poorly in compacted, cloddy, or rocky soil, in rough terrain situations, and in soil that contains large amounts of undecomposed crop residues, such as straw or alfalfa crowns and roots.

The soil should be moist (60 to 80% available) at planting depth and for 2 or more feet below the soil surface. **Avoid planting in a dry seed bed.** A preplant irrigation, preferably in the fall, may be necessary to provide proper soil moisture at planting time. If the seed is planted in dry soil, you may need to apply a light irrigation with sprinklers immediately after planting to reduce losses from seedpiece decay.

Apply the first irrigation before available soil moisture drops below 60% at root depth. This should be a light irrigation. With a sprinkler, apply just enough to meet the deeper moisture; with a gravity system, wet under the hill to the seedpiece. Timing the second irrigation is also critical because the root system may still be quite shallow. If the weather is warm and dry, the soil moisture in the top foot of soil may be lost very rapidly. You would then need to apply irrigation closely following the first irrigation.

If you used hilling discs at planting, harrow or plank down the row to permit faster, more even emergence. Time and conduct this operation carefully to avoid breaking off or injuring sprouts and uncovering or moving seedpieces.

When cultivating, avoid uncovering or dislodging seedpieces, covering recently emerged plants, or severely injuring sprouts or the stems and roots of older plants ("cultivator blight").

Certain soil-inhabiting insect forms (e.g., wireworms, cutworms) may attack seedpieces or young stems and cause delayed emergence and, occasionally, actual loss of stand. In such cases, consult your county agent, area potato specialist or qualified field man.

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