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Cooperative Extension Service Agricultural Experiment Station

# Disposal of Cull APR 0 5 1988 and Waste Potatoes ITY OF IDAHO

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Potatoes that do not meet the minimum standards of size, weight, appearance, quality and disease tolerances for tablestock, processing or seed purposes are classified as cull or waste potatoes. Cull potatoes are caused by bruising injury, diseases, insect damage and stressful growing and storage conditions (Table 1). These agents may cause potatoes to have unattractive appearance or strong odors, or make them inedible for humans.

Potatoes can become culls at almost any time before they are consumed — throughout the growing season or during harvest, storage, transportation, fresh packing or processing. Factors such as bruising, high temperature stress or frost damage can be more severe in some years, causing larger amounts of cull potatoes to be produced. In addition, cull potatoes that have become infested with disease can spread rotting and decay organisms to adjacent healthy potatoes, causing more potatoes to become culls. This is true at any stage of the growing season and during storage or transportation. Cull or waste potatoes are routinely sorted out during grading and cleaning in freshpack and processing operations.

Only small amounts of cull potatoes are produced most years, and disposal is not usually difficult or expensive. Most on-farm culls occur during piling and sorting and when potatoes are being removed from storage cellars. Soil is usually removed with the culls during these operations. This mixture of potatoes and soil, including that scraped from the cellars, is often discarded into small piles nearby. After a short time the cull potatoes decompose, and the soil is spread on non-crop areas of the farm.

Disposal of cull potatoes in years when large amounts are produced is not always so easy or inexpensive. Freshpack, processing and farming operations may accumulate large amounts of cull potatoes that need to be properly discarded during years of hard frost. The

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Causal agent	Tuber symptoms
Bruleing injuny	
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cuts and punctures	damages tuber nesh; unattractive
shattor bruiss	domages tuber skin and fleeb.
snaller Druise	damages tuber skin and nesh;
okinning	domagoo tubor oking unottractive
skinning	damages tuber skin; unattractive
	appearance
Diseases (biotic)	
blackleg	reduces tuber size; leads to rotting of
	tuber flesh
early blight	reduces yield and size of tubers; lesions
	develop on tuber skin
dry rot	decays tuber flesh
leafroll virus	reduces yield and size of tubers; brown
	streaks in flesh
ring rot	decays tuber flesh
scab	causes pits and scars on tuber skin
soft rot	decays tuber flesh; strong odors
verticillium wilt	reduces yield and size of tubers; brown
	streaks in flesh
wet rot	decays tuber flesh
Insect damage	
Colorado potato	reduces vield and size of tubers: may
beetle	cause malformations
root knot nematode	tubers off-type
wireworm	damages tuber flesh
Streetul growing oo	aditiona
nutrient imbalance	affects vield size shape and maturity
Inditionit initialiance	of tubers
high temperature	causes dark processed products
frost damage (foliar)	may affect yield size and shape of
noor damage (ional)	tubers
frost damage (tuber)	damages tuber flesh: allows entry of
noor damago (rabol)	rotting diseases
hail	may affect yield size and shape of
	tubers
sunburn	causes greening of tuber skin and flesh
	the second grooting of tubor skin and light
stressful storage con	ditions
low temperature	sugars accumulate in tubers causing
	dark processed products
high temperature	promotes decaying and rotting
low relative humidity	causes tuber flabbiness, shriveling,
iow relative numidity	
or continuous	flattening and pressure bruise

guidelines presented in this publication are intended for disposal of large amounts of cull or waste potatoes, but the principles are also suitable for smaller quantities.

Cull and waste potatoes can be a health hazard and public nuisance when disposed of improperly. Health hazards occur when waste potatoes are dumped into streams, marshy areas or natural drainageways to contaminate surface water. Waste potatoes can also contaminate groundwater when they are dumped near wells and gravel pits or in areas where the effluent can flow into groundwater. A public nuisance can be created when piles of waste potatoes are allowed to decompose near residential dwellings. Decaying cull piles emit strong odors and are a breeding place for insects, principally small flies. The Idaho Department of Health has received formal complaints regarding odor and flies that have been traced to piles of waste potatoes.

Cull potatoes can be disposed of economically. The use of waste potatoes and potato processing waste as a livestock feed is a tradition in Idaho. Processing waste has also been used for pet food and potato starch production. Market demand is usually sufficient to remove cull potatoes, particularly when they are in low supply. When the supply is in excess, however, waste potatoes become a disposal problem.

## Managing and Disposing Of Waste Potatoes

Three basic disposal methods are possible for large quantities of cull or waste potatoes: (1) feed them to livestock, (2) incorporate them into a landfill or (3) spread them on the land. Each farm or business operation will use a different method depending upon which of the problems associated with the cull piles are most important (Table 2).

Table	2. F	Prob	lems	assoc	lated	with	cull	pile	dispo	sal	
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Problem	Disposal objectives				
Economics	disposal costs need to be minimized; sell potatoes to recover production cost				
Disease	prevent spread of nematodes, diseases and insect pests to nearby potato crops				
Volunteers	prevent sprouting and foliage growth which can harbor diseases and insects				
Pollution	prevent contamination of surface and groundwater with potato effluents				
Nuisance	dispose of culls away from residential buildings or prevent odors and insect breeding				
Land availability	locate land suitable for waste potato disposal				
Toxins	prevent growth of toxin-producing microorganisms in culls used for livestock feed				
Quantity	manage for a minimum and constant quantity of waste potatoes				

#### **Livestock Feed**

Using waste potatoes as livestock feed is the ideal disposal method because it provides an economic return for a minimum of cost. Potatoes have significant

Table 3. Average chemical composition of potatoes used for feed.<sup>1</sup>

Category	Dry matter
	(%)
Fat Fiber Protein	1.0 2.7 7.2
Starch Ash	79.0 4.4

<sup>1</sup>Average dry matter content = 22.5%.

Source: University of Idaho Research Bulletin 112, "Studies on the Utilization of Potato Processing Waste for Cattle Feed."

amounts of starch and protein and are excellent livestock feed supplements (Table 3). Feeding potatoes provides less of a disease or regrowth problem than surface disposal methods since the culls are usually used before warm spring and summer temperatures. A relatively constant yearly supply of cull potatoes is needed to make the investment in storage facilities and handling equipment worthwhile.

Cull potatoes stored for feed are often piled in open pits that have soil floors. Such storage can still contaminate groundwater if it is located on porous soil or unless the storage pit floor is sealed with a waterproof material such as bentonite, plastic or cement. (The effectiveness of an anaerobic soil seal is not known.) The surface water contamination problem is usually minimal since the feedlot must also be managed to prevent contamination from animal waste. Draining standing water and effluent away from the potato pile will help to reduce odor and fly nuisance problems. However, the best method to eliminate complaints from odor and fly nuisances is to locate the feeding operation away from residential areas.

Cull piles can develop microtoxins while being stored before feeding. Fungi, yeasts and bacteria produce microtoxins when warm, moist, non-acidic conditions in the pile promote microorganism growth. These toxins are more likely to be produced when cull piles are held over the summer months. They are harmful to livestock. Livestock feeders concerned about toxicity should separate and not feed the rotten and moldy portions of the cull potatoes. The spoiled material can also be tested for toxins at a veterinary diagnostic laboratory. Cattle are quite tolerant of spoiled potatoes; other animals are less tolerant. Pregnant animals are more susceptible to toxicity than non-pregnant ones.

Waste potatoes can also be fed to livestock on pasture. In this case the potatoes are spread over the land. The potatoes should be allowed to wilt or soften before cattle are turned into the field for feeding. Turgid potatoes can slip from an animal's teeth and lodge in the throat causing the animal to choke to death. If not immediately fed, the individual potatoes usually dry or freeze, which provides silver-dollar size feed chips at a later time. Since cull potatoes may contain soilborne diseases or nematodes, they should only be spread on pasture or noncultivated land.

## Landfill Disposal

Sanitary landfill disposal is suitable only for relatively small quantities of potatoes and then only after the landfill operator gives permission. Sanitary landfills can also be established on the farm. Idaho law requires that permission be obtained from the county commissioners. The district health department should be consulted before developing an on-farm landfill to avoid infringement on applicable environmental regulations.

Landfill disposal involves digging a trench large enough to hold the waste potatoes. The removed soil should be piled alongside the trench for recovering. The trench should be refilled with alternate layers of potatoes and soil. At least 3 feet of soil should be above the upper potato layer. Soil not used immediately will be needed as the backfill settles. Drainage from the trench must not contaminate a stream or drainageway. The trench location should be in an area with a low water table, and groundwater should not seep into the bottom of the trench before filling. If it does, another site must be selected.

#### **Field Spreading**

Spreading waste potatoes on non-potato cropland may be one of the less expensive disposal methods. The two principal problems associated with surface-spreading are (1) sprouting and regrowth and (2) disease and insect proliferation and subsequent spread to nearby potato crops. These problems can be minimized by proper management.

Waste potatoes should never be spread on land that will be planted to potatoes because the culls are potential sources of numerous soilborne diseases, nematodes and volunteer potatoes. Marshy land and drainageways should also be excluded to prevent water pollution. The waste potatoes should not be plowed or disked into the soil since this will only enhance these two problems. Allowing surface-spread potatoes to freeze and dry will help control regrowth and diseases. Ideally, the potatoes should be spread thinly so they will freeze and dry quickly. Exact spreading depths are not known and would depend on the weather. Intense winter freezing will probably prevent regrowth with depths up to more than 6 inches.

Cull potatoes that are spread may have some livestock feed value at a later date but should not be fed if they have been chemically treated. Freezing will prevent regrowth if the potatoes are later incorporated into the soil. Waste potatoes spread on the land also have fertilizer value and can add significant amounts of nitrogen, potassium and other nutrients to the soil (Table 4).

# Recommendations

 Minimize disposal expenses — Handle the waste potatoes only once when removing them from storage. Transport the potatoes directly to the disposal

Table	4.	Nutrient	composition	and	fertilizer	value	of	cull
		potatoes						

	Dry weight	Fresh weight fertilizer value <sup>1</sup> Ib nutrient per			
Nutrient	(%)	100 sacks	ton		
Nitrogen	2.14	43	8.6		
Phosphorus	0.29	6	1.2		
Potassium	2.40	48	9.6		
Calcium	0.074	1.48	0.296		
Magnesium	0.148	2.96	0.592		
Sodium	0.029	0.58	0.116		
Manganese	0.0007	0.01	0.003		
Iron	0.0132	0.26	0.053		
Zinc	0.0018	0.04	0.007		
Copper	0.0010	0.02	0.004		
Boron	0.0006	0.01	0.002		

<sup>1</sup>Based on 80% moisture content.

Source: University of Idaho Current Information Series 470, "Nutrient Use by Potato Vines and Tubers."

site whether it be land spreading, a landfill trench or livestock feeding area. Make the hauling distance as short as possible.

- 2. Use cull potatoes as livestock feed Cull potatoes used as livestock feed reduce disease and regrowth problems and convert a disposal problem into a marketable product. Cull potatoes stored in a pit for later feeding must be clean (washed) when ensiled. Ensiled potatoes should be incorporated into an appropriate feed ration.
- 3. Spread on the land Waste potatoes that cannot be fed to livestock should be spread on land not used for crop production. Potatoes spread on the soil surface may regrow or serve as hosts for nematodes, diseases and insects that can infect adjacent potato crops. These problems can be avoided by spreading the potatoes in late fall or winter so low temperatures will freeze each tuber. The depth of spreading should be no greater than 6 inches, depending on air temperature, snow cover and freeze duration. If spreading potatoes in a non-freezing season is unavoidable, select a time when the potatoes will dry and rainfall is insufficient for regrowth. The potatoes should be spread one deep, not piled.
- 4. Avoid large pile storage Large potato piles are more likely than small piles to create odor and insect nuisance problems. If large pile storage is unavoidable, locate it on non-crop land at least l mile from an occupied home or business. As the potatoes settle and decay, liquid will accumulate around the pile base. Drainage from the pile should not enter a drainageway, surface stream, marshy area or well, or in any way contaminate the groundwater. Use ditches and/or berms around the pile to contain and control the effluent so it can be spread on and absorbed into adjoining soil. The soil water table should be low enough to prevent contamination.
- 5. Minimize existing nuisances Odors and insect nuisances surrounding existing cull potato piles can be reduced in two ways. If the weather is cold

enough, the potatoes should be spread on land to freeze and dry, as noted earlier. If this is impractical, lime can be spread over the rotting areas and wet soil around the pile. These areas should be dusted thickly until white. The dusting will probably need to be repeated during warm weather to mini-

mize odor. If insects persist, an insecticide may be required. It must be applied strictly according to label directions. Cull potatoes treated for odor and insects in this manner should not be used for livestock feed.

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