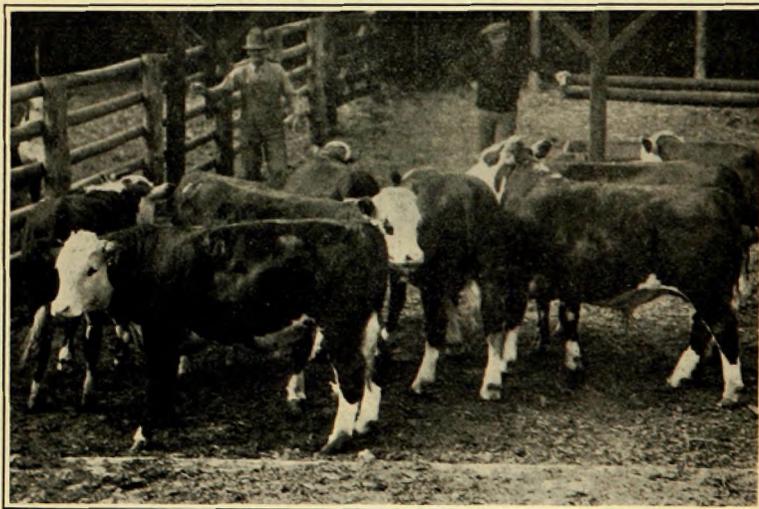


POTATOES FOR LIVESTOCK



Calves fattened on cull potatoes, barley, linseed oil meal, and alfalfa.
They gained practically 2 pounds per head daily

COLORADO AGRICULTURAL COLLEGE
EXTENSION SERVICE FORT COLLINS C. A. LORY, DIRECTOR

COOPERATIVE EXTENSION WORK IN AGRICULTURE AND HOME ECONOMICS
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Summary

Potatoes fed in livestock rations are generally comparable to good corn silage.

Potatoes may be fed raw to cattle, sheep, horses and swine but are best cooked for swine. Raw potatoes have only $\frac{2}{3}$ the value of cooked potatoes fed to pigs. Raw potatoes proved to be as good as cooked potatoes fed to dairy cows.

Raw potatoes may safely constitute $\frac{1}{2}$ the dry matter in rations for cattle and sheep and $\frac{1}{4}$ the dry matter in rations for horses. Cooked or raw potatoes should not replace more than $\frac{1}{2}$ the grain allowance in fattening pigs.

Raw potatoes fed to dairy cows at the rate of from 25 to 35 pounds daily have actually increased milk production but larger amounts will taint the milk, cause a salty butter and may cause indigestion and bloating.

The dry matter in potatoes is composed largely of starch, a carbohydrate valuable in both fattening and milk-producing operations.

Potatoes are low in protein or growth-producing material and some protein concentrate or roughage should be fed with them.

Raw potatoes are best fed sliced thru a root cutter. Frozen, rotted or decayed potatoes may cause trouble if fed to livestock.

Raw potatoes have an acrid taste and tend to increase the flow of digestive juices. They should not be fed with other feeds that tend to irritate the digestive system and they should always be fed with caution.

POTATOES FOR LIVESTOCK

E. J. MAYNARD, Associate in Animal Investigations

Potatoes make a good succulent feed for all classes of livestock when fed as a part of the ration.

Much of the expense incident to putting good potatoes on the market such as cost of sacks, cost of labor, sorting, sacking and hauling to market does not enter into the feeding operation. Consequently in a year of over production, potatoes can often be fed to advantage when they would otherwise be marketed at a loss. In beet-growing areas in Colorado, some potatoes are being used at present to replace a short supply of wet beet pulp in livestock-feeding operations.

Potatoes have been fed extensively in Europe, certain large, high-yielding varieties being actually grown for livestock; but in this country ordinarily only the culls are fed except when prices are low.

Potatoes may be classed with stock beets and other root crops. They contain about 20 percent dry matter which is largely composed of starch and they are high in available energy for the amount of dry matter they contain. The digestible nutrients in potatoes compare closely with those found in well-matured corn silage according to tables reported by Henry and Morrison.

	Pounds Digestible Nutrients in 100 Lbs.					
	Moisture	Crude Protein	Carbohydrate	Fat	Total	Nutritive Ratio
Potato	21.2	1.1	15.8	.1	17.1	14.5
Corn Silage	26.3	1.1	15.0	.7	17.7	15.1

As Potatoes are low in protein they should always be supplemented in the ration with feeds containing a considerable quantity of good-quality protein such as cottonseed meal, linseed oil meal, alfalfa hay or tankage.

Raw potatoes have an acrid taste and a tendency to increase the flow of digestive juices in the stomach and intestines. For this reason they should be gradually introduced into the ration, and if a change is to be made they should be taken away by degrees.

A poisonous material, solanin, is a regular constituent of all parts of the potato plant but exists in such minute quantity that it causes no harm. Altho this poison does not increase when potatoes are stored or when they decompose, it passes in considerable quantities into the young shoots when the potatoes germi-

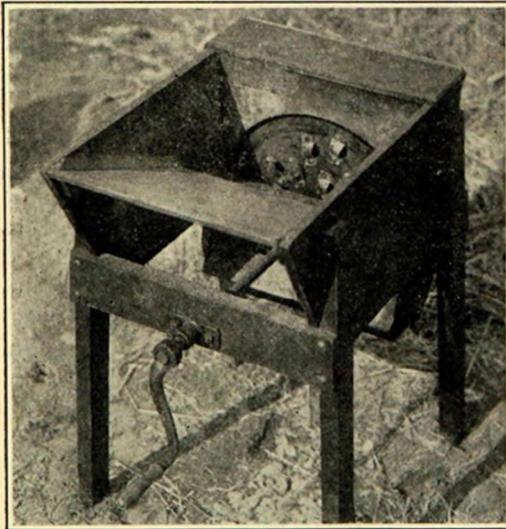
nate and the sprouts may contain a considerable amount. These sprouts should be removed before feeding.

The action and amount of this solanin is reduced thru cooking.

Foreign authorities warn that too large an amount of uncooked potatoes fed to livestock may cause indigestion, but Pott^s recommends that potatoes may safely furnish one-half of the dry matter in fattening rations for cattle and sheep, and one-fourth the dry matter in rations for horses.

Preparation for Feeding

Raw potatoes may be fed to beef cattle, dairy cattle, horses, sheep and hogs altho it is generally considered best to cook or steam potatoes for hogs. Potatoes are often fed whole but they



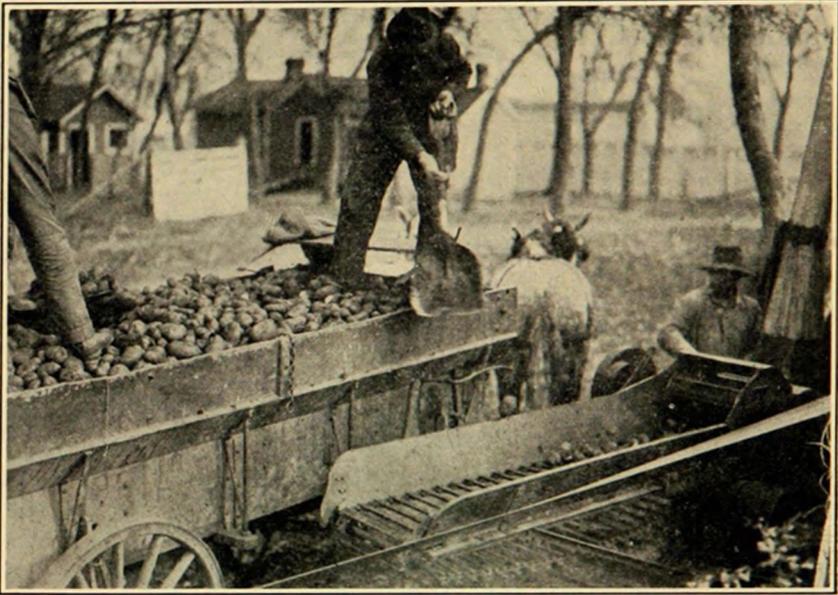
A low-priced root cutter with good capacity

are safer and more conveniently fed when cut with a spade or thru a root slicer. There are low-priced, efficient root cutters on the market and these cutters are being used extensively today.

When potatoes are fed whole, there is danger that some will freeze before they are eaten. The animals do not relish whole potatoes as they do chopped ones. When frozen potatoes thaw, the starches and sugars in them break down and

fermentation soon begins which makes them generally unsafe for feeding. For this reason it is wise to feed them sliced directly from the cellar or pit. If potatoes are fed whole to cattle it is best to feed them under a pole fence either in a low trough or on the ground as the pole tends to keep their heads down and often prevents choking.

If potatoes are cooked for swine they should be salted and the water in which they have been cooked should be thrown away.



Cutting potatoes thru an ordinary ensilage cutter to make potato silage. Two percent of corn chop added thru the hopper insures the proper fermentation

Potato Ensilage

A palatable ensilage can be made by cutting potatoes thru an ensilage cutter into the silo. A 2 percent mixture of finely ground corn chop should be included to inoculate the potatoes with lactic acid bacteria and cause the proper fermentation.

Altho the silage thus prepared has a higher feeding value than the potatoes, the cost and losses incurred in the ensiling process caused a lower net return in feeding experiments at the Colorado Experiment Station.

The principal advantage secured in ensiling potatoes has been that of indefinite storage. Potatoes ensiled in late winter and early spring have been successfully held over and fed as silage the next fall. If potatoes are ensiled with some dry roughage or fodder such as corn, cane or even straw, much of the juice may be saved and perhaps a higher value returned for the silage than was secured in the feeding tests reported here.

Good drainage is necessary for the production of good-quality potato silage.

Potatoes and Potato Silage for Fattening Calves, 10 Calves per Lot (5 open heifers and 5 steers) fed 208 days at Colorado Agricultural Experiment Station.

(Table based on one average calf)

Rations fed	Barley Corn Silage L. O. Cake Alfalfa	Barley Cull potatoes L. O. Cake Alfalfa	Barley Potato silage L. O. Cake Alfalfa
All weights in pounds.			
Weight at start	347.8	348.5	358.0
Weight at market	761.0	763.0	785.6
Shipping shrink (percentage)	3.06	2.49	2.68
Gain at market	413.2	414.5	427.6
Daily gain—208 days	1.99	1.99	2.06
Daily feed fed (lbs.)			
Ground barley	6.9	6.9	6.9
Corn silage	9.2		
Cull potatoes		9.1	
Potato silage			7.4
Linseed oil cake	1.0	1.0	1.0
Alfalfa hay	4.9	6.7	6.7
Feed Required for 100 pounds gain (lbs.)			
Ground barley	350.7	349.2	341.0
Corn silage	462.9		
Cull potatoes		436.9	
Potato silage			348.0
Linseed oil cake	52.0	52.1	50.4
Alfalfa hay	246.7	336.3	327.7
Feed Cost for 100 pounds gain.....	\$9.53	\$9.54	\$9.71
Feed costs used per ton:			
Barley	\$25.00	Potato silage	\$ 7.69
Corn silage	7.50	Linseed oil cake	60.00
Cull potatoes	5.00	Alfalfa hay	15.00

Block salt was self fed in all lots.

Potatoes and Potato Silage for Fattening Cattle

A single feeding test was completed at the Colorado Agricultural Experiment Station in which mixed beef calves were fed separate rations containing corn silage, cull potatoes and potato silage.

Cull potatoes fed in the experiment were stored in a cellar and fed raw. They were chopped with a spade before feeding. Each ton of cull potatoes, fed and compared to corn silage, replaced 2119 pounds of silage, 6.9 pounds of barley and .5 pound of linseed-oil cake but 410.2 pounds more alfalfa were required for the same gain. The cull potatoes, compared to corn silage worth \$7.50 per ton, showed a feed replacement value of \$5.76 per ton in this experiment. Due to spoilage it was necessary to sort the cull potatoes several times late in the spring.

Cull potatoes were cut thru an ordinary silage cutter into the silo. A 2 percent mixture of corn chop was included to start fermentation. There was a loss of 20 percent in the weight of this silage in the silo. Each ton of potato silage, fed and compared to corn silage, replaced 2661 pounds of silage, 55.7 pounds of barley, 9.2 pounds of linseed-oil cake but 465.5 pounds more alfalfa were required with each ton of potato silage fed.

The potato silage showed a replacement value of \$7.46 per ton fed or was practically equal to good corn silage in feeding value. The potato silage cost 7.69 per ton fed from the silo.

Potatoes for Yearling Steers

During the latter part of this feeding test it was found that the potato silage in the bottom part of the silo had not drained properly. This silage had soured and spoiled. Good drainage is essential in the production of potato silage.

In a demonstration conducted in the San Luis Valley by the Colorado Agricultural College Extension Service, 775-pound yearling steers were finished during a 73-day feeding period on the following average daily feed per steer: Potatoes, 18.8 pounds; ground barley, 9.6 pounds; ground corn, 3.7 pounds; cottonseed cake, .9 pound; alfalfa hay, 8.0 pounds.

The steers were started on 2.5 pounds of potatoes per head daily and were gradually increased to 21.5 pounds per head daily at 10 days. This amount was then fed during the remainder of the feeding test. These cattle had been on sweet-clover pasture and grain previous to the potato-feeding period.

When the potatoes were started it was found necessary to drop back 1.7 pounds on their grain ration. On a full feed of potatoes the grain was increased again.

These cattle did well and made satisfactory gains during the feeding period.

There is no experimental work in this country to indicate the maximum amount of potatoes that can be safely fed to fattening beef cattle. According to German authorities potatoes can safely replace $\frac{1}{2}$ the dry matter in the cattle-fattening ration. According to these figures the maximum daily amount for 3-year-old steers would be about 50 pounds; for 2-year-old steers, about 40 pounds; for yearlings, about 30 pounds; and for calves about 20 pounds.

In fattening rations containing grain, a legume hay, and some standard high-protein concentrate, the following amounts of potatoes are recommended: From 8 to 20 pounds daily for calves, 12 to 30 pounds daily for yearlings, 15 to 40 pounds daily for 2-year-olds, and 20 to 50 pounds for 3-year-olds.

If the larger amounts of potatoes are fed they should be fed cautiously. Frozen, rotted or decayed potatoes should be sorted out before the potatoes are put thru the slicer for feeding.

Potatoes and Potato Silage for Sheep

Lambs fattened at the Colorado Agricultural Experiment Station on cull potatoes and potato silage fed with corn and alfalfa outgained lambs fattened on corn and alfalfa and lambs fattened on corn, corn silage and alfalfa. The potatoes were cut up with a spade before feeding. The potato silage was made by cutting potatoes and 2 percent finely ground corn chop thru an ensilage cutter into the silo. Two pounds of potatoes or potato silage were considered a full feed for the lambs during the test.

67.5 Pound Lambs Fed 105 Days at Colorado Agricultural Experiment Station
(Table based on one average lamb)

Ration fed	Corn	Corn	Corn	Corn	
	Alfalfa	Corn Silage Alfalfa	Potato Silage Alfalfa	Cull potatoes Alfalfa	
Final Wt. of lamb (lbs.).....	100.0	98.8	103.6	102.4	
Gain (105 days)	32.9	32.3	38.4	35.6	
Average daily feed (lbs.)					
Shelled corn	1.0	1.0	1.0	1.0	
Corn silage		1.8			
Potato silage			1.8		
Cull potatoes				1.9	
Alfalfa	2.7	1.7	2.2	2.1	
Feed required for 100 lbs. gain					
Shelled corn	333.3	331.3	322.2	301.6	
Corn silage		600.4			
Potato silage			511.2		
Cull potatoes				549.8	
Alfalfa	864.6	539.6	609.9	631.3	
Feed cost per 100 lbs. gain.....	\$11.48	\$11.27	\$11.37	\$10.62	
Feed costs per ton:					
Shelled corn	\$30.00			Cull potatoes	\$ 5.00
Corn silage	7.50			Alfalfa hay	15.00
Potato silage	7.69				

Salt was fed in all lots.

Each ton of cull potatoes fed to lambs replaced 115.5 pounds of corn and 848.6 pounds of alfalfa or at existing prices the cull potatoes had a feed-replacement value of \$8.00 per ton. Each ton of potato silage fed replaced 996 pounds of alfalfa and 43.4 pounds of corn, showing a feed-replacement value of \$8.02 per ton. Each ton of corn silage fed in the same experiment replaced 1082.6 pounds of alfalfa and 6.7 pounds of corn or was worth \$8.22 in terms of shelled corn and alfalfa saved.

This comparison would indicate potatoes and potato silage as having nearly the same feeding value as corn silage in fattening lambs. It has been customary to feed about 2 pounds of potatoes in fattening rations to lambs.

Sheep can usually be fed up to $2\frac{1}{2}$ pounds of potatoes per 100 pounds live weight, while fattening sheep may consume as high as 4 pounds per 100 pounds live weight.

Potatoes for Dairy Cows

Lindsey¹⁰ fed raw potatoes with a grain and hay ration to dairy cows in amounts ranging from 10 to 50 pounds at the Massachusetts Experiment Station. The addition of potatoes in 2 out of 3 cases not only checked the natural decrease in milk flow but actually increased the milk yield. Towards the end of the feeding period the cows showed indications of indigestion on the 50-pound feed and he concluded that 25 pounds of potatoes daily should be sufficient with the necessary concentrates and dry roughages.

Swedish investigators³ report that raw potatoes have as high a feeding value as cooked potatoes for dairy cattle. Cows on experiment were raised carefully to 34 pounds daily on cooked and uncooked potatoes with no noticeable difference in the feeding value.

Cows in milk should not be fed over 35 pounds of potatoes daily as larger amounts have been found to taint the milk and produce a salvy butter, but Kellner¹ states that dry cows may be safely fed up to 40 pounds of potatoes daily. There is danger from bloat if potatoes are fed in too large quantities and they are best fed without other feeds which have an irritant effect such as beet molasses.

Potatoes for Swine

According to results secured at the South Dakota Experiment Station⁹ it took 513 pounds of new raw potatoes fed with corn and tankage to replace 100 pounds of yellow corn, while under the same conditions, it took 962 pounds of old potatoes to replace the same amount of corn. In these tests an average of 339 pounds of new cooked potatoes replaced 100 pounds of corn.

In rations for pigs, according to Hansson³ .9 pound of dry matter in cooked potatoes has the same feed value as 1 pound of barley. A summary of feeding experiments reported by Henry and Morrison² indicates that 420 pounds of cooked potatoes are equal to 100 pounds of corn if fed in a properly balanced ration to pigs and that raw potatoes are worth only $\frac{2}{3}$ as much as cooked potatoes for pigs. The water in which potatoes have been

cooked should be thrown away and salt should be added before feeding.

For best results with pigs the cooked potatoes should not replace more than $\frac{1}{2}$ the grain ordinarily fed in the ration and some good source of protein should be included in the ration.

The proportion of potatoes should not be greater than 4 pounds of potatoes to 1 pound of concentrate.

Potatoes for Horses

Potatoes make a good horse feed and, as with swine, can be used to replace a considerable part of the concentrate fed. Kellner states that horses are more easily affected by raw potatoes than cattle or sheep but that small quantities, 3 to 5 pounds daily, have a beneficial effect on their general condition and that work horses can be safely fed up to 12 pounds per day per 1000 pounds live weight.

The daily ration of raw potatoes for horses should never be more than 10 to 14 pounds per head.

REFERENCES

1. The Scientific Feeding of Animals—Kellner.
2. Feeds and Feeding—Henry and Morrison.
3. Fütterung Der Haustiere—N. Hansson.
4. Proceedings of National Potato Conference—1928.
5. Handbook Ernähr. u. Futter, II, 1907—Pott.
6. Feeding Dairy Cows, Special Circular—Wisconsin.
7. Bulletin 218, University of Minnesota.
8. Practical Dairy Cow Feeding, Extension Circular—Michigan Agricultural College.
9. Bulletin 231, South Dakota Experiment Station.
10. Massachusetts Station Report 1912, part 2, pp. 56-64.
11. South Dakota Agricultural Experiment Station Bulletin 209
12. U. S. D. A. Bulletin 596.
13. Canada Experiment Farms, Report 1909.
14. Landw. Wchnbl. Schles. Holst. 57, 1907.
15. Canada Experimental Farms, Agassiz (B.C.) Farm Report. Supt. 1923.
16. Seale Hayne Agricultural College Pamphlet 9 (1923).
17. Ireland Department of Agriculture and Tech. Instr. Jour. 29 (1920).
18. U. S. D. A. Farmers Bulletin 1297.
19. Feeding Potatoes for Cheese Production—Pacific Rural Press 85, 1913, July-Dec. 1913.
20. Dairy Institute at Proskau (Milchw. Zentbl. 6) (1910).
21. Oregon Agricultural Experiment Station Bulletin 165.
22. Wisconsin Report, 1890.
23. Copenhagen (Dnmk) Station Report 1890.