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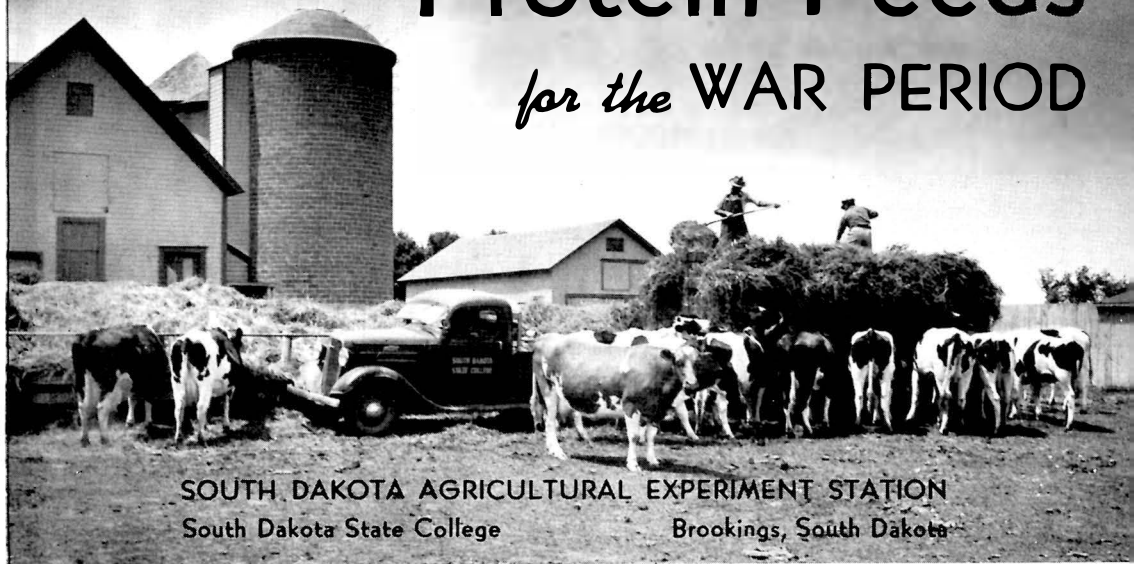
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Protein Feeds

for the WAR PERIOD



SOUTH DAKOTA AGRICULTURAL EXPERIMENT STATION
South Dakota State College **Brookings, South Dakota**

PREPARED BY A STATION NUTRITION COMMITTEE CONSISTING OF A. L. MOXON, CHEMISTRY; E. L. ERICKSON, AGRONOMY; F. U. FENN, ANIMAL HUSBANDRY; G. C. WALLIS, DAIRY HUSBANDRY; AND W. O. WILSON, POULTRY HUSBANDRY

The shortage of high-protein feeds and protein supplements for livestock is becoming more acute every day. Supplies of animal protein are not large enough to meet present needs mainly because of the increased demand for them due to (1) greater use of protein feeds by livestock producers in order to provide more milk, meat, and eggs, and (2) the need for larger amounts of casein and other animal proteins, as well as certain vegetable proteins, in war industries. It has been estimated that the shortage of protein concentrates in the United States will exceed 1,810,000 tons for 1943.¹

Because of this shortage it is very important to the war effort that every livestock producer—farmer, rancher, and livestock feeder—do everything within his power to use existing supplies efficiently and to produce more protein feeds. He can use them best by avoiding overfeeding and other waste of feed, culling out low-producing animals and selling them, and using methods approved by authorities to control diseases and maintain sanitation.

Good Crop Management Means More Protein

The South Dakota farmer will find that he can increase his protein supply if he will carry out these recommendations:

Make greater use of pasture. The pasture season can be lengthened by supplementing permanent pastures with such crops as rye, Sudan grass, sweet clover, and rape. (See South Dakota Extension Leaflet No. 59.)

¹ *Nutrition Review*, January, 1943, p. 248.

Cut hay in early stage. Alfalfa has a much higher protein content when starting to bloom than when in full bloom or mature. Native grasses also contain much more protein when they are cut before maturity.

Cure, handle, and store hay carefully. This will avoid loss of leaves and spoilage. Leaves contain a much higher percentage of protein than do the stems.

Increase production of high-protein crops. Alfalfa is the best protein crop. But soybean hay is nearly equal in nutritive value to alfalfa. For hay production, late varieties of soybeans (100- to 120-day maturity) may be used in eastern South Dakota. Maximum production of nutrients can be expected if soybeans are cut when the beans are well set or in the dough stage. Special care must be used to prevent loss of leaves in the drying and haying operations.

Sweet clover cut before bloom and well cured provides a roughage high in protein. It can be preserved in the silo if cut at the stage best for hay-making and allowed to wilt two or three hours in the swath. The hay must be handled with care to prevent loss of leaves and to insure thorough curing. It keeps best when it contains 60- to 68- percent moisture and is finely cut and well packed.

Such small grains as oats, smooth-awned barley, and wheat can be mowed for hay when they are in the milk or dough stage. Hay made from these crops is usually high in protein and makes excellent feed, but in areas where oat-hay poisoning has occurred, oat hay should not be made.

South Dakota crops high in protein. Fortunately crops grown in South Dakota contain more protein than those grown in many other states (*see below*).

	AVERAGE PROTEIN CONTENT (MORRISON)* percent	PROTEIN IN SOUTH DAKOTA CROPS percent		AVERAGE PROTEIN CONTENT (MORRISON)* percent	PROTEIN IN SOUTH DAKOTA CROPS percent
Corn, No. 3	9.2	10.76	Wheat (spring)	13.1	15.86
Oats	12.0	15.16	Alfalfa hay	14.7	16.44
Barley	11.8	14.09	Wild hay	5.7	6.94

* F. B. Morrison, *Feeds and Feeding*, 20th ed., 1936.

Because of this higher protein content, South Dakota farmers will not need to buy as much protein supplement as will many other farmers.

Feeding Suggestions for Poultry

The poultry producer who formerly mixed his own rations cannot obtain all necessary ingredients, and some commercial feed companies cannot fill all orders. He must do the best he can with available materials (*Table 1*). Suggestions to help poultrymen meet shortages of proteins, vitamins, and minerals are:

Keep rats away from feeds. Cull out non-laying hens.

See that the birds are healthy and free from such parasites as worms, lice, and mites.

Prevent waste by putting lips on the mash feeders and filling them only half full.

Protein sources. If vegetable proteins are available, they should be used. When supplemented with minerals and vitamins, these proteins are quite satisfactory. The maximum amount of any one vegetable protein to use in the ration depends on the type of poultry, but in general not more than the amounts given at the top of page 3 should be used in the mash.

During the spring, summer, and fall, poultry pasture supplies protein. Alfalfa range is ideal for this purpose. The birds also pick up grasshoppers and

other insects containing protein. For winter months when the hens are confined, leafy alfalfa hay should be fed in racks.

PROTEIN SUPPLEMENT	HIGHEST RECOMMENDED AMOUNT percent of ration	OBJECTION TO LARGER AMOUNT
Soybean oil meal	30	To use more would be wasteful.
Corn gluten meal	20	Protein contained lacks certain essential amino acids.
Cottonseed meal	1	Green or olive egg-yolks result. (Ten percent may be used in rations for non-laying stock.)
Linsced meal	1	Some ingredients that depress chick growth are contained.

When skim milk or buttermilk is fed at the rate of four gallons daily per 100 hens, they will require very little other protein material. Buttermilk can sometimes be purchased at local creameries. One gallon (8½ pounds) of liquid buttermilk is equal to 3 pounds of condensed milk and to .9 pound of dried buttermilk.

Vitamin sources. Sunshine and green grass are the cheapest sources of vitamins for poultry. Poultry pasture, fresh lawn clippings, and alfalfa hay are the easiest means of supplying them. For mid-summer pasture, Sudan grass sowed in rows has no superior. The rows should run in the direction faced by the poultry house. For best pasture the grass should not be allowed to head.

Skim milk and buttermilk are also excellent sources of vitamins. Possible substitutes for dried buttermilk in the rations are the byproducts from distilleries.

Mineral sources. Oyster shells are one of the best sources of calcium but limestone grit is a good substitute (Table 1). Raw rock phosphate should not be fed unless it contains less than .6-percent fluorine because fluorine is poisonous to chickens. Fresh raw green bones may be fed ground (½- to ¾-ounce per hen daily).

TABLE 1. RECOMMENDED PERCENTAGES OF DIFFERENT FEEDS FOR HOME-MIXED POULTRY MASHES*

Feed	Chick-starting mash	Chick-growing mash (to be fed with grain)	Hen-laying mash (to be fed with grain)	Hen-breeding mash (to be fed with grain)	Turkey-starting mash	Turkey growing mash (to be fed with grain)
Ground grains and grain byproducts	62.5 to 72.5	68.5 to 78.5	62.5 to 77.5	56 to 68	50.5 to 60.5	62.5 to 72.5
Minimum animal-protein supplements	3 to 4	3.5 to 4.5	3.5 to 4.5	7 to 9	4 to 5	3.5 to 4.5
Additional protein supplements (primarily vegetable)	15 to 18	12 to 15	15 to 19	12 to 14	24 to 27	15 to 17
Riboflavin supplements, liver meal, milk, or distillers' byproducts	5 to 8			5 to 7	7 to 10	3 to 4
Alfalf meal, dehydrated	2 to 5	4 to 10	4 to 10	4 to 10	2 to 5	4 to 10
Bone meal or defluorinated phosphate† (approximate amount)	1	1	1	1	1	1
Ground limestone‡ (approximate amount)	1.5				1.5	
Salt						
Vitamin D carrier (such as fish-oil, needed when birds are kept indoors)						

* Data furnished by the National Research Council, Washington, D. C. † Amounts should be changed when necessary in order to meet the phosphorus requirements of .8 to 1.0 percent of the ration. ‡ Amounts should be increased or decreased when necessary in order to meet the calcium requirement of 1.5 percent of the ration. Oyster shells or limestone grit should be fed to laying hens at all times.

Feeding Suggestions for Hogs

Lack of enough protein in rations for hogs will result in inefficient use of grain, and grain supplies may also be short during the next feeding season. Under present conditions it is essential that hog rations be carefully planned so as to save both protein supplements and grain.

Save animal-protein supplements for weanling pigs. Pigs weighing more than 75 pounds can be fed rations containing protein supplements of vegetable origin, but weanling pigs need some animal protein such as that furnished by tankage, meat scraps, and milk.

Make good use of green, succulent pasture. Such pasture—alfalfa, rape, rye, spring-sown small grain and Sudan grass—will reduce the amount of protein supplement needed by about one third and also lower the grain requirement.

Feed generous amounts of green, leafy legume hay. Such hay as choice alfalfa should comprise 5 to 15 percent of the rations for growing, fattening hogs not on pasture and 15 to 25 percent of the ration for brood sows not on pasture. It can be ground fine or self-fed unground from racks. When alfalfa hay is not available locally, it is advisable to purchase alfalfa meal for hogs not on pasture.

Sources of vitamins. Fish-liver oils and yellow corn are sources of vitamin A and are needed when pasture or green leafy alfalfa hay is not available. Distillers' grains contain the B vitamins which may be lacking in hog rations that do not include pasture or animal protein. Sunshine, sun-cured alfalfa hay or meal, and fish-liver oils supply vitamin D.

Only simple mineral mixtures are needed. For dry-lot feeding without animal protein, increased supplies of calcium and phosphorus are necessary in hog rations. A mixture of 40 pounds ground limestone, 40 pounds bone meal, and 20 pounds salt self-fed supplies the calcium and phosphorus. Iodized salt should be used in areas where goiter or hairlessness occurs in new-born pigs.

Protein supplemental mixtures. Many hog producers like to self-feed their growing, fattening hogs a protein supplemental mixture, free choice, along with home-grown grains. Six recommended supplemental mixtures are given on page 5. Weanling pigs need the supplements containing tankage. Older animals can be fed supplements without tankage.

TABLE 2. POUNDS OF GRAIN AND PROTEIN SUPPLEMENT NEEDED FOR ENTIRE RATION MIXTURES FOR HOGS FED SOUTH DAKOTA GRAINS

Class of hog	For hogs in dry lot*				For hogs on pasture			
	Corn or milo	Protein supplement	Small grain	Protein supplement	Corn or milo	Protein supplement	Small grain	Protein supplement
Growing, fattening hogs								
30 to 75 pounds	75	25	82	18	80	20	85	15
75 to 125 pounds	82	18	85	15	84	16	88	12
125 to 175 pounds	85	15	92	8	90	10	94	6
175 to 225 pounds	92	8	95	5	95	5	97	5
225 pounds and over	95	5	100	0	100	0	100	0
Brood sows during gestation	88	12	95	5	92	8	97	5
Sows and litters	82	18	90	10	88	12	94	6
Growing young								
breeding stock	85	15	92	8	90	10	95	5

* Allow additional green, leafy legume hay in racks.

TABLE 3. POUNDS OF VARIOUS FEEDS IN 100 POUNDS OF SIX DIFFERENT PROTEIN-SUPPLEMENT MIXTURES FOR HOGS

Feed	For dry-lot feeding			For pasture feeding		
	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6
Tankage or meat scraps (55% protein)	20	10	10	20	10	10
Soybean oil meal	35	45	55	55	65	75
Linseed meal or cottonseed meal	20	20	20	25	25	25
Ground alfalfa hay	25	25	25			
Total	100	100	100	100	100	100

Entire ration mixtures. These mixtures (*Table 2*), which contain most of the food elements needed, are often used for hogs either self-fed or hand-fed. Proportions of them can easily be varied for animals of different ages and weights and for those fed for various purposes. By hand feeding, the amount of feed can be limited for the desired rate of gain or condition.

Where skim milk or buttermilk is available, three-fourths to one gallon per pig daily will furnish all of the protein supplement needed to balance the ration in dry-lot feeding. Even where only about one-third gallon of either of these feeds is available per pig, other animal proteins are not needed, and the amount of protein supplement in the ration can be reduced one third or slightly more. For pigs on pasture, one-half gallon of skim milk or buttermilk per pig daily will supply all of the protein supplement needed.

A mineral mixture (page 4) should be self-fed to hogs in addition to the ration mixtures of grain and protein supplement combinations.

Feeding Suggestions for Dairy Cattle

For Milk Cows

An important help in feeding dairy cattle during the war period is to extend the pasture season as long as possible by following the advice on page 1.

Milk cows on pasture. On good pasture cows giving daily less than 20 pounds (10 quarts) of milk testing 3.5-percent fat need no additional feed. For cows giving as much as 20 pounds of milk daily, supply two pounds of grain daily, and for each increase of 5 pounds in milk production over 20 pounds, provide two more pounds of grain. A grain mixture of common farm grains such as corn, oats, milo, and barley is all that is necessary. High-protein supplements are not needed, as young pasture grass is high in protein.

On poor pasture, cows should have two pounds of grain daily when milk production reaches 12 pounds (6 quarts) daily. For each 5 pounds of milk above 12 pounds, feed an additional two pounds of grain. Scanty pastures with more mature plants should be supplemented with hay, silage, or other roughage, and the amount of grain fed should be about equal to that used in winter feeding.

Milk cows on winter feed. Legume hay should be provided milk cows on winter feed if possible. Silage will also improve the winter ration. When legume silage is fed, consider 3 pounds equal to 1 of legume hay for protein.

Legume hay will go farther if only half legume hay is fed with half some other roughage such as prairie hay, corn or cane fodder, and corn silage. The legume hay saved can be sold to a neighbor to increase his protein supply. Three pounds of corn silage equal 1 pound of dry roughage in feeding value. *Feed the cows all of the roughage that they will clean up.* The protein

requirements of cows giving up to 50 pounds of 3.5-percent milk daily will be supplied when the roughage is half legume and half non-legume and when a mixture of farm grains only is fed at the rate of 1 pound (1 quart) to 3 or 4 pounds (1½ to 2 quarts) of milk. When no legume hay or legume silage is on hand, a protein supplement is needed.

When early-cut prairie hay (heading stage) is used as the only roughage, a 14-percent grain mixture can be used. Hay made from early-cut cereal grains (milk or dough stage) will be about equal in feeding value to half-legume and half non-legume hay and may be fed accordingly.

Sample grain rations are given below for 1,200-pound cows giving various amounts of 3.5-percent milk. The rations given under *half legume hay and half other roughage* should be fed in addition to 12 pounds of legume hay plus either 12 pounds of non-legume roughage or 36 pounds of corn silage. When no legume hay is available, feed all the other roughage the cows will clean up plus grain as indicated under *no legume hay available*.

HALF LEGUME HAY AND HALF OTHER ROUGHAGE

POUNDS OF MILK PRODUCED	POUNDS OF HOME-GROWN GRAINS NEEDED
Under 20	none
20	4
30	8
40	12
50	15

NO LEGUME HAY AVAILABLE

POUNDS OF MILK PRODUCED	POUNDS OF GRAIN MIXTURE NEEDED (18-PERCENT PROTEIN)
10	3
20	5
30	8
40	12
50	16

These recommendations are based on requirements of cows giving 3.5-percent milk. For cows giving 4.5-percent milk, feed about one fifth more grain. For cows giving 5.5-percent milk, feed about one third more grain.

Dry cows. Proteins and other critical feeds can be conserved by having dry cows in good condition at freshening time. This usually means to feed 4 or 5 pounds of a farm grain mixture daily for two months before freshening.

Heifers and Other Young Stock

On pasture. After being weaned at four to six months of age, calves will do better if they continue to get a small allowance of mixed farm grains even when they have good pasture. On good pastures, heifers of 10 to 12 months and older will not need additional grain until two months before calving time when they should be given 4 to 5 pounds of mixed farm grains daily.

TABLE 4. POUNDS OF PROTEIN SUPPLEMENTS AND MIXED SOUTH DAKOTA GRAINS (GROUND) NEEDED FOR ONE TON OF MIXTURE HAVING PERCENT OF PROTEIN INDICATED

Protein supplements	18-percent mixture		16-percent mixture		14-percent mixture	
	Supplement	Grains*	Supplement	Grains*	Supplement	Grains*
	lb.	lb.	lb.	lb.	lb.	lb.
Supplements having 42-percent protein (soybean meal, cottonseed meal, and corn-gluten meal)	375	1,625	240	1,760	105	1,895
Supplements having 36-percent protein (linseed meal or ground soybeans)	470	1,530	300	1,700	130	1,870
Supplements having 30-percent protein (ready-mixed supplements)	630	1,370	400	1,600	170	1,830
Supplements having 24-percent protein (brewers' grains, distillers' grains, or ready-mixed supplements)	960	1,040	610	1,390	260	1,740

* Mixed South Dakota-grown farm grains contain about 12.5-percent total protein.

Winter feeding. When good-quality alfalfa hay and corn silage are fed to yearling heifers, they require no grain. When corn silage is not available, feed half legume hay and half other roughage to the limit of their appetite and for calves six months of age to freshening time supply also 3 pounds daily of mixed farm grains. When no legume hay is available, feed all the other roughage that the calves will eat, and to calves from six months of age to freshening time feed also 3 to 4 pounds daily of a grain mixture containing about 18-percent protein.

How to Make Grain Mixtures

Ready-mixed feeds containing up to 18-percent total protein may be purchased or mixed at home (*Table 4*). Use a grain mixture having the lowest percentage of protein but making a balanced ration with available roughage.

Feeding Suggestions for Beef Cattle and Sheep

Beef cattle and sheep can utilize pasture and harvested roughages very efficiently while hogs and poultry can make use of only a limited amount of these feeds. Beef and sheep producers are expected to use a minimum of the nation's protein supplement and grain supplies during the war emergency.

Feeding Beef Cattle

The following ten feeding recommendations are based upon the experiences of farmers and ranchers and upon the results of many feeding and management tests conducted at experiment stations in South Dakota and adjoining states.

1. For cattle of all ages, except nursing calves, green grass alone is the best and cheapest ration. Many cattle will fatten sufficiently for slaughter on grass alone. Mature grass is less nutritious than green grass and in rations for growing or fattening beef cattle other feeds should be fed with it.

2. Mature breeding cattle in good condition on good, open winter range or fed fairly liberal amounts of good prairie hay, silage, or fodder, can be expected to winter in fair condition without being fed additional protein supplements or grain. Beef cows so wintered will usually produce strong, normal calves in the spring. It is considered good management when protein supplements are available to feed 1 pound per head daily for 60 days preceding calving and until green grass is available following calving.

Mature, beef breeding cattle in good condition can also be wintered well on (a) a ration of three-fourths poor-quality roughage such as straw, cornstalks, or low-grade hay and one-fourth good-quality legume hay, or (b) a ration of all low-quality roughage or poor range plus 1 pound of protein supplement daily. When the range or roughage is very poor, some grain may be fed.

3. Thin, mature breeding cattle should be given either good pasture or several pounds of grain per head daily in the fall, so as to add flesh before severe weather arrives. Otherwise, they will need grain or protein supplement all winter.

4. Yearling and two-year-old stock cattle can be wintered satisfactorily on good winter range or on good-quality prairie hay, silage, or fodder. Liberal supplies of these feeds result in good growth and fair to good gains.

5. Beef calves being wintered should receive either legume hay for one half of the dry matter of their roughage or 1 pound per head daily of protein supplement in addition to prairie hay, silage, or fodder.

6. Cattle will not need additional protein when they are fattening in dry lot and fed South Dakota grains and good legume hay for all their roughage.

7. Cattle fattening in dry lot and receiving non-legume hay, silage, or fodder for all of their roughage, require 1 to 2 pounds per head daily of protein supplements and one-tenth pound per head daily of ground limestone in order to make good gains and efficient use of their feed.

8. Cattle being fattened by grain-feeding on pasture do not need protein supplements if the pasture is good.

9. Creep feeding grain and protein supplements to nursing calves on good pasture followed by 4 to 7 months of feed-lot fattening did not pay in four recent tests at the South Dakota Station. But if these calves had been sold as feeders at weaning the Station would have profited by using creep feeds.

10. Phosphorus supplements should be fed to beef cattle during the winter or during long drought periods if their rations contain little or no protein supplement or grain. The soils in some areas of South Dakota are low in phosphorus. Roughages grown on such soils lack enough phosphorus for proper nutrition of cattle on all-roughage rations. Depraved appetite as shown by cattle chewing such objects as bones or boards usually indicates a phosphorus deficiency in the rations. Two parts of bone meal or defluorinated phosphates mixed with one part of salt and self-fed make a good phosphorus source. Bone meal can also be self-fed alone. Salt should be self-fed alone to beef cattle at all times.

Feeding Sheep and Lambs

The same principles for feeding beef cattle apply to sheep except that smaller amounts of feed are needed per head. For sheep of all ages, green grass is an excellent ration. Nursing lambs start to eat grass when they are very young.

Mature breeding sheep have been wintered successfully on good range, good grass hay, or fodder, but it is considered wise management to replace one fourth or more of the roughage with legume hay or to add one-eighth to one-fourth pound of protein supplement per head daily, especially for the last 30 to 60 days before lambing. If ewes are not on pasture after lambing, replace at least one half of the roughage with legume hay or increase the protein supplement to two-fifths pound per head daily. One-half to one pound of grain per head daily replaces the supplement. No supplement is needed if green feed is plentiful.

Lambs fattening in dry lot and getting good-quality legume hay for all of the roughage in their rations do not need protein supplements. If they are fed non-legume hay for all of their roughage, one-fifth pound of protein supplement and one-fourth ounce of ground limestone should be fed per head daily.

Salt should be self-fed to all sheep. Where protein supplements, legume hay, or grain is not used, it is desirable to self-feed a phosphorus-containing mineral such as bone meal, spent bone black, or defluorinated phosphate, mixed with an equal amount of salt.