factsheet
Pork Information Gateway

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Forages for Swine

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Use of Forage

Pork producers have long recognized the value of forages in the swine enterprise. Prior to 1950, pasture was considered a vital component in swine feeding programs. But after synthetic vitamins became universally available during the early '50s, the need for forage crops in swine production was diminished. But even today, pastures and forages may contribute a practical and economical part of feeding hogs.

Can hogs utilize forage? Research demonstrates that pigs make better use of forage crops than previously assumed. Studies have also shown that the digestibility of fiber improves as the pig matures. They absorb more nutrients from forages after an adaptation period of at least two months with nearly all of the fiber digestion taking place in the large intestine. The importance of using forage when it is at an early stage of maturity is more critical with swine than with ruminants.

Why use forage? The primary reason a pork producer would consider using forage in his feeding program is to save on grain or protein costs. Before making forage a major part of the diet, first consider the potential savings that may be realized. Since most forages contain more protein than do the grains, both grains and protein supplements may be reduced when using forages. But it is also important to remember that the digestibility of protein in forages is lower than that of soybean meal or other protein supplements. If the diet contains more than 25% forages, the protein content in the complete feed should be slightly higher than that of a typical grain-soybean meal diet.

Forage can simplify feeding and management of the breeding herd. For example, sows on good quality pasture can be fed less often and with a smaller amount of concentrate. With the proper amounts of forage in a complete feed, sows can be self-fed during gestation without adversely affecting weight gain or reproductive performance (although some feed wastage may occur). Sows appear more content when the dietcontains a significant amount of forage, compared to limit-fed sows that receive only 4-5 lb. of concentrate each day.

Forage may also be used to provide a source of fiber. Nutritionists and producers have both recognized that fiber prevents constipation during late gestation and early lactation. Diets for newly arrived feeder pigs and starter diets containing increased fiber levels have been shown to reduce diarrhea problems. While it's not a direct benefit of the forage, pigs and sows on pasture may have fewer health problems because of im-

proved sanitation and air quality.

Potential drawbacks to forage. Fresh forages are low in dry matter, which means the pig must consume more material to get the same amount of nutrients found in grain or in complete feed. For this reason, pastures and/or high levels of forage in the diet are less practical for pigs weighing less than 40lb. and for sows in lactation.

Another drawback to using forages, especially pastures, is that they might not be available during the entire year. This means that the feeding program may have to be modified from one season to the next.

Hogs should be rotated off pastures periodically to prevent heavy bacterial and parasite contamination.

Feed value from pastures is often overestimated by producers since forages may be heavily damaged by hogs. Both the pasture and the forage crop must be well-managed to provide optimum feed savings. Producers may find this difficult especially during the spring and fall months when damage from hogs rooting the soil reaches a peak.

Forage Crop[1]	Dry Matter Basis									
	Dry Matter (%)	Crude protein (%)	Metab. energy Keal/lb.	Ether extract (%)	Crude fiber (%)	Hemi-cellulose (%)	Cellulose (%)	Lignin (%)	Calcium (%)	Phosphorus
Alfalfa, fresh, eb	23	19.0	986	3.1	25.0	8	23	7	2.33	.31
Alfalfa, fresh, flb	25	14.0	905	2.8	31.0	13	27	10	1.53	.27
Alfalfa, meal, deh	92	18.9	1005	3.0	26.2	-	24	11	1.52	.25
Alfalfa hay, sun-cured, eb	90	18.0	986	3.0	23.0	9	24	8	1.41	.22
Alfalfa hay, sun-cured ltb	90	14.0	854	1.8	32.0	12	26	12	1.43	.25
Alfalfa haylage, wltd, eb	35	17.0	986	3.2	28.0	9	23	10	-	-
Alfalfa haylage, wltd, flb	45	14.0	905	2.7	33.2	12	25	12	-	-
Barley hay, sun-cured	87	8.7	923	2.1	27.5	-	-	-	.23	.26
Bluegrass, Kentucky, fresh, vegetative	31	17.4	1182	3.6	25.3	-	26	3	.50	.44
Bluegrass, Kentucky, hay, sc	89	13.0	923	3.5	31.0	-	-	-	.33	.25
Brome, smooth, hay, sc, mdb	90	14.6	923	2.6	31.8	22	31	4	.29	.28
Clover, alsike, hay, sc	88	14.9	955	3.0	30.1	13	-	-	1.29	.26
Clover, crimson, hay, sc	87	18.4	936	2.4	30.1	-	-	-	1.40	.22
Clover, ladino, hay, sc	90	22.0	986	2.7	21.2	-	-	7	1.35	.31
Clover, red, fresh, eb	20	19.4	1136	5.0	23.0	-	-	-	2.26	.38
Clover, red, hay, sc	89	16.0	905	2.8	28.8	9	26	10	1.53	.25
Corn, dent yellow, Silage, well-eared	33	8.1	1150	3.1	23.7	-	-	-	.23	.22
lespedeza, common-lespedeza, Korean, hay, sc, eb	93	15.5	905	-	28.0	-	-	-	1.23	.25
Orchardgrass, fresh, mdb	31	11.0	932	3.5	33.5	27	33	6	.23	.23
Rape, fresh, eb	11	23.5	1232	3.8	15.8	-	-	-	-	-
Rye, fresh	24	15.9	1136	3.7	28.5	-	-	-	.39	.33
Ryegrass, perennial, hay, sc	86	8.6	986	2.2	30.3	-	-	2	.65	.32
Sorghum, sundangrass fresh, mdb	23	8.8	1036	1.8	30.0	25	34	5	.43	.36
Sweetclover, yellow hay, sc	87	15.7	886	2.0	33.4	-	-	-	1.27	.25
Timothy hay, sun-cured, eb	90	15.0	968	2.9	28.0	29	31	4	.53	.25
Timothy hay, sun-cured, flb	89	8.1	922	3.1	32.0	30	34	6	.43	.20
Trefoil, birdsfoot, hay, sc	92	16.3	968	2.5	30.7	-	24	9	1.70	.27
Wheat, fresh, vegetative	22	28.6	1200	4.4	17.4	18	24	4	.42	.40

Table 1. Average nutrient composition of some forage crops. Adapted from Nutrient Requirements of Bee, National Academny Press. Metabolizable energy values shown are for beef, since comparable values are unavailable for swine. Similarly, amino acid levels are unknown for most forages. [1]flb=full bloom; deh=dehydrated; ltb=late bloom; wltd=wilted; eb=early bloom; ltb=late bloom; mdb=midbloom; sc=sun-cured

Finally, hogs housed in a pasture setting have a higher energy requirement since hogs outside get more exercise than those housed in pens or enclosed facilities. Sows will require more feed during gestation, and market hogs may gain slower and less efficiently.

Forage analysis. Table 1 lists the average nutrient composition for various forages. The table can be used as a guide to formulation, but forage analysis should form the base for diet formulation whenever practical.

Crude protein, calcium and phosphorus can be assayed at most analytical laboratories at a relatively low cost. In addition, most laboratories offer Neutral Detergent Fiber (NDF) analysis. NDF provides an estimate of the percentage of cell walls contained in the forage. The cell walls contain all of the fiber, which is the least digestible component of the forage. The fibrous components of the cell wall primarily include cellulose, hemicellulose and lignin. None of the lignin is digestible and only 30 to 40% of the hemicellulose and cellulose is digestible. The percent of cellulose in the forage is estimated by subtracting Acid Detergent Fiber (ADF), another fiber analysis, from NDF. Percent lignin is estimated with an Acid Detergent Lignin (ADL) analysis. Percent hemicellulose is calculated by subtracting ADL from ADF. If levels of hemicellulose and lignin are significantly higher than the average values shown in Table 1, metabolizable energy and crude protein concentrations in the forage will likely be lower.

Suggested pasture supplement[3] for gestating sows	Legume		Grass		Legume-grass mix		Rape	
Corn	1756	1744	1371	1335	1521	1495	1858	1857
Soybean meal, 48%	173	-	525	-	372	-	11	-
Soybean meal, 44%	-	186	-	562	-	398	-	12
Ground Limestone	-	-	16	16	24	24	18	18
Dicalcium phosphate	-	-	64	63	59	59	89	89
Monosodium phosphate	47	46	-	-	-	-	-	-
Salt	12	12	12	12	12	12	12	12
Vitamin premix[1]	6	6	6	6	6	6	6	6
Trace mineral premix[2]	6	6	6	6	6	6	6	6
Calculated composition								
Metab, energy, kcal/lb.	1499	1492	1470	1449	1469	1442	1453	1452
Crude protein, %	11.7	11.5	18.6	18.0	15.5	15.1	8.2	8.2
Lysine (estimated), %	.49	.49	.99	.99	.77	.77	.25	.25
Calcium, %	.05	.05	1.16	1.16	1.23	1.23	1.44	1.44
Phosphorus, %	.81	.81	.95	.95	.88	.88	1.09	1.09

Table 2. [1]Should provide the following amounts per ton of complete feed: 8,000 IU vitamin A; 8000,000 IU vitamin D; 64,000 IU vitamin E; 3.2g vitamin K; 8g riboflavin; 48g niacin; 29g pantothenic acid; 24mg vitamin B12; 1.6g choline; 1.76g folic acid; 320mg biotin. (Concentrations higher than normal to compensate for reduced dry feed intake). [2]Should provide the following amounts per ton of complete feed: 15g copper, 144g zinc; 40g manganese; 320 mg iodine; 435 mg selenium. (Concentrations higher than normal to compensate for reduced dry feed intake). [3]Assumptions: Sows will consume 3.5lb. pasture dry matter and will be fed 2.5lb. of the diet per day. Pasture and feed together will provide a minimum of .75lb. protein, 17g lysine, 18g calcium and 14g phosphorus per day, respectively.

Methods of Feeding Forage

Pasture. Pastures containing a high percentage of legumes are normally the most practical for pork producers. On a dry matter basis, legumes are similar in energy content and higher in crude protein than are the grasses. Some grass species in the mixture may help prevent soil erosion.

Optimum stocking rates depend on soil types, plant species and weather conditions. Normally, 4-6 gestating sows per acre (8-12 if irrigated) or 10-12 growing hogs (15-25 if irrigated) will make good use of the pasture crop without excessive damage. Damage to the pasture from hogs rooting the soil is most prevalent in the spring and fall months.

Sows should be fed approximately 2-3lb. of complete feed while on pasture. Grower-finisher pigs should have free access to complete feed at the same time they are grazing a pasture crop.

Suggested pasture supplement[3] for growing hogs (40-125lb)	Legume		Grass		Legume-grass mix		Rape	
Corn	1486	1454	1423	1387	1450	1416	1496	1465
Soybean meal, 48%	464	-	514	-	493	-	438	-
Soybean meal, 44%	-	497	-	551	-	528	-	469
Ground Limestone	4	4	15	15	10	10	15	15
Dicalcium phosphate	26	25	28	27	27	26	31	31
Salt	10	10	10	10	10	10	10	10
Vitamin premix[1]	5	5	5	5	5	5	5	5
Trace mineral premix[2]	5	5	5	5	5	5	5	5
Calculated composition								
Metab, energy, kcal/lb.	1512	1494	1502	1482	1507	1488	1500	1468
Crude protein, %	17.6	17.1	18.5	18.0	18.1	17.6	17.0	16.5
Lysine (estimated), %	.91	.91	.98	.98	.95	.95	.87	.87
Calcium, %	.48	.48	.70	.70	.59	.59	.74	.74
Phosphorus, %	.60	.60	.62	.62	.61	.61	.64	.64

Table 3. [1]Should provide the following amounts per ton of complete feed: 3,5000,000 IU vitamin A; 600,000 IU vitamin D; 36,000 IU vitamin E; 2g vitamin K; 5g riboflavin; 29g niacin; 14g pantothenic acid; 17mg vitamin B12; 480mg choline; 650mg folic acid. (Concentrations higher than normal to compensate for reduced dry feed intake). [2]Should provide the following amounts per ton of complete feed: 9g copper, 90g iron; 90g zinc; 16g manganese; 185mg iodine; 327mg selenium. (Concentrations higher than normal to compensate for reduced dry feed intake). [3]Assumptions: Hogs will consume 0.75lb. pasture dry matter plus 3.75lb of the diet per day. Pasture and feed together will provide a minimum of 0.76lb. protein, 18g lysine, 13g calcium and 11g phosphorus per day, respectively.

Suggested feed formulas for sows and growing pigs are shown in Tables 2, 3 and 4.

Pastures should be plowed, disked and reseeded at least every other year. This serves to level the pasture, reestablish plant growth and reduce bacterial and parasite contamination.

When grazing hogs on legume pastures in northern latitudes, allow enough time in the fall to permit at least 6in. of growth before the arrival of a killing frost. This helps reduce winterkill by enabling the plant to build root reserves.

Suggested pasture supplement[3] for finishing hogs (125-240lb)	Legume		Grass		Legume-grass mix		Rape	
Corn	1600	1576	1538	1511	1566	1540	1617	1596
Soybean meal, 48%	346	-	396	-	375	-	313	-
Soybean meal, 44%	-	371	-	424	-	401	-	335
Ground Limestone	5	5	16	16	10	10	16	16
Dicalcium phosphate	29	28	30	29	29	29	34	33
Salt	10	10	10	10	10	10	10	10
Vitamin premix[1]	5	5	5	5	5	5	5	5
Trace mineral premix[2]	5	5	5	5	5	5	5	5
Calculated composition								
Metab, energy, kcal/lb.	1510	1497	1501	1485	1506	1491	1498	1475
Crude protein, %	15.2	14.9	16.1	15.7	15.7	15.4	14.5	14.1
Lysine (estimated), %	.74	.74	.81	.81	.78	.78	.69	.69
Calcium, %	.51	.51	.73	.73	.62	.62	.77	.77
Phosphorus, %	.60	.60	.62	.62	.61	.61	.64	.64

Table 4. [1]Should provide the following amounts per ton of complete feed: 1,8000,000 IU vitamin A; 600,000 IU vitamin D; 24,000 IU vitamin E; 2g vitamin K; 2g riboflavin; 19g niacin; 10g pantothenic acid; 12mg vitamin B12; 480mg choline; 648 mg folic acid. (Concentrations higher than normal to compensate for reduced dry feed intake). [2]Should provide the following amounts per ton of complete feed: 7g copper, 65g iron; 65g zinc; 16g manganese; 185mg iodine; 327mg selenium. (Concentrations higher than normal to compensate for reduced dry feed intake). [3]Assumptions: Hogs will consume 1.0lb. pasture dry matter plus 5lb of the diet per day. Pasture and feed together will provide a minimum of 0.90lb. protein, 20g lysine, 18g calcium and 15g phosphorus per day, respectively.

Silage and haylage. Feeding programs for gestating sows or replacement gilts weighing more than 250lb. in gestation can include silage and haylage. These forages should be finely chopped to prevent sorting by sows. To avoid reproductive problems, be sure that any ensiled forage is fresh and free of mold.

Offer corn silage as a free-choice item. Intake is variable, but under most conditions sows will consume 10-12lb. per head per day. Sows should also be fed approximately 2.5lb. of a complete feed in addition to the silage. For best results the corn silage should be made when the ears are formed, and at the same time the plant is still green and not frosted. Silage made from corn nearing maturity is less palatable.

When feeding legume haylage, offer all the haylage sows will clean up (usually 6-8lb. per head per day), plus 2.5lb. of complete feed.

Suggested feed formulations for use with haylage and silage are listed in Table 5.

Suggested silage and haylage supplement[3] for gestating sows	Legume haylage (45% dry matter)		Corn silage (33% dry matter)	
Corn	1660	1641	1332	1294
Soybean meal, 48%	271	-	560	-
Soybean meal, 44%	-	290	-	599
Ground Limestone	-	-	24	24
Dicalcium phosphate	-	-	60	59
Monosodium phosphate	45	45	-	-
Salt	12	12	12	12
Vitamin premix[1]	6	6	6	6
Trace mineral premix[2]	6	6	6	6
Calculated composition				
Metab, energy, kcal/lb.	1499	1488	1467	1445
Crude protein, %	13.6	13.4	19.2	18.7
Lysine (estimated), %	.63	.63	1.04	1.04
Calcium, %	.06	.08	1.26	1.26
Phosphorus, %	.81	.81	.92	.92

Table 5.[1]Should provide the following amounts per ton of complete feed: 8000,000 IU vitamin A; 800,000 IU vitamin D; 64,000 IU vitamin E; 3.2g vitamin K; 8g riboflavin; 48g niacin; 29g pantothenic acid; 24mg vitamin B12; 1.6g choline; 1.76g folic acid and 320mg biotin. (Concentrations higher than normal to compensate for reduced dry feed intake). [2]Should provide the following amounts per ton of complete feed: 15g copper, 144g iron; 144g zinc; 40g manganese; 320mg iodine; 435mg selenium. (Concentrations higher than normal to compensate for reduced dry feed intake). [3]Assumptions: Sows will consume 3.5lb. haylage or silage dry matter and will be fed 2.5lb of the diet per day. The ensiled forage and feed together will provide a minimum of .75lb. protein, 17g lysine, 18g calcium and 14g phosphorus per day, respectively.

Complete Feed. Dried forages can be included in a complete feed. For many producers this is the most practical feeding method. Hammermills equipped with screens containing 3/16 to 1/4-inch openings will provide the correct particle size. Pelleting the diets that contain high amounts of forage will reduce separation, and improve palatability and fiber digestion. Recommended diets containing dried forages for sows and growing-finishing pigs are listed in Tables 6, 7, 8, and 9.

Value of Forage Crops

Legumes

Alfalfa. Most of the research on the use of forage in swine diets has been with alfalfa. It appears to be the most practical forage crop for the pig because it can be used for both pasture and silage. Because of their maturity, sows make the better use of alfalfa (and other forages) than do growing-finishing hogs. Potential benefits to feeding alfalfa during gestation include improved survival of the baby pigs during the nursing period and a reduced culling rate in the sow herd. Some research has shown that as much as 97% can be included in gestation diets without impairing reproductive performance. For commercial operations, however, no more than 65% alfalfa should be used in gestation diets. Gestation diets containing approximately 60% alfalfa can be self-fed.

Growing pigs show satisfactory performance on diets containing alfalfa, provided the level does not exceed 20% of the diet. Even at this level, you can expect a 5 to 15% depression in feed efficiency compared to a grain-soybean meal diet. Receiving diets containing 10% alfalfa may improve gain and feed intake in newly arrived feeder pigs.

Alsike clover. This clover provides a leafy crop with fine stems, and it grows well in soils that are too acidic or too wet for red clover. It is less desirable where hot, dry summer conditions are common. It is often used in pasture mixtures.

Suggested diets containing alfalfa hay for gestating sows	1	2	3	4	5	6	7	8
Corn	1201	1187	1001	990	799	792	599	593
Soybean meal, 48%	205	-	163	-	122	-	80	-
Soybean meal, 44%	-	220	-	175	-	130	-	86
Alfalf	500	500	750	750	1000	1000	1250	1250
Limestone	32	31	23	22	14	14	5	5
Monosodium phosphate	44	44	45	45	47	46	48	48
Salt	8	8	8	8	8	8	8	8
Vitamin premix[1]	5	5	5	5	5	5	5	5
Trace mineral premix[2]	5	5	5	5	5	5	5	5
Calculated composition								
Metab, energy, kcal/lb.	1338	1330	1273	1267	1208	1204	1144	1141
Protein, %	14.6	14.4	15.0	14.8	15.4	15.2	15.7	15.7
Lysine (estimated), %	.65	.65	.65	.65	.65	.65	.65	.65
Calcium, %	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Phosphorus, %	.77	.77	.77	.77	.77	.77	.77	.77

Table 6. [1]Should provide the following amounts per ton of complete feed: 5,000,000 IU vitamin A; 5000,000 IU vitamin D; 40,000 IU vitamin E; 2g vitamin K; 5g riboflavin; 30g niacin; 18g pantothenic acid; 15mg vitamin B12; 1g choline; 200mg folic acid; 1.1mg viotin. [2]Should provide the following amounts per ton of complete feed: 9g copper, 90g iron; 90g zinc; 25g manganese; 200mg iodine, 272mg selenium.

Suggested high-forage diet for gestating sows	1	2	3	4	5	6	7	8	9	10
Corn	1194	1180	1217	1204	1179	1162	1163	1146	1153	1135
Soybean meal, 48%	217	-	194	-	239	-	253	-	270	-
Soybean meal, 44%	-	232	-	208	-	256	-	271	-	289
Birdsfoot trefoil	500	500	-	-	-	-	-	-	-	-
Red Clover	-	-	500	500	-	-	-	-	-	-
Kentucky Bluegr	-	-	-	-	500	500	-	-	-	-
Orchardgrass	-	-	-	-	-	-	500	500	-	-
Ryegrass	-	-	-	-	-	-	-	-	500	500
Ground limestone	28	28	30	30	14	14	15	15	11	11
Dicalcium phosphate	-	-	-	-	50	50	51	50	48	47
Monosodium phos	43	42	41	40	-	-	-	-	-	-
Salt	8	8	8	8	8	8	8	8	8	8
Vitamin premix[1]	5	5	5	5	5	5	5	5	5	5
Trace mineral premix[2]	5	5	5	5	5	5	5	5	5	5
Calculated composition										
Metab energy kcal/lb	1338	1329	1380	1372	1331	1322	1332	1322	1351	1340
Crude protein, %	14.4	14.2	14.7	14.5	14.1	13.8	13.8	13.6	13.6	13.3
Lysine (estimated),%	.65	.65	.65	.65	.65	.65	.65	.65	.65	.65
Calcium, %	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Phosphorus, %	.77	.77	.77	.77	.77	.77	.77	.77	.77	.77

[1]Should provide the following amounts per ton of complete feed; 5,000,000 IU vitamin A; 5000,000 IU vitamin D; 40,000 IU vitamin E; 2g vitamin K; 5g riboflavin; 30g niacin; 18g pantothenic acid; 15mg vitamin B12; 1g choline; 200mg folic acid; 1.1mg biotin. [2]Should provide the following amounts per ton of complete feed: 9g copper, 90g iron; 90g zinc; 25g manganese; 200mg iodine, 272mg selenium.

Birdsfoot trefoil. Birdsfoot trefoil is palatable and similar in nutrient content to alfalfa. Unlike alfalfa, it grows well on poorly drained soils. While it is not as productive as alfalfaon good soils, birdsfoot trefoil yields have exceed-ed yields of alfalfa on the wetter soils. Most varieties perform better in cooler climates. It will normally outlive red clover by several years.

Crimson clover. Crimson clover provides a good spring forage and sometimes winter forage in warm climates.

Ladino clover. Under optimum conditions, ladino clover will not produce as much forage per acre as alfalfa. But the protein content of ladino clover is superior to that of alfalfa. Ladino clover works best as an all-summer pasture crop in the northeastern and north central states.

Lespedeza. Also called Japanese clover, this species is less palatable to pigs than all clovers except sweetclover. It cannot be grazed until midsummer, but it does grow reasonably well without lime and fertilizer and will adapt to soils that cannot be used for red clover.

Red clover. Red clover is a short-lived, relatively easy-toestablish perennial legume that will grow on soils too acidic or too wet for alfalfa. Red clover does not yield as much forage early in the spring as alfalfa and it is not as drought resistant as alfalfa. It is useful for pasture or silage. It will provide good forage through most of the grazing season if it is not overgrazed nor allowed to become too mature. Several studies have shown that pigs on red clover forage gain as rapidly as those on alfalfa.

Soybean forage. Soybeans as a green forage are less valuable than alfalfa, red and ladino clovers and rape. The soybeans should be grown in rows to reduce damage from trampling. Unlike most forages, soybeans cannot regenerate new growth from the crowns. Soybeans are less sensitive to nutrient levels in the soil than are alfalfa and clovers. In hot climates, soybeans may out-yield other legumes during the same period of time.

Pigs grazing mature soybeans should also have access to grain fortified with vitamins and minerals. However, inhibitors in the raw soybeans will prevent the pig from utilizing the dietary protein efficiently. In addition, the oil contained in the beans tends to make the carcass soft.

Sweetclover. Since pigs find sweetclover unpalatable, it may be more suitable for soil improvement. Sweetclover may be planted on soils not adapted for alfalfa or other clovers. If biennial sweetclover is sown in the spring, the first season's growth is more succulent and palatable than that harvested during the second summer.

White clover. White clover is a practical perennial legume to use with permanent pasture, especially those containing bluegrass. White clover makes a high-quality pasture and it does well in years of frequent rain. Note that ladino clover is a large-type white clover. Dutch or common white clover is a small-type.

Brassicas

Rape. Rape is a high-yielding, fast-growing annual forage that belongs to the brassica family. Related species include kale and swede. Rape provides an excellent pasture for swine. When overgrazing is avoided, it provides abundant, palatable forage for a long-growing season. Rape can lead to photosensitization (sunburning), when grazed wet. Pigs with white skin are most sensitive.

Grasses

Bluegrass. Bluegrass may serve as a permanent pasture for swine. The pasture can be grazed early, but it contains less protein than do legumes and is usually dormant during the warmest part of the summer.

Smooth bromegrass. Bromegrass is a palatable crop that withstands heavy grazing. Its early spring growth enables it to be pastured for longer periods than many legumes. Studies show that pigs on bromegrass pastures require more grain and supplement than pigs grazing alfalfa. Bromegrass can be successfully mixed with legumes.

Orchardgrass. Orchardgrass, a perennial, is a hardy species that can tolerate trampling. It quickly loses its palatability if not grazed down to prevent the grass from becoming tall and mature.

Sudangrass. Sudangrass, an annual, is palatable to pigs, and when seeded thickly, it provides ample forage during the hottest part of the summer when other species are dormant. The early growth of sudangrass contains a cyanogen, which may be converted to prussic acid (extremely toxic to pigs) under certain conditions such as wilting, trampling, chewing, frost and drought. Because of the near-neutral pH in the rumen, ruminants are more sensitive to cyanogens than are nonruminants. Poisoning can be avoided if the grass is grazed only after it reaches a height of at least 18-24in. Because sudangrass is low in protein, it is better adapted for sows and older market hogs.

Timothy. Timothy withstands heavy use, but it should only be included as a minor part of a pasture mixture since it is less desirable than most other pasture crops. Winter rye. Winter rye seeded during late summer will provide a useful forage crop for winter or early spring grazing. Optimal planting time should provide just enough growth so that seed stems are starting to shoot when the plant enters winter dormancy. When pigs are allowed to graze rye during the winter and spring months, stock the pasture with no more than 8 growing pigs, or 3-5 sows per acre. Winter wheat and barley. These two cereal grains are at least as palatable and nutritious as rye, but they do not provide as much fall production as rye and they cannot be grazed as heavily. Note that fresh wheat forage contains significantly more crude protein than is contained in barley forage.

Economics of Forage Use

Pasture. Costs for establishing and maintaining pasture crops should be estimated before making this forage system a part of your feeding program. For example, the annual cost for maintaining alfalfa pasture in the northeast is about $260/acre (including land costs of $62/acre) according to the 1989-1990 Penn State Agronomy Guide. If the pasture were available for 180 days, the cost per day would be $1.44. For a stocking rate of 5 sows per acre, the daily feeding cost associated with the pasture would be $0.29 per sow per day. Using the pasture should reduce feed requirements by about 3.5 lb. per sow per day. If the cost for 3.5lb. of complete feed is more than $0.29, then the pasture system would be economical.

If the same pasture were used for growing-finishing hogs at the rate of 10 pigs per acre, the daily feeding cost associated with the pasture would be $0.14 per pig per day. Using the pasture should reduce feed requirements by 0.75 to 1.0lb. per pig per day. To make the pasture profitable in this situation, the cost of purchasing 0.75 to 1.0lb. of feed should be more than $0.14.

In summary, making pasture a viable feeding system for sows or growing pigs will require low land costs, land that is unsuitable for crop production, or expensive feed.

Silage and haylage. Using corn silage or haylage will reduce sow feed requirements by about 3.5lb. per head per day (see Table 5). But higher than normal lysine and mineral concentrations are required in the feed used to supplement corn silage. That means the reduction in feed requirement is partly offset by a higher feed cost (usually about $20) per ton. For example, if corn silage is worth $18/ton, a feeding rate of 10lb. per sow per day would cost $0.09 per sow per day, (10lb. X [$18/2000lb.]). If gestation feed normally costs $140 per ton, then the feed used to supplement corn silage would cost about $160 per ton because of the increased nutrient concentrations. Since sows would require about 2.5lb. per day of this supplementary feed, the cost would be $0.19 per day. Adding this to the silage costs of $0.09 per day brings the total feed costs to $0.29 per day per sow on a corn silage program. This compares favorably to $0.35 per day associated with feeding 5lb. of conventional gestation feed (assuming $140/ton).
Feed used to supplement legume haylage is similar in cost to conventional gestation feed since the only change in formulation is a reduction in the level of calcium (an inexpensive nutrient). If alfalfa hay costs $100 per ton, alfalfa haylage (45% dry matter) would be worth about $50 per ton ([45%/ 90%] X $100/ton = $50/ton). At a feeding rate of 7.75lb. per day, the haylage would cost $0.19 per sow per day. Sows would require 2.5lb. of feed to supplement the silage. Assuming the supplementary feed costs $140 per ton, the daily expense for this feed would be $0.18. Adding this to the haylage costs of $0.19 per day would bring the total feed cost to $0.37 per day for a sow on an alfalfa haylage program. This is slightly higher than the $0.35 per day associated with feeding 5lb. of conventional gestation feed (assuming $140/ton).

Complete feed. When any forage is incorporated into a complete feed, the energy density of the feed is decreased because of the low concentrations of metabolizable energy in forages. Tables 6 and 7 provide suggested gestation diets containing alfalfa and other forage. To determine whether these diets are more economical than conventional diets, the producer must do two things. First, calculate the costs per lb. of the conventional diet and the high forage diets using current market prices. Next, calculate the feed cost per day of feeding a sow on each of the diets—keeping in mind that sows will require about 0.5lb. of additional feed per day for every 500lb. of forage included in a 1-ton formulation. For example, a conventional diet may cost $140/ton. At a 5lb. feeding rate, the feed cost per sow per day would be $0.35 (5lb. X [$140/2000lb.]). A high forage diet (containing 500lb. of alfalfa) may cost only $130 per ton. But since the sow will need 5.5lb. each day to meet her energy requirements, the daily feed cost would be $0.36 (5.5lb. X [$130/ 2000lb.]).

Suggested high-forage diets for growing hogs (40-125lb)	1	2	3	4	5	6	7	8	9	10	11	12
Corn	1358	1334	1354	1330	1364	1341	1333	1307	1326	1299	1320	1294
Soybean meal, 48%	346	-	352	-	341	-	364	-	371	-	380	-
Soybean meal, 44%	-	371	-	377	-	365	-	390	-	398	-	407
Alfalfa	250	250	-	-	-	-	-	-	-	-	-	-
Birdsfoot trefoil	-	-	250	250	-	-	-	-	-	-	-	-
Red Clover	-	-	-	-	250	250	-	-	-	-	-	-
Kentucky Bluegr	-	-	-	-	-	-	250	250	-	-	-	-
Orchardgrass	-	-	-	-	-	-	-	-	250	250	-	-
Ryegrass	-	-	-	-	-	-	-	-	-	-	250	250
Ground limestone	6	6	5	5	7	7	14	14	14	14	12	12
Dicalcium phosphate	24	23	23	22	22	21	23	23	23	23	22	21
Salt	8	8	8	8	8	8	8	8	8	8	8	8
Vitamin premix[1]	5	5	5	5	5	5	5	5	5	5	5	5
Trace mineral premix[2]	4	4	4	4	4	4	4	4	4	4	4	4
Calculated composition												
Metab. energy kcal/lb	1445	1432	1445	1431	1465	1452	1432	1418	1432	1418	1442	1427
Crude protein, %	16.4	16.1	16.3	16.0	16.5	16.2	16.1	15.8	16.0	15.6	15.9	15.5
Lysine (estimated),%	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80	.80
Calcium, %	.65	.65	.65	.65	.65	.65	.65	.65	.65	.65	.65	.65
Phosphorus, %	.55	.55	.55	.55	.55	.55	.55	.55	.55	.55	.55	.55

[1]Should provide the following amounts per ton of complete feed: 3,000,000 IU vitamin A; 5000,000 IU vitamin D; 3000 IU vitamin E; 2g vitamin K; 4g riboflavin; 24g niacin; 12g pantothenic acid; 14mg vitamin B12; 400mg choline; 540mg folic acid. [2]Should provide the following amounts per ton of complete feed: 7g copper; 75g zinc; 15g manganese; 150mg iodine; 272mg selenium.

Table 8 provides suggested high-forage diets for grower pigs. Since the amounts of forage in these formulations are at a moderate level of 250lb. per ton, little or no change in weight gain or feed conversion is expected. This means that as long as the feed cost per ton of the high-forage diets is similar or lower than a conventional diet, feed cost per lb. of gain should also be similar to that of a conventional diet. However, in Table 9, 400lb. of forage per ton of feed are suggested in each of the diets for finisher pigs. Research shows that although finisher pigs can utilize higher levels of forage than that of grower pigs, growth rate in finishing pigs consuming the diets in Table 9 would be reduced by 5-10%, and feed/gain ratios would be increased by 10-15%. Therefore, the feed cost of the high-forage diet should be at least 10% less than a conventional finisher diet to be economical. For example, if a conventional finisher diet costs $130 per ton, a high forage diet should cost no more than $117 per ton (130 - [10% X $130] = $117).

Summary

Forages in the form of pasture, or as part of a complete feed, can be successfully used in pork production. However, because of their high-fiber content and low-energy density, they should be used only to a limited extent for young pigs and lactating sows. Even in growing-finishing, and gestation diets, forage is best utilized at an early stage of maturity. Forages may be used to reduce both grain and protein costs, but producers should consider all factors discussed before making forage a major part of the diet.

Suggested high-forage diets for finishing hogs (125-240lb)	1	2	3	4	5	6	7	8	9	10	11	12
Corn	1326	1312	1321	1306	1339	1325	1300	1284	1288	1270	1281	1262
Soybean meal, 48%	218	-	227	-	209	-	246	-	257	-	270	-
Soybean meal, 44%	-	233	-	244	-	224	-	263	-	275	-	290
Alfalfa	400	400	-	-	-	-	-	-	-	-	-	-
Birdsfoot trefoil	-	-	400	400	-	-	-	-	-	-	-	-
Red Clover	-	-	-	-	400	400	-	-	-	-	-	-
Kentucky Bluegr	-	-	-	-	-	-	400	400	-	-	-	-
Orchardgrass	-	-	-	-	-	-	-	-	400	400	-	-
Ryegrass	-	-	-	-	-	-	-	-	-	-	400	400
Ground limestone	17	16	14	13	16	15	12	12	13	13	9	9
Dicalcium phosphate	-	-	-	-	-	-	26	25	26	26	24	23
Monosodium phos	23	23	22	21	20	20	-	-	-	-	-	-
Salt	8	8	8	8	8	8	8	8	8	8	8	8
Vitamin premix[1]	4	4	4	4	4	4	4	4	4	4	4	4
Trace mineral premix[2]	4	4	4	4	4	4	4	4	4	4	4	4
Calculated Composition												
Metab. energy kcal/lb	1396	1388	1396	1387	1429	1421	1385	1375	1386	1376	1401	1390
Crude protein, %	14.5	14.3	14.4	14.2	14.6	14.4	14.1	13.8	13.9	13.7	13.7	13.5
Lysine (estimated),%	.65	.65	.65	.65	.65	.65	.65	.65	.65	.65	.65	.65
Calcium, %	.65	.65	.65	.65	.65	.65	.65	.65	.65	.65	.65	.65
Phosphorus, %	.55	.55	.55	.55	.55	.55	.55	.55	.55	.55	.55	.55

Table 9. [1]Should provide the following amounts per ton of complete feed: 1,500,000 IU vitamin A; 500,000 IU vitamin D; 2000 IU vitamin E; 2g vitamin K; 2g riboflavin; 16g niacin; 8g pantothenic acid; 10mg vitamin B12; 400mg choline; 540mg folic acid. [2]Should provide the following amounts per ton of complete feed: 5g copper; 55g iron; 55g zinc; 15g manganese; 150mg iodine; 272mg selenium.

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