

notes on goats



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FEEDING VALUE OF SEED-HARVESTED COWPEA VINES FOR GOATS

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Cowpeas are originally from North West Africa and they entered Americas through the West Indies. Cowpeas or southern peas (*Vigna*) were once grown extensively for hay crop; however, the more modern cultivars are grown as green shell peas.

Cowpeas are considered as green manure and can be planted to benefit soil. Cowpeas can grow on poor soils when soils are extremely depleted, highly acid to neutral and can withstand considerable drought (Kansas Rural Center, 1998).

Cowpea is an excellent crop to grow for pasture or with corn for silage (two parts corn plus one part cowpeas) and with Sudan grass for hay. Thus they can provide high quality pasture from June until frost if managed properly and total yield can increase by cutting the plant twice in the season. If grown for hay it should be planted early when there is no more danger of frost; however, for pasture or green manure it can be planted later. The straw and seed-harvested vines can be used as roughage for all kinds of livestock. Fresh cowpea pasture has high protein content (more than 20% crude protein, CP) and low fiber (24%). Cowpea hay has about 14-16% CP and seed-harvested vines (cowpea residues) contain about 6% CP. Cowpea residues when chopped and moistened with molasses and water, after 30 days of ensiling can provide a good source of roughage feed for goats.

Cowpeas are grown in many states in the U.S. for their seeds and the state of Texas claims almost half of the production of cowpeas in the nation (Table 1). There is

no data reported in the USDA Census (2002) on cowpea hay production; however, seed-harvested vines are produced in several states and can be used as animal feed.

Table 1. Top states in cowpeas production (bushels) in the U.S

U.S.	236,666
Texas	102,680
Florida	52,046
Oklahoma	40,473
Missouri	24,755
North Carolina	5,469
Alabama	3,253
New Mexico	2,113
Louisiana	1,844
South Carolina	1,186

Source: USDA Census 2002

CASE STUDY

Animals and Diet

An experiment was conducted at Tuskegee University George Washington Carver Agricultural Experiment Station to determine the feeding value of seed-harvested cowpea vines (cowpea residues) for goats. More specifically, this experiment was conducted to compare intake and digestibility of cowpea residue compared to silage in goats. Based on a prior in vitro experiment in our lab (Table 2), 5% molasses and 40% moisture resulted in overall lower pH, higher lactic acid production and improved in vitro digestibility of silage when compared to 0% molasses and 60% moisture.

Table 2. Cowpea residues silage characteristics

	Molasses, %		Moisture, %	
	0	5	40	60
pH	6.1	5.8	6.1	5.5
Lactic Acid	0.35	0.53	0.41	0.47
In Vitro Digestibility	47.0	48.9	50.3	47.0

Cowpea residues of two varieties of Mississippi silver and pink eye purple hulls were harvested and dried before used for this study. The residues from two varieties were mixed, chopped and moistened with 40% volume of water and 5% molasses solution. This mix was packed and ensiled for 30 days prior to use as **silage** treatment. Cowpea residues were sprayed with 40% volume water solution plus 5% molasses daily and were used as **hay** treatment. Both treatments were top dressed with 100 grams of soybean meal to meet all the requirements for growth of young Angora goats. Eight Angora goats with average body weight of 21.6 kg (47.5 lbs.) were randomly divided into two groups of four animals each and were assigned to one of the two treatments, **silage** group or **hay** group. Animals were fed the respective diets for 10 days followed by 5 days of total collection digestion trial. Feed offered, refusals and fecal output was monitored throughout the experiment. Table 3 represents the chemical composition of the cowpea residues hay and silage. Cowpea residues ensiled had higher protein content and lower fiber (neutral detergent fiber (NDF), hemicellulose and lignin). Silage is partially fermented forage and cowpea residues were improved in nutritive quality by process of fermentation that was enhanced by molasses and moisture. Fermentation has partially digested fiber and resulted in lower NDF in the final product.

Table 3. Chemical composition of the experimental diets

Items ^a	Cowpea Residues	
	Silage	Hay sprayed with water and molasses
Dry Matter	62.9	67.7
Crude Protein	6.61	5.61
Neutral Detergent Fiber	72.2	81.3
Acid Detergent Fiber	58.2	56.7
Hemicellulose	14.0	24.6
Cellulose	40.0	33.0
Lignin	18.1	23.7
Ash	7.1	5.5

^a All values are on dry matter basis except dry matter.

Intake and Digestion

Body weight, dry matter intake and apparent digestibility of the diets fed to goats in this study are presented in Table 4. Animals used were Angora goats. According to NRC 2007, the estimated dry matter intake, total digestible nutrients and protein requirements for 20 kg (44 lbs.) goat gaining 20 grams of body weight per day and producing 4 grams of mohair are 680 grams (1.5 lbs.) of dry matter, 450 grams (1 lb.) of total digestible nutrients and 65 grams of protein. According to Table 4, animals on silage diet consumed 605 grams (1.34 lbs.) of dry matter, slightly below the requirements. Considering dry matter digestibility of 54.2%, total digestible nutrients (328 grams) fall below the required amount of 450 grams per day. According to Table 3 and 4, silage contained 6.61% protein and provided approximately 40 grams (605 x 0.0661) of protein per animal per day and did not meet the requirements of the animals; however, all animals were supplemented with 100 grams of soybean meal (contains almost 50% CP on dry matter basis) that over supplied (40 + 50 = 90 grams) the 65 grams of required protein. Cowpea residue hay top sprayed with water and molasses solution had lower intake when compared to silage. Cowpea residues when fed as hay had also lower digestibility of dry matter, and fiber for optimum goat production; however, when ensiled for 30 days with water (40%), and 5% molasses solution the quality was improved. Ensiling improved dry matter intake, dry matter and fiber digestibility of cowpea residues.

Table 4. Dry matter intake and apparent digestibility of experimental diets fed to goats

Items	Cowpea Residue	
	Silage ¹	Seed-harvested vines ²
Body Weight, kg	21.6 ^a	21.6 ^a
Dry Matter Intake, g	605 ^a	394 ^b
Digestibility (%)		
Dry Matter	54.2 ^a	37.5 ^b
Crude Protein (CP)	67.4 ^a	71.4 ^a
Neutral Detergent Fiber (NDF)	53.0 ^a	49.7 ^a
Acid Detergent Fiber (ADF)	49.7 ^a	34.1 ^b
Cellulose	52.6 ^a	42.7 ^b

Hemicellulose	68.8 ^b	79.2 ^a
Lignin	44.5 ^a	38.4 ^a

^{a,b} Means within a row with different superscript differ (P < 0.05).

How to Use Seed-Harvested Cowpea Residues

Cowpea residues are considered low quality forage and should be fed to goats along with other forages and supplements. If used as a sole source of roughage it may limit intake due to its high fiber values (neutral detergent fiber). A list of other roughages similar in nutritive value to cowpea residues is presented in Table 5 for your reference. Roughages high in NDF tend to have lower intake and those with high ADF tend to have low digestibility. Residues used in our study were harvested and dried before use and that may have adversely affected the nutritive quality. Goats can graze the residues in the field after the harvest and this practice may result in better quality roughage. However, it is clear if justified, the quality of residues ensiled with a source of energy (molasses) and with adequate moisture can be improved.

Table 5. Forages similar in nutritive values to cowpeas residue

Forages ^a	DM	CP	ADF	NDF
	%			
Cowpeas Residue Silage	63	6.6	58	72
Cowpea Residue	89	5.6	56	81
Pea Vine Hay	89	6	52	62
Sorghum Stover	87	5	41	65
Sorghum Straw	88	5	54	70
Corn Stover	80	5	44	70
Cottonseed Hulls	90	5	68	87
Almond Hulls	89	5	27	35
Alfalfa Stems	89	6.9	51	68
Bluegrass Straw	93	6	50	78
Barley Straw	90	4	52	78
Corn Cobs	90	3	39	88
Fescue Straw	94	4	48	73

^a All values are on dry matter basis except dry matter.

DM = dry matter, CP = crude protein, ADF = acid detergent fiber, NDF = Neutral detergent fiber.

Source: NRC, 2007.

Conclusion

Cowpea seed-harvested vines are fodder remaining in the field after removal of peas. Although cowpea planted as hay is high quality forage, its residues after harvest of peas have low protein content and dry matter digestibility when fed to goats. However, when these residues are moisten with water and molasses and ensiled for 30 days, the product has slightly higher protein content, higher dry matter intake and digestibility because of improved fiber digestibility in the silage. Microbial fermentation in the silage increases fiber digestibility and therefore improves intake. Seed-harvested cowpea vines when harvested and dried are low quality forage and shouldn't be considered to sustain high producing animals. Cowpea vines should be used as a part of the forage portion of the diet when fed to goats.

References

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