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# Agricultural Experiment Station

OF THE

AGRICULTURAL AND MECHANICAL COLLEGE,

AUBURN.

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VELVET BEANS.

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J. F. DUGGAR.

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## THE VELVET BEAN.

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By J. F. DUGGAR.

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### INTRODUCTORY.

Among the plants recently introduced to the public, few have received so much notice in the Gulf States as the velvet bean. In Florida within the last few years it has come into extensive use and has found general favor, especially as a plant for use as a fertilizer in orange groves. Although Alabama has no orange groves, the farmers of this State also have uses for the velvet bean, which matures seed in the southern part of Alabama and makes a luxuriant growth of vines in every part of the State.

The velvet bean (*Mucuna utilis*) is a plant which, in general appearance of leaves and stems, is nearly similar to the running varieties of cow peas. The vines attain great lengths, a growth of twenty feet being usually made and much greater lengths being sometimes attained. The beans are larger than cowpeas and usually 3 or 4 are found in each pod. The pods are short and stout, nearly black in color and covered with a coat of velvety hairs.

The velvet bean belongs to the same family as the cowpea. It is a legume or leguminous plant, and like the cowpea, the velvet bean is a renovating plant, having the power to enrich the land on which it grows. The velvet bean, cowpeas, vetch, clover, lespedeza, beggar weed, and indeed all the commonly-cultivated leguminous plants, have the advantage over other cultivated plants of being able to obtain a large proportion of their nitrogen from the air. Nitrogen, if purchased in cotton seed meal or commercial fertilizers, costs 12 to 15 cents per pound. Nitrogen is several times more expensive than an equal weight of phosphoric acid or

potash, the other two constituents that make fertilizers useful and costly.

The farmer who plants a fair proportion of his land with cowpeas, velvet beans, or other legumes, can dispense with high priced nitrogenous fertilizers or ammoniated guanos, not only with the legumes themselves, but he can also dispense with them in fertilizing the cotton, corn, or small grain which follows on the land where the restorative crop grew the preceding year.

Most of the soils of this State are deficient in vegetable matter and nitrogen. This deficiency can be made good by the growth of leguminous plants. A large proportion of the energies of the Agricultural Department at this Station are given to the endeavor to learn which of these plants is most effective as a fertilizer and best adapted to use as a means of restoring the fertility of the soil.

During each of the past three years velvet beans have been grown on the farm of the Alabama Experiment Station. Most of our experiments have had as their object the determination of the value of the velvet bean as a fertilizer, for which use it seems even better fitted than for forage.

Our first seed was bought in the spring of 1896 from J. W. Thorburn & Co., New York City, under the name of banana field pea, or velvet bean.

#### USES OF VELVET BEANS.

Apparently the first use made of velvet beans was as ornamental climbing plants. Planted around porches with proper trellises they make a dense shade. Doubtless for this purpose the shade could be obtained earlier in the season by planting the seed in very small flower pots and transplanting after danger of frost is passed.

The first recognition of the value of velvet beans as renovating plants seems to have been made in Florida, where they are now planted in orange groves as a means of enriching the soil.

As a rule the leguminous plants prized for soil improve-

ment are also excellent for feeding animals, their large percentage of nitrogen making them especially nutritious. Both vines and seed of the velvet bean are used as food for domestic animals, and some slight use has been made of the seed as food for mankind. Another use for velvet beans is as means of crowding or shading troublesome weeds. In the velvet bean we probably have a means of fighting Bermuda and nut grass, and perhaps also Johnson grass.

#### VELVET BEANS FOR SOIL IMPROVEMENT.

*Soil improvement as measured by increased yield of sorghum Hay.*—At Auburn, on poor sandy soil, velvet beans were planted May 13, 1896, to note the character of growth and the effect in enriching the soil. For comparison a similar plot of land was planted on the same day with Wonderful or Unknown cowpeas. Both crops were fertilized alike, as was also an adjacent plot which produced no crop during 1896. Both velvet beans and cowpeas were planted in drills about two feet apart. Velvet beans were sown at the rate of 80 pounds and cowpeas at the rate of 60 pounds per acre. The cowpeas ripened a fair crop of seed; these were not picked, but left to be turned under as fertilizer the following spring. The velvet beans formed pods but matured no seed.

In March, 1897, the cowpeas and velvet beans were plowed under, and April 23 early amber sorghum was sown broadcast at a uniform rate on all three plots, and fertilized with 240 pounds per acre of acid phosphate, and 64 pounds of muriate of potash. The cowpeas and velvet beans were depended upon to supply sufficient nitrogen for the successful growth of sorghum.

The weights in pounds per acre of cured sorghum hay obtained in 1897 on each plot, were as follows:

	Yield of sorghum hay.	Increase due to legumes.
	Lbs.	Lbs.
Sorghum, on plot not cropped in 1896 . . .	3792	...
Sorghum after cowpeas, plowed under . . .	7008	3216
Sorghum after velvet beans, plowed under .	7064	3272

In this case the crop of sorghum in 1897 was nearly doubled as the result of plowing under a crop of velvet beans or of cowpeas. The increase in the yield of sorghum hay which we must attribute to the favorable effects of the preceding leguminous crops is more than  $1\frac{1}{2}$  tons per acre. The value of the increase is more than \$12, if we value sorghum hay at \$8 per ton.

The yield of sorghum was practically the same on the plot where velvet beans had been grown as on the plot where cowpeas had been turned under. The two plants stand then, under these conditions, on an equality, as measured by the increase in the yield of the crop following immediately after the legumes. Probably both velvet beans and cowpeas afforded sufficient nitrogen for a much larger crop of sorghum, the yield of which was lowered by extremely dry weather.

*Soil improvement as measured by increased yield of oats.*— A somewhat similar experiment was begun May 14, 1897, when two plots were planted with velvet beans at the rate of three pecks per acre, two with Wonderful cowpeas at the rate of one bushel per acre, and a fifth plot with German millet. A sixth plot was plowed and fertilized like the other five, that is with 264 pounds of phosphate and 66 pounds of muriate of potash per acre, but was not planted, being left to grow up in crab grass and poverty weed. The soil was poor and sandy and similar to that in the experiment described above.

At the proper stage the millet, one plot of cowpeas, and one of velvet beans were cut for hay. The dates on which these plants reached the proper stage of maturity were July 16, Sept. 10, and Sept. 21, respectively.

The weights in pounds per acre, were as follows :

	Green forage.	Cured hay.
	Lbs.	Lbs.
German millet.....	2,732	994
Velvet beans .....	11,550	3872
Cowpeas .....	13,750	2420

The yield of both cowpeas and velvet beans was several times greater than that of German millet. This is partly due to the longer period of growth of the velvet beans and cowpeas, but it is also due to the fact that these two legumes had the power to draw a large part of their nitrogenous food from the air, while the millet could obtain only the small amount of nitrogen which a poor soil afforded.

The stand of velvet beans was not quite thick enough in the drill. The drills were two feet apart. When weighed the velvet bean hay contained perceptibly more moisture than the cowpea hay; hence we can not conclude from the above figures that the yield of dry matter (food) was greater with the velvet beans than with the cowpeas. The velvet bean plants on the remaining plot were left to continue their growth until the time should arrive for plowing them under. The peas on the remaining plot were picked October 6, and yielded at the rate of eleven bushels per acre. Velvet beans did not mature seed.

October 25, 1897, oats were plowed in on all six plots with a one-horse turn plow, turning under on one plot the growth of crabgrass and poverty weed, on a second the stubble of millet, on another the stubble of cowpeas, on a fourth the stubble of velvet beans, on another the vines of cowpeas (after being picked), and on still another the entire growth of velvet beans, including the half-grown seed. The plowing was poorly done on the plot containing velvet beans, a large proportion of the vines being left on the surface. This could have been remedied by the use of a rolling coulter attached to the plowbeam.

The oats were fertilized with acid phosphate and muriate of potash. No nitrogenous fertilizer was applied to any plot.

The yields of oats, as influenced by the preceding crop of legumes, are recorded in Bulletin 95, published last summer, and the results are quoted here.

*Yield per acre of oats grown after stubble or vines of cowpeas,  
velvet beans, etc.*

Plot No.		YIELD PER ACRE.	
		Grain.	Straw.
		<i>Bus.</i>	<i>Lbs.</i>
1	Oats after velvet bean vines .....	28 6	1206
6	Oats after velvet bean stubble .....	38 7	1672
	Average after velvet bean vines and stubble.	<b>33.6</b>	<b>1439</b>
4	Oats after cowpea vines .....	28 8	1463
3	Oats after cowpea stubble .....	34 4	2013
	Average after cowpea vines and stubble....	<b>31.6</b>	<b>1738</b>
2	Oats after crab grass and weeds .....	7 1	231
5	Oats after German millet .....	9 7	361
	Average, after non-leguminous plants .....	<b>8.4</b>	<b>296</b>

From early spring there was a marked difference in the appearance of the several plots, the plants being much greener and taller where either the stubble or vines of cowpeas had been plowed under.

When the oats began to tiller, or branch, the difference increased, the plants supplied with nitrogen, through the decay of the stubble or vines of cowpeas and velvet beans, tillering freely and growing much taller than the plants following German millet or crab grass.

May 18, 1898, oats on all plots were cut.

In this experiment the average yield of oats was 33.6 bushels after velvet beans, 31.6 bushels after cowpeas, and only 8.4 bushels after non-leguminous plants (crab-grass, weeds and German millet).

Here is a gain of 24.2 bushels of oats and nearly three-fourths of a ton of straw as a result of growing leguminous or soil-improving plants, instead of non-leguminous plants, during the preceding season.

The figures in the above table measure the improvement in the soil which, under favorable conditions, velvet beans may effect. Here again cowpeas and velvet beans seem to stand nearly on an equality as renovating plants. Doubtless both furnished sufficient nitrogen for a much larger crop of oats than was produced, which excess was useless in a dry season.



It will be noticed that the oat crop following velvet bean stubble was larger than that obtained where the effort was made to plow under the entire plant. This should not be taken as indicating that the stubble and roots contain most of the fertilizing material of the plant. It indicates rather that they contained sufficient nitrogen for as large a crop as the moisture conditions of the soil and the unfavorable season permitted to be grown. It is certainly more profitable to cut and feed most legumes, saving the resulting manure and plowing under the stubble, than to use the entire plant as fertilizer. There are, however, conditions under which it is desirable to plow under the entire velvet bean plant, as on fruit farms or on other farms where there is an insufficiency of live stock.

If velvet beans are cut for hay it should be remembered that the removal of the hay takes from the land a large amount of nitrogen, phosphoric acid, and potash. According to analyses made at the Louisiana Station (Bu. 55, p. 121) a little more than one-third of the nitrogen of the entire velvet bean plant is found in the roots and fallen leaves.

Two other experiments are now in progress here to determine the amount of increase in the cotton crop which may be effected by turning under the stubble alone or the entire velvet bean plant.

*Nitrogen in velvet beans growing on one acre.*—A field of velvet beans grown here on very poor land in 1898 and fertilized with 240 pounds of acid phosphate and 48 pounds of muriate of potash per acre yielded 19,040 pounds of green material per acre. The weight of hay after five days curing was 8,240 pounds per acre. These beans were planted April 20 in rows  $3\frac{1}{2}$  feet apart and at the rate of 110 pounds per acre. They were not cut until October 12, when the stems had become too hard to make first class hay.

October 8, 1898, samples were taken from this field for analysis. The roots found in the upper six inches of one square yard were carefully taken up, and the weights of the fresh roots and vines recorded. After drying 11 days the

weights of roots and vines were again taken, and samples sent to the chemical laboratory for analysis. The roots and stubble from one square yard, on which six plants were growing, weighed when dry 0.26 pound, which is at the rate of 1,258 pounds per acre.

Dr. J. T. Anderson, Associate Chemist of the Station, determined the percentages of nitrogen and of moisture in both vines and roots, with the following results :

The nitrogen in the air-dry roots and stubble was 1 per cent., and in the air-dry vines, including partially grown pods, it was 2.29 per cent.; the moisture was 6.72 and 9.52 per cent., respectively. On the basis of the yield of hay as determined by cutting and curing a sixteenth-acre plot, the nitrogen in the crop of velvet bean plants on one acre was as follows :

	Lbs. nitrogen per acre.
In 1258 lbs. roots and stubble, excluding fallen leaves .....	12.5
In 8240 lbs. cured, coarse, hay.....	188.7
	<hr/>
In entire plants.....	201.2

These figures indicate that the amount of nitrogen contained in the entire growth of velvet beans on an acre was equal to that contained in about 2,800 pounds of cotton seed meal. As the soil was very poor, the greater part of this nitrogen must have been obtained from the air. The yield of hay on this field was unusually large, but even if half this amount be taken as an average yield, we have still a most impressive lesson as to the value of leguminous plants for storing up nitrogenous fertilizing material for the enrichment of the soil.

It is evident that there will be no need to apply cotton seed meal to any crop following immediately after a crop of velvet beans, plowed under, and it is probable that on this land the mass of rich vegetable matter will render it unnecessary to use cotton seed meal for several years.

The above table does not do justice to the fertilizing value of velvet bean stubble, inasmuch as the dead fallen leaves, which are abundant and very rich in nitrogen, were not included with the roots and stubble in the sample analyzed. The roots and stubble alone contained only 12.5 pounds of nitrogen per acre, or about as much as is contained in 175 pounds of cotton seed meal. If the fallen leaves had been included, the value of the stubble would probably have been doubled. Our field experiments suggest that the usual stubble left after cutting the vines for hay contains sufficient nitrogen for the needs of the crop following immediately after the velvet beans.

These results showing the great value of the velvet bean as a fertilizer do not stand alone. They agree very closely with results obtained at Calhoun, Louisiana, by Dr. C. W. Stubbs and C. E. Mooers, and reported in Bulletin No. 55 of the Louisiana Experiment Station. The results of both investigations are brought together in the following table:

*Yield of vines, roots and nitrogen in crop of velvet beans on one acre.*

	ALABAMA.	LOUISIANA.
Yield green vines and fallen leaves per acre	19,040	22,919
Yield cured vines . . . . .	8,240	7,495
Weight air-dried roots . . . . .	1,258	173*
Lbs. nitrogen in entire plants on 1 acre . . .	201	191
Per cent. nitrogen in cured vines . . . . .	2.29	2.27
Per cent. nitrogen in air-dry roots . . . . .	1.00	1.54

\* It is not stated in Louisiana Bulletin 55 that any of the stem or stubble was included with the roots; in our tests stubble of about 8 inches in length was included with the roots; hence, probably the wide difference in the amount of roots in the two experiments.

#### ADVANTAGES AND DISADVANTAGES OF VELVET BEANS.

In any comparison of velvet beans with cowpeas as a renovating crop, there is one point in which velvet beans are conspicuously superior. When frost comes the vines and leaves settle down together in such a way that the force of falling rain is broken and the network of vines is so complete that the leaves, the most valuable portion, cannot be blown or

washed away. With cowpeas the case is somewhat different, the bare stems standing erect and affording no means of retaining the leaves in place.

On the other hand better implements are required to turn under vines of the velvet beans than to plow under cowpea vines. The work of burying velvet bean vines is, however, easily done with a rolling coultter attached to the turn plow, or by the use of the disk plow, which latter implement is not likely to come into general use on the light sandy soils where the velvet bean is most valuable. One orange grower writes of running a cutaway disk harrow across the vines in two directions before plowing. This dispenses with the necessity for a coultter.

An Alabamian who planted velvet beans in his young orchard concluded that they were undesirable there on account of their habit of climbing into the trees, which he thought were thereby injured. This objection might perhaps be overcome by planting velvet beans at some distance from the trees and by occasionally cutting off the vines growing towards the trees, by the use of a plow run shallow, with rolling coultter attached, or even by moving the vines with the hands before they obtained firm hold upon the trees. Our experiments at Auburn show that velvet beans should not be planted, like cowpeas, between rows of corn, as the tangle of vines will cause the corn to rot and make it difficult to gather the crop.

#### THE VELVET BEAN FOR FORAGE.

As before stated both the vine and the pod are used as food for live stock.

However, the seed ordinarily mature only in the southern part of Alabama, while the vine thrives at least as far north as the northern boundary of this State.

Velvet bean vines can be used either for pasturage, for cutting and feeding green, soiling, or for hay.

The writer has preserved velvet bean vines in the silo alone and mixed with corn silage. In some portions of the silo the velvet beans made good silage, in other portions

they spoiled. Further experiments are required before we can say that this plant is well adapted for use in the silo.

As a forage plant velvet beans must be judged by (1) quality, (2) quantity (yield), and (3) cost of production.

*Quality of velvet bean hay.*—In the absence of chemical analysis, showing the per centages of starch, fat, etc., in velvet bean vines or hay, we cannot form an accurate idea of the value of the velvet bean plant as a forage. Both the green material and the hay are readily eaten by most farm animals. We know from the fertilizer analysis of the plant that it is rich in nitrogen and hence in muscle making material. The large proportion of leaves also suggests that the hay is highly nutritious.

Until analyses are made and accurate experiments conducted to determine directly the digestibility and nutritive value of this forage plant, we may assume that for purposes of food the velvet bean is probably identical with its near relative, the cowpea.

*Yield of velvet bean hay.*—The quantity of hay yielded by velvet beans is satisfactory. On this farm the yield of velvet bean hay has never been less than one and one-fourth tons per acre, and has in one instance amounted to over four tons per acre. On poor land one can safely count on a larger yield of velvet beans than of millet, sorghum, or most other non-leguminous forage crops.

It is a more difficult matter to reach a correct judgment as to the relative yields of velvet bean and cowpea hay. In the table below are brought together the results of all the experiments conducted here in which direct comparisons were made between the yield of hay from velvet beans and from the "Wonderful" variety of cowpeas, which variety is one of the most luxuriant growers.

*Yield of velvet bean hay as compared with hay from Wonderful cowpeas at Alabama Experiment Station.*

SOIL AND METHOD OF PLANTING.	Velvet beans		Wonderful cowpeas.	
	Seed sown per acre.	Hay per acre.	Seed sown per acre.	Hay per acre.
Sandy soil, 1897; in 2 ft drills . . . . .	Lbs. 46	Lbs. 3872*	Lbs. 64	Lbs. 2420
Sandy soil, small plots, 1897; in 2 ft drills, cultivated. . . . .	.....	7800	.....	8930
Fair reddish loam soil, 1898; broadcast. . . . .	120	5360	60	6400
Fair sandy soil, 1898; broadcast. . . . .	128	4200	96	4160
Average 4 experiments. . . . .	.....	5183	.....	5477

\* Apparently this sample of velvet bean hay was not so well cured and contained more water than the corresponding sample of cowpea hay.

The average yield of velvet bean hay as shown in the above table was 5,183 pounds, and of cowpea hay 5,477 pounds per acre. The difference in yield is so slight that we may regard the average yields as practically identical.

*Harvesting velvet bean hay.*—If thus far equal areas of velvet beans and cowpeas have seemed to be practically equal to each other, whether regarded as fertilizer or as forage, the cost of growing the two is by no means the same in regions where seed must be purchased.

Our experience suggests that it is desirable to use at least one bushel of seed per acre. The price paid for shelled beans in 1899 was \$1.00 per bushel, plus the freight from Florida. Our supply in 1898 was brought from M. S. Moreman, Switzerland, Fla., and in 1899 from H. K. Fuller, Apopka, Fla. Assuming the cost of purchased velvet bean seed at \$1.40 per bushel, we have an expense somewhat greater than the usual cost of the seed necessary for planting an acre of cowpeas. Again we have found that when using a grass blade a laborer can cut a larger area of cowpeas than of velvet beans in a day. If it should be found practicable here to cut velvet beans several times each

season or before they become badly tangled, thus allowing the use of the mower, this difficulty of harvesting would be overcome. It is stated that velvet beans are in Florida cut several times during one season. It has yet to be learned whether in our climate, with irregular summer rainfall, velvet beans will make a luxuriant second growth after being cut. If practicable, this method of cutting velvet beans several times during the season will remove the chief disadvantage of this plant for hay making. If only one cutting is made, it should occur when the plants are in bloom.

It has been suggested that the velvet bean may be induced to mature seed further north than is now done by planting thinly in locations where the vines may climb up on trees, fences, etc., thus exposing the pods to air and sunshine more completely than when the pods lie near the ground. In this way they may perhaps be gradually acclimatized and made to ripen seed at least as far north as the central portion of Alabama. To encourage the maturing of seed, planting should be done as early as practicable, or at least as early as the earliest planting of cotton. A few dozen plants intended especially for seed production might be given even an earlier start, by planting a month earlier under glass and transplanting with a ball of adhering earth when danger of frost is past.

#### AMOUNT OF SEED REQUIRED.

A count made by the writer showed that a bushel of 60 pounds of velvet beans contained a little over 32,000 beans. In three feet rows this would plant an acre, provided two seed were dropped every 11 inches in the drill.

One correspondent writes that less than one peck of seed will plant an acre if two beans are dropped in hills five by three feet apart. This is evidently too thin for best results. Three experienced Florida growers of velvet beans, consulted on this point, reply in substance as follows: (1). "I never use less than one bushel per acre. I plant in 4-foot

rows, dropping three or four beans in hills two feet apart, in every fourth furrow while breaking the land;" (2). "I plant in hills three feet apart each way, two to three beans in a hill;" (3). "I get best results by planting quite thick, not less than one bushel per acre, or even two."

In a test made at Auburn in 1898, velvet beans sown broadcast at the rate of 128 pounds, which is more than two bushels per acre, yielded 4,160 pounds of hay per acre as against only 2,880 pounds when only 64 pounds of beans were sown. In a parallel experiment with drilled velvet beans the results were inconclusive. The amounts of seed used in some of our experiments are given in the table on page 120.

It is probably best to plant in drills and to use about one bushel of seed per acre. On poor land acid phosphate and potash fertilizer, as kainit, muriate of potash, or ashes, will be desirable. Cultivate shallow—until the vines interfere with cultivation.

#### USES OF THE BEANS (FRUIT).

*Velvet beans as human food.*—The shelled beans have been used as food for cattle, hogs and chickens and even as a table vegetable. The writer has up to this time made no experiments to determine the suitability of the beans for feeding to different classes of livestock.

Inasmuch as there is on record one well authenticated case of injury following the use of green, immature, shelled velvet beans as a table vegetable, caution is advised in using the beans for human food. This case of apparent poisoning or acute indigestion following the eating of green velvet beans, boiled, was carefully investigated by Mr. V. K. Chestnut, of the U. S. Department of Agriculture. He has kindly permitted the writer to examine his correspondence with Mr. J. S. Sergeant, of Florida, who reported the only case on record where velvet beans proved decidedly harmful. With him green boiled velvet beans proved injurious, not only to men, but also to the poultry. Mr. Sar-



geant writes as follows concerning velvet beans as a substitute for coffee :

“We have since used them as coffee two and three times a day for three or four months continually without observing any deleterious effect. If properly ground they make a very pleasant drink. The least bit of burning makes the beverage too bitter, and on the other hand, too little browning leaves them with an unpleasant taste and odor.” Four Floridians who have had extensive experience with velvet beans were consulted on the suitability of velvet beans for food of man and beast. All hold the opinion that they contain no poisonous principles, but three of these four correspondents agree that the velvet bean is not a desirable table vegetable. The fourth, Mr. E. J. Johnson, Leesbury, Fla., writes thus : “For human food they are by all odds the richest and best vegetable I have ever tasted. If eaten in large quantities they will nauseate the stomach, not from poison, but from richness. They should be soaked in water over night. This separates the inside hull from the bean. They should then be parboiled in at least two waters. Then cook them as you do any other beans.”

*Velvet beans for live stock.*—Here are some results of long experience in feeding the beans to live stock :

Mr. E. J. Johnson writes : “I fed them ground and dry to chickens, cows, and horses. Others cook them. I have a neighbor who fattened 60 hogs by turning them into the field and allowing them to help themselves.”

Mr. H. K. Fuller, Apopka, Fla., writes thus :

“I have fed the beans ground with hulls to my milk cows with the best of results ; I think them equally as good as cotton seed meal. Some of my neighbors have tried cooking them. They claim that stock eat them readily and thrive as well as when the beans are ground into meal. \* \* I fattened 4 very fine hogs this year on cleaned beans ground fine and mixed with equal parts of wheat bran. The meat was very sweet and juicy. I also feed my poultry with the same mixture with the best results.”

The statement of Mr. A. P. Newheart, Ocoee, Fla., is as follows: "All stock and poultry are exceedingly fond of them in the green stage, but I have never persuaded a horse to eat them when ripe, neither whole, ground, nor cooked

\* \* When the beans are too hard, I have them ground with the hulls and feed of this about 4 quarts at a meal with a little salt and find them equally as good milk producers as cotton seed, though in warm weather the butter is oily. Pigs eat them and it is said that the pork is deliciously sweet."

Mr. C. L. Smith, of Pomona, Fla., writes thus: "Ground in the hull they are fine feed for horses, cows and hogs. Feed with a little wheat bran at first and at no time feed too much. Boiled (in pod) or carefully ground velvet beans are good for chickens. You can turn hogs into [a field of velvet beans] in November and the hogs will grow fat by the middle of January. Then you can turn the vines under for corn."

From the experience of these men and others it seems that there is no danger in the judicious feeding of velvet beans (fruit) to cattle, hogs, and poultry. The air-dry shelled beans analyzed by Prof. H. H. Persons, (Fla. Bul. No. 35), contained 6.29 per cent. of fat, 53.5 per cent. of nitrogen-free extract (starch, etc.) and the very large amount of 18.81 per cent. of protein or muscle-forming material. This indicates that the beans are even richer in food materials than the cowpea, which ranks especially high as a foodstuff.

From the large number of pods formed on velvet bean vines grown at Auburn, it is evident that the yield of seed would be very large, if they should mature. In Florida 18 to 20 bushels of beans per acre are reported as the usual crop.

Unfortunately it is only the farmers of the southern third, or at most, of the southern half of Alabama who can grow the velvet bean with the expectation of getting a crop of seed, and in the seed a very nutritious concentrated food-

stuff. For the deep sandy soils of the southern part of the State the velvet bean promises to be extremely useful, both as fertilizer and as food for animals.

CO-OPERATIVE TESTS OF VELVET BEANS IN ALABAMA.

In 1898, co-operative experiments were made with velvet beans for this Station by farmers in 14 localities in Alabama. In reporting results the great majority of experimenters reported a more luxuriant growth made by velvet beans than by cowpeas. Almost invariably the yield of hay as *judged by the eye* was estimated as much greater than the yield of cowpea hay. However our work here has convinced us that it is easy to over-estimate the yield of velvet bean hay, for the growing vines present an imposing appearance and the hay is loose and bulky.

Giving due weight to these reports of results based merely on appearance and to our accurate experiments at Auburn, where the product of large plots was weighed, it appears probable that on good land the cowpea and velvet bean afford practically equal yields of hay, while on poor, deep sandy land the velvet bean may afford a larger yield.

