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COWPEA CULTURE.

By J. F. DUGGAR.

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COWPEA CULTURE.

By J. F. Duggar.

Summary.

Cowpeas may be planted in May, June or July. For the production of seed, planting in June has been most satisfactory.

By planting New Era cowpeas April 26, two crops were matured before frost.

Early planting lengthens the period of growth and increases the tendency for the plants to form runners.

Weevil in cowpea seed should be destroyed by the use of carbon bi-sulphide.

Subsoiling and liming failed to increase the yield.

In one test broadcast sowing afforded a larger yield of hay than did drilling and cultivation, but the latter method is more certain to afford a fair crop of peas in an unfavorable season.

A large number of varieties have been tested, both as to yield of seed and of hay. Those averaging the largest production of grain are New Era, Black and Red Ripper. The varieties making the largest average yields of hay for three years are Wonderful and Clay. Wonderful, or Unknown, is a standard general purpose cowpea for the central and southern parts of the State.

The number of seed in a bushel varied from 94,634 with the Taylor variety, to more than 236,000 with New Era and Small Black.

The number of pounds of dry unhulled peas required to shell a bushel of 60 pounds varied between 78 pounds

with Brown-eye Crowder and 90 pounds with Wonderful.

Fertilizer experiments at Auburn on soil repeatedly fertilized showed very slight gains from any fertilizer, but on poor sandy or loamy soils an application of acid phosphate, with or without potash, is recommended. In three tests acid phosphate proved superior to crude or raw phosphate.

In composition cowpea hay resembles wheat bran, and the seed are much richer in nitrogen, or muscle-forming material, than either wheat bran or corn. By the use of a good quality of peavine hay the usual corn ration of working teams can be greatly reduced.

As compared with the velvet bean as a forage plant, cowpeas have the advantage in convenience of curing and in palatability, but are at a disadvantage on certain soils by reason of the susceptibility of cowpeas to the attacks of the nematode worm and of several fungous diseases. Velvet beans and beggar weed were found to be exempt from injury from nematodes.

At Auburn the yield of forage has averaged higher from cowpeas than from velvet beans, soy beans or beggar weed.

There is great need for a suitable grass to grow with cowpeas to aid in retaining the cowpea leaves during curing and to hasten the curing process. A volunteer growth of crab grass often serves this purpose. German millet has been found fairly satisfactory for sowing with the early varieties, but it matures too early for use with medium and late varieties.

Sorghum sown with cowpeas increased the yield of hay, but did not make curing easier.

The most profitable method of disposing of the growth of cowpeas consists in cutting the vines for hay and using the roots as fertilizer for the next crop.

Where haying is not practicable and picking too expensive except for seed, the vines should be grazed while the leaves are still retained.

Cows pastured on corn stalks and drilled cowpeas between the corn rows afforded butter and increased live weight worth in 1900 $4.47 per acre grazed over; the next year the returns in butter alone from cowpeas drilled between the corn rows was $5.28 per acre.

As an economical method of harvesting the grain of cowpeas the use of a scythe or reaper is practicable for the bunch varieties, the entire mass being thoroughly cured.

In curing peavine hay no rule as to the number of hours of exposure in swath, in window, or in cocks can be blindly followed, as the method must vary with the luxuriance and succulence of the vines and the condition of the weather. The aim should be to retain all the leaves, which requires that the exposure of the unraked hay be as short as practicable and that part of the curing be effected while the partially cured material is in windrows or cocks.

Hay caps make haying with cowpeas less risky, and when they are repeatedly used in curing hay from a succession of plantings, they soon repay their first cost.

With different varieties from 51 to 75 per cent. of the weight of the entire plant was obtained in the hay, the remainder being in roots, stubble, and fallen leaves. The leaves averaged 30 per cent. of the weight of the hay.

Analyses made of leaves, pods and blooms, fine stems, coarse stems, fallen leaves, roots and stubble, showed that the leaves were at least twice as rich in protein (or muscle-forming material) as the other portions of the plant.

Introduction.

This bulletin gives the results of experiments made at Auburn during the past six years. The experiments have been planned and directed by the writer and all the weighings and supervision of labor have been in charge of Mr. T. U. Culver.

Our work with cowpeas is divisible into two parts, that which relates to their cultivation and use as forage plants and that which takes note of their value as fertilizers or soil improving plants. This bulletin treats only of the first division of the subject. Our next bulletin will record results showing the fertilizing value of cowpeas and the best methods of disposing of this plant when the improvement of the soil is the principal aim.

The cowpea is highly appreciated by the best farmers in every southern state, yet several times as many acres as at present might be devoted to it with advantage.

An enormous increase in the acreage of cowpeas would do more, we think, than any other immediately practicable reform to cure the ills of southern farming, to enrich the soil, to raise the acreage yield of all other crops, to build up the live stock industries, and to promote diversified farming.

Time for Planting Cowpeas.

The cowpea is very tender as regards cold. It is strictly a hot weather plant and the seed should not be planted until the soil is quite warm. It can be planted as early as the beginning of the cotton planting season. But such early planting is unwise in itself as well as in conflict with other work that is imperative in April.

Usually nothing is gained by planting before the first of May, and our largest yields of seed have been obtained

by planting after the first of June. It should be noted that in the variety test of 1901, where most of the plots afforded more than 20 bushels of seed per acre, planting did not occur until June 28.

Rather late planting tends to promote seed production and to reduce the growth of vine. Early planting promotes a luxuriant growth of vines, with consequent increased tendency for the vines to run and tangle, and often results in a decreased yield of seed.

Whippoorwill peas planted in drills, April 19, 1898, and cultivated, did not ripen seed until the latter part of summer, and a period of 160 days elapsed between the dates of planting and picking, though properly the harvesting should have taken place several weeks earlier. This was in a year when the rainfall was deficient up to July, and abundant after the first week in July.

Compare this with the Whippoorwill variety planted July 1, 1896, in drills in the special phosphate test. Here all the pods were ripe 87 days after planting.

Notice also that, in 1900, in the fertilizer experiment, only 99 days elapsed between the planting and picking of the Whipporwill cowpeas.

Likewise Whipporwill peas planted June 28, 1901, were picked almost clean 102 days after the date of planting.

These and other examples which we might cite indicate that by planting cowpeas rather late we greatly shorten the period of growth.

Even when it is desired to grow two crops of cowpeas the same year it is not necessary to plant many days before May 1. In 1901 we grew two crops of New Era cowpeas to full maturity, the second crop being from pods ripening in midsumer.

The seed planted April 26 matured a crop which was picked July 22 and planted July 26.

This planting in turn afforded a crop (of mature pods) before frost, about 90 per cent. of the pods being ripe on November 1.

The New Era is the only one among the varieties tested here, from which we have endeavored to obtain two crops in one year. Such a course is probably advisable only where cowpeas for planting are scarce and costly.

The middle of July is probably the latest date of planting with the expectation of getting a large yield, and with most varieties planting in June seems preferable at Auburn.

To destroy the weevil that becomes so destructive in stored cowpeas on the approach of warm weather, we use carbon bisulphate, which is also needed as a means of destroying the weevil in corn. The cost is 10 to 20 cents per pound, and one pound will treat a number of bushels of shelled cowpeas. About an ounce of the liquid is poured into an open can and placed upon the upper surface of the peas in a box or barrel and a cloth spread over all. The treatment may be repeated after a few days. The liquid evaporates rapidly, and the vapor of carbon bi-sulphide destroys insect life. The vapor is highly inflammable and no flames or lighted pipe should be allowed near until the odor has disappeared.

Preparation and Planting.

The place in the rotation usually assigned to cowpeas is that of a partial crop planted between the corn rows at the last or next to last cultivation, or else that of a second crop on the land where oats, wheat, or rye has been harvested.

It is not putting the matter too strongly to say that 80 per cent. of the acreage of corn in this State should have cowpeas between the rows and that at least 80 per cent. of the area from which small grain is cut in May and June should be planted in cowpeas.

On sandy upland where the corn rows are five feet apart we prefer to plant the cowpeas in a single drill half way between the lines of corn and to plant at the next to the last cultivation, so that the last cultivation serves also to give the cowpeas a start. On good bottom land, well supplied with moisture, we prefer to cow cowpeas broadcast in corn, and this, of course, can be done only at the time of the last cultivation.

On rich land care should be taken that the sowing of cowpeas, especially of the running varieties, does not take place so early that the corn will be overrun by the vines. Avoidance of this trouble lies either in late planting or in the use of the bunch varieties.

In drilling cowpeas between the corn rows we obtain a more uniform start by employing the planter than by dropping the seed by hand in the first or center scrape furrow and covering with the two siding furrows of the scrape run next to the corn.

We have employed numerous methods of planting cowpeas after small grain. Since work is pressing at this season and the soil sufficiently moist for plowing only for relatively brief periods, our usual policy is to plant the seed without waiting to make thorough preparation.

There is room for considerable ingenuity in determining the best method of completing the preparation and giving the first cultivation. One of the most important aims to be kept in view in this is to keep the land nearly level so that the plants may better resist drought and so that a mower may be conveniently used. After the first cultivation, when this serves also as a partial

breaking, only the heel scrape or other shallow-working implement should be used.

Though drilled cowpeas on the Experiment Station farm when growing alone are usually hoed once, yet we are inclined to think this is often an avoidable and unprofitable operation.

With cowpeas intended for hay, pasturage or fertilizer, it is, of course, even less necessary than where the prime object is the production of seed.

Possibly the weeder, which we have successfully used on other crops, and which others have run over cowpeas without injury, may prove a partial substitute for the hoe. It should be employed when grass and weeds are extremely small.

We have made no test to ascertain the best amount of seed, which will doubtless vary somewhat with different varieties. The usual amount is one to one and one-half bushel when sown broadcast and about half a bushel per acre when planting is in drills far enough apart to permit cultivation.

The grain drill, with all tubes open or with part of them stopped, is sometimes used in planting cowpeas.

Subsoiling.

Two tests of the effect of subsoiling for cowpeas have been made on reddish loam soil, in the same field as that used for similar experiments with corn and cotton. In both cases the variety Wonderful was employed. The peas were in drills and were cultivated several times.

In 1897 cowpeas were planted on a plot that had been imperfectly subsoiled in February, 1896, by using a scooter run to a depth of four inches in the bottom of the furrow made by a one-horse turn plow. This operation was not repeated in 1897.

On both the plot thus treated and on that which had never been subsoiled the crop was exceedingly poor. The plot once subsoiled yielded at the rate of 6.7 bushels per acre and that not subsoiled 5.6 bushels.

In May, 1898, cowpeas were planted on a plot which had been subsoiled as above in the preceding February. The yield of hay was 5,120 pounds on the subsoiled plot and only 40 pounds less on the plot never subsoiled. A different result might have resulted from thorough work with a subsoil plow.

Drilling Versus Sowing Broadcast.

May 12, 1898, Wonderful cowpeas were sown broadcast at the rate of 60 pounds per acre and plowed in with one-horse turn plows. On the same date an equal quantity of seed was planted in drills, which was done by dropping the seed by hand in every third turn plow furrow, the nex t furrow-slice serving as a covering.

On all plots the fertilizer, phosphate and muriate of potash, was applied broadcast on the plowed surface and harrowed in.

The vines were cut September 13. After curing for a week, most of this time in cocks, the weights of hay were found to be as follows:

Pounds of cowpea hay per acre from drilling versus broadcast sowing.

Plot No.		Hay per acre. Lbs.
4	Broadcast	6,400
7	Broadcast	6,400
5	Drilled	5,600

In this test broadcast sowing afforded 800 pounds of hay per acre more than drilling. The large yields indicate that the season was favorable and the rainfall

records show that a large amount of rain fell in July and August.

The drilled peas were cultivated twice with scrapes, the total number of furrows per row being three.

In addition to experimental plots we plant every year considerable areas of cowpeas, both broadcast and in drills. In deciding on the best method of planting in this "general crop" we are governed by the price and available supply of seed and labor. We use four to six pecks of seed sown broadcast and two or three pecks in drills. In sowing broadcast we seldom plow in the seed, as in the above-described experment, but sow them on the plowed land and cover seed and fertilizer with disc harrow or with one-horse cultivator.

In planting in drills we open the drills in plowed or unplowed ground, and are careful either to apply the fertilizer in the covering furrow or else to mix it with the soil before the seed are dropped.

Where the ground has been plowed, the combined grain drill and fertilizer distributor would doubtless be satisfactory, stopping most of the tubes if it is desired to drill the seed in rows wide enough for cultivation.

Our observations lead to the belief that in unfavorable seasons drilling and cultivation gives the largest yield of hay (and always of seed) and that in seasons of abundance of rainfall broadcast planting affords the greater amount of hay, but not of seed.

Varieties.

During each of the past six years one or more tests of varieties of cowpeas have been undertaken. Some of these tests have been vitiated by agencies that need not be stated here, and only those are here reported which have been free from inequalities and errors.

Varieties of cowpeas have been tested both with reference to the yield of seed and to the yield of hay. The variety Whippoorwill (a speckled bunch pea) has competed in all these tests and its yield has been taken as a basis by which the yield of any other variety may be conveniently stated. Thus, taking the yield of grain from Whipporwill in 1897 as 100, that of Wonderful for the same year is 106, or 6 per cent. greater.

The grain yield of varieties of cowpeas.—The following table gives the results of four tests of varieties on the basis of seed production, all varieties planted in drills and cultivated. In all cases a bushel of shelled peas is assumed to weigh 60 pounds.

Yields of grain of varieties of cowpeas.

VARIETY.	Yield per acre in				Relative yield taking Whipporwill yield as 100 per cent.				
	'97	'98	'00	'01	'97	'98	'00	'01	Av.
	Bus.	Bus.	Bus.	Bus	%	%	%	%	%
Clay	....	7.6	....	14.0	....	50	....	63	58
Crowder, Brown-eye	....	....	....	19.3	....	....	....	87	....
Crowder, Large White	....	17.5	....	....	....	116	....	....	....
Crowder, Yellow	....	....	....	23.3	....	....	....	105	....
Brown-eye, White	....	2.5	....	....	....	17	....	....	....
Black, from Wood	....	21.0	....	21.2	....	140	....	96	118
Black, from Ala. Ex. St.	....	9.6	....	....	....	64	....	....	....
Black, from Hastings	....	....	7.8	....	....	....	52	....	....
Black, Large Early, from Packard	....	19.5	....	....	....	130	....	....	....
Black-eye Large (Wood)	....	15.0	....	19.0	....	100	....	86	92
Black-eye, Large White from Willett	....	9.0	....	....	....	60	....	....	....
Black-eye, Extra Early	....	16.2	....	16.6	....	108	....	75	92
Early Brown Dent	....	23.4	....	....	....	156	....	....	....
Early Bullock	....	21.8	....	....	....	145	....	....	....
Iron	....	14.9	....	....	....	99	....	....	....
Jones White	....	8.0	....	....	....	53	....	....	....
Lady	....	8.9	....	....	....	59	....	....	....
Lealand	....	17.5	....	....	....	116	....	....	....
Miller	....	8.2	....	....	....	54	....	....	....
Mush	....	17.6	....	....	....	117	....	....	....
New Era	....	22.0	....	22.0	....	146	....	104	125
Ross White	....	11.9	....	....	....	79	....	....	....
Red Ripper	....	18.5	....	20.1	....	123	....	91	107
Taylor	....	....	....	23.6	....	....	....	107	....
White Giant	....	....	10.8	15.9	....	....	75	72	74
Unknown	8.3	....	....	....	106	....	....	....	....
Wonderful	7.4	15.2	....	21.6	94	101	....	98	98
Whippoorwill	7.8	15.0	14.4	22.0	100	100	100	100	100

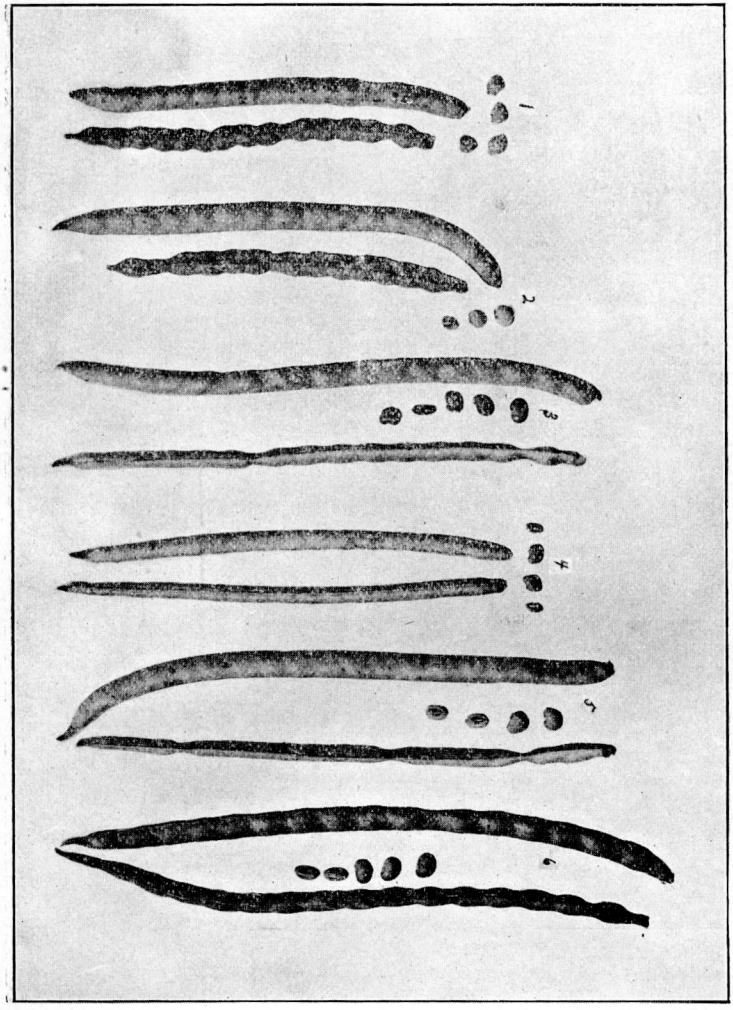
Varieties averaging large yields of seed have been New Era, Black (from Wood), and Red Ripper. Wonderful wants only 2 per cent. of equalling the average yield of Whippoorwill.

Varieties making large yields, but which have been tested only once, are Early Brown Dent, Early Bullock, Large Early Black (from Packard), Lealand, and Large White Crowder.

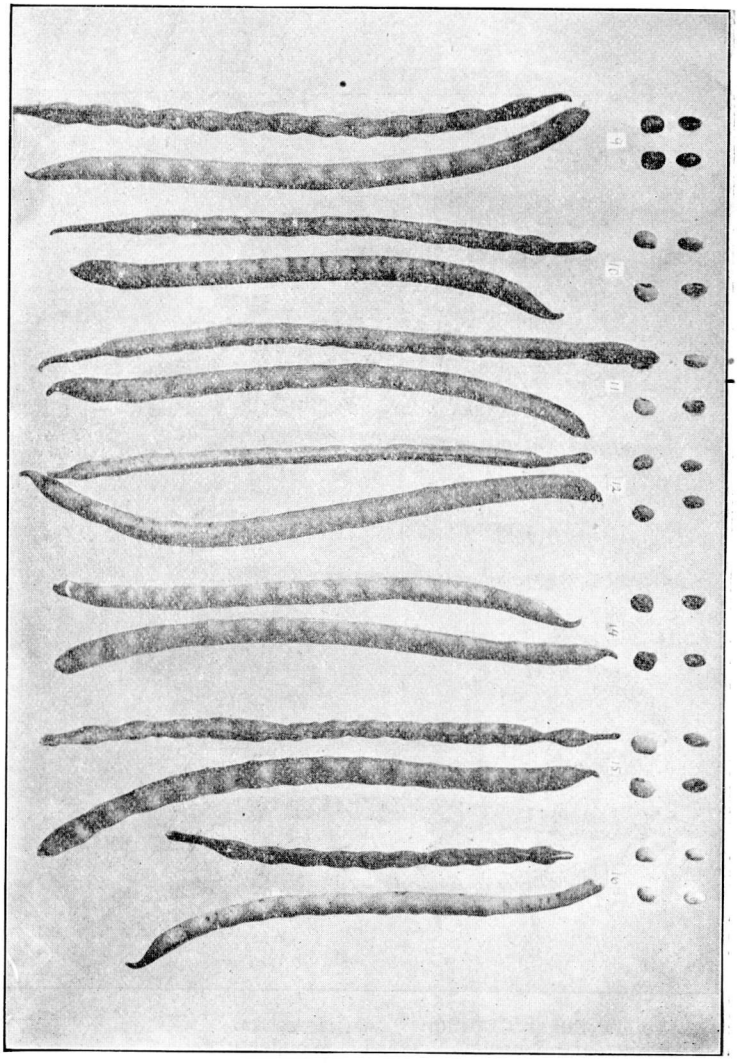
Additional tests must be made before conclusions can be drawn as to the relative values of these varieties for seed production. There is need for a variety of cowpeas that in addition to the good qualities of Whipporwill, prolificacy, upright growth, and earliness, shall be more resistant to mildew or rotting of the pods than is this standard kind. The writer will be glad to test any local varieties for which this quality is claimed.

Size of seed.—The following table gives the weight of 100 cowpeas of the varieties grown in 1901, and also the calculated number of seed in a bushel of 60 pounds:

VARIETY.	Wgt. of 100 seed	No. of seed in 1 bush. (60 lbs.)
Taylor	28.72	94,634
White Giant	25.45	106,797
Brown-eye Crowder	24.74	109,858
Yellow Sugar Crowder	23.16	117,314
Black	22.07	123,153
Red Ripper	20.89	130,110
Extra Early Black-eye	20.74	131,051
Large Black-eye	20.04	135,638
Whippoorwill	17.98	150,621
Wonderful	18.86	144,117
Clay	17.86	151,629
Jones' Perfection White	13.97	194,560
New Era	11.49	236,545
Small Black	11.30	240,531



1. Yellow Sugar Crowder.
2. Brown-eye Crowder.
3. Whippoorwill.
4. New Era.
5. Wonderful.
6. Taylor.



9. Black, from Wood.
10. Large, Black-eye.
11. Ex. Early Black-eye.
12. Clay.
14. Red Ripper.
15. White Giant
16. Jones White.

Taylor had the largest seed, of which only 94,634 were required to make a bushel. New Era has the smallest seed of any kind in the variety test, having 236,545 seed in a bushel. In rows three feet apart, and three seed per foot of drill, an acre would require about 11 pounds of New Era or about 28 pounds of Taylor seed.

Small Black, grown in another field, had seed slightly smaller than those of New Era.

Where to Get Seed.

The Station cannot undertake to supply seed. The addresses of the parties from whom this Station has obtained seed, as given below, will enable intending buyers, who cannot get seed nearer home, to correspond with seedsmen or growers.

New Era, from J. C. Little, Louisville, Ga.

Numerious varieties from H. P. Jones, Herndon, Ga.; Alexander Seed Co., Augusta, Ga.; Willett Seed Co., Augusta, Ga.; Mark W. Johnson Seed Co., Atlanta, Ga.; Curry-Arrington Seed Co., Rome, Ga.; H. C. Hastings, Atlanta, Ga.; E. G. Packard, Dover, Del.; and T. W. Wood & Sons, Richmond, Va.

The hay yield of varieties of cowpeas.—These tests were all made on poor sandy upland, though the land used for this experiment in 1897 was richer than that occupied by this test in the other years. In 1897 the seed was sown broadcast; in 1898 and 1899 the seed was planted in drills about 2½ feet apart. The yields are lower than we usually obtain in our fields sown for hay, which may be partly due to the fact that the peas in the experiments were sown late,—the last week in June,—and that the product was weighed only after the hay had become extremely dry.

Yields of hay of varieties of cowpea.

VARIETY.	Yield per Acre in			Relative yield, Whipprowill—100 per cent.			
	'97 lbs.	'98 lbs.	'99 lbs.	'97 %	'98 %	'99 %	Av. %
Black-eye, Extra Early	....	....	1416	....	....	79	....
Black-eye, Large	....	....	....	....	....	....	....
Black	2220	2880	1618	89	105	83	92
Black, Large Early	....	....	1383	....	....	68	....
Clay	3975	3373	1209	160	121	59	113
Crowder	....	....	1308	....	....	64	....
Crowder, Large White	....	1280	2034	....	47	100	73
Iron	....	4080	2154	....	150	106	128
Lady	....	....	1401	....	....	69	....
Lealand	....	....	2206	....	....	119	....
Miller	....	....	1623	....	....	79	....
Mush	....	....	1929	....	....	95	....
New Era	....	....	2310	....	....	113	....
Ross White	....	....	2430	....	....	119	....
Red Ripper		3720	....	....	136	....	....
Whippoorwill	2485	2720	2030	100	100	100	100
Wonderful	3700	4160	1569	148	153	77	126

The largest average for three years was made by the Wonderful (or Unknown) variety, followed by Clay. Iron, which was tested only two years, surpassed all other varieties in the average yield for those two years.

The ease of harvesting varies greatly with different varieties, the running kinds affording the greatest difficulty.

The quality of the hay differs somewhat with different varieties. For example, Wonderful has larger stems than any other variety tested and hence its hay appears coarser.

Nevertheless, the large yield and erect stem make this a very popular variety for hay. It is too late to mature seed in a high latitude or when planted very late in summer.

On the whole, as a general purpose cowpea, suitable for either grain, forage, or fertilizer, we may safely plant the Wonderful or Unknown in the central and southern parts of the state until some other variety is

proved to be superior. Perhaps an exception should be made of the Central Prairie Region where there is complaint that there is an extreme tendency for cowpeas to run to vine and fail to fruit properly. It is suggested that the early bunch varieties, especially New Era, planted late in June, be tried on these soils; also that when seed are desired from medium and late varieties, that they be planted early and thick in the drill.

Proportion of seed and hulls in unshelled cowpeas. The following table gives the number of pounds of seed in 100 pounds of unshelled cowpeas. In all cases the peas were not beaten out until at least several weeks after the date of picking, thus giving time for thorough drying.

Pounds seed in one hundred pounds of unshelled cowpeas.

	Yrs.	Lbs.		Yrs.	Lbs.
Brown-eye, White	1	70	Early Brown Dent	1	77
Black, from Wood	2	76	Early Bullock	1	82
Black, from Ala. Ex. Sta	3	69	Iron	5	69
Black, Large Early, from Packard	1	76	Jones, White	2	69
Black-eye, Large, from Wood	2	77	Lady	3	74
from Willett	3	73	Lealand	3	77
Black-eye, Large White,			Miller	1	77
Black-eye, Extra Early,			Mush	1	83
Black-eye, Extra Early, from Wood	2	76	New Era	2	73
Clay	4	67	Ross White	1	69
Crowder	3	75	Red Ripper	4	71
Crowder, Brown-eye	1	85	Taylor	1	77
Crowder, Yellow Sugar	1	84	White Giant	2	71
Crowder, Large White	1	83	Unknown	2	67
			Wonderful	4	70
			Whippoorwill	4	73

The proportion of seed and hulls varies according to the variety. In our tests it is highest with the several Crowder varieties, and lowest with Wonderful and Clay; number of pounds of thoroughly dry unhulled peas in the pod required to make a bushel (60 pounds) of shelled peas was only 78 pounds with Brown Eye Crowder

and 90 pounds with Wonderful. To get corresponding figures for any other variety the reader can divide 6,000 by the figure opposite each variety. It should be stated here that the percentage of grain in the same variety varied greatly in different years.

Effects of Lime on Cowpeas.

Two tests were made on this point, using drilled cowpeas of the variety Wonderful, fertilized with acid phosphate and cultivated several times.

In 1897, on reddish loam soil, and stiffer than that in the later tests, the yield was 5.6 bushels of peas without lime and only 5.2 bushels where slaked lime at the rate of 640 pounds per acre had been applied broadcast in February of the preceding year. Whatever lime remained in the soil was evidently of no benefit of cowpeas.

In March, 1898, water slaked lime was used as a top dressing on oats on gray sandy soil. It was used at the rate of 1,000 pounds per acre of the unslaked lime, which is equivalent to a much larger weight of the slaked material.

After the oats were cut the land was plowed and cowpeas drilled in and cultivated as necessary. The yield follows:

Plot not limed, 13 bushels cowpeas per acre.

Limed plot, 10.2 bushels cowpeas per acre.

Clearly lime was of no benefit, but apparently injurious as regards seed formation. There was no notable difference in the appearance of the vines.

Fertilizer Experiment.

This test was made in 1898 with Whipporwill cowpeas on gray or white sandy soil on a hilltop. Two cultivations were given, requiring altogether three furrows per row. The results follow:

Results of fertilizer experiment with cowpeas in 1898.

Plot No.	Fertilizer.		Yield of seed per acre.
	Per acre.	Kind.	
	Lbs.		*Bus.*
1	240	Acid phosphate	13.9
2	51	Muriate of potash	15.9
3	00	No fertilizer	16.
4	240	Acid phosphate	15.4
	51	Muriate of potash	
5	240	Acid phosphate	19.1
	51	Muriate of potash	
	80	Nitrate of soda	
6	240	Acid phosphate	16.7
	51	Muriate of potash	
7	240	Acid phosphate	15.2
8	00	No fertilizer	14.3
9	240	Acid phosphate	14.9
	51	Muriate of potash	
10	51	Muriate of potash	15.1
Av. 3 & 8	00	No fertilizer	15.1
Av. 1 & 7	240	Acid phosphate	14.1
Av. 2 & 10	51	Muriate of potash	14.5
Av. 4, 6 & 9	.....	Phosphate and muriate	15.3

Apparently none of the mineral fertilizers was decidedly advantageous, though with the complete fertilizer there was an increase of four bushels per acre. The failure of acid phosphate and muriate of potash to increase the yield is surprising, and the only explanation we can suggest is the fact that both phosphate and potash salts had been liberally used on this field during each of the preceding five years, and probably these materials had been applied annually for about fifteen years. This view implies that even on this gray light sandy soil, containing some flint stones, and underlaid by a rather stiffer sandy sub-soil, acid phosphate and potash are not wholly used up or lost during the year when they are applied but exert a considerably residual or cumulative effect.

Is Nitrogen Advantageous in a Fertilizer for Cowpeas?

Cowpeas are able to grow on poorer soil than is cotton or corn. This is because the cowpea plant, through the agency of the specific enlargements or tubercles or nodules on its roots, is able to draw a part of its nitrogen from the air, while corn, cotton, grasses, etc., are entirely dependent for their nitrogen on the soil and fertilizer.

Since the cowpea plant possesses this source of supply it is reasonable to assume that nitrogen can be omitted from its fertilizer, thus reducing the cost of fertilization. On the other hand it has been stated that during the early period in the life of this plant the tubercles afford no nitrogen, and that nitrogenous fertilizers are beneficial during this early period. One writer has recorded as his observation that cotton seed meal is a suitable fertilizer for cowpeas.

To put this latter statement to a test, four plots of drilled cowpeas in 1898 were employed. All were fertilized with 240 pounds of acid phosphate and 48 pounds of muriate of potash per acre. Two plots received in addition cotton seed meal at the rate of 100 pounds per acre. The cured hay averaged practically 2½ tons per acre, the plots with cotton seed meal affording only 40 pounds of hay per acre in excess of the others. There was a practical equality in yield, and a failure of cotton seed meal to exert any appreciable effect.

This is in accord with nearly all of the published fertilizer experiments with cowpeas.

We have found the tubercles on cowpeas when the plants were only a few inches high and a few weeks old. Apparently the nitrogen in the seed and that which even a poor soil yields is usually sufficient for the little

plants up to the time when the root tubercles begin to exercise their function of supplying nitrogen.

The fertilizer test detailed in a preceding paragraph shows that with a complete fertilizer the yield of peas was 3.8 bushels per acre greater than where only phosphate and potash were used together.

This increase seems to be attributable to the use of 80 pounds of nitrate of soda.

The majority of experiments agree with the one where cotton seed meal was used in indicting that nitrogen is not a profitable constituent of the fertilizer for cowpeas.

Forms of Phosphate for Cowpeas.

A test was made in 1896 of acid phosphate, crude Florida soft phosphate, and a moistened mixture of these two, which mixture should have produced reverted phosphate. The crop was a failure, probably because of injuries to the roots by nematode worms, and there were only slight differences in the yields of seed on the plots differently fertilized. This was on very poor white sandy soil.

In 1898, co-operative tests of acid phosphate in comparison with equal weights of Florida soft phosphate (crude) were made for this Station by Mr. A. A. McGregor, on a loam soil with clay sub-soil, at Town Creek, Ala., and by Mr. J. P. Slaton, on sandy soil between Notasulga and Tuskegee. Apparently the soil at Town Creek was rich in lime, the other poor in lime.

Unfortunately there was a failure to pick the peas in both the tests, but the notes made by both of the experimenters have no doubt as to the superiority of acid phosphate over insoluble phosphate as a fertilizer for

cowpeas. At Town Creek, where pods did not mature, the vines made the best growth where acid phosphate was applied; no difference could be detected between the growth of the unfertilized plot and that on the plot where Florida soft phosphate was employed.

On the sandy soil near Notasulga "the plot fertilized with acid phosphate seemed to me one-third better" than the one with the raw phosphate. These observations as to the superiority of acid phosphate agree with the results of experiments made at the Georgia Experiment Station and with a test made at Auburn in 1898, the results in our test being as follows:

	Bus. seed per acre.
Cowpeas, with no phosphate	9.4
Cowpeas, with 240 lbs. Florida soft phosphate	13.9
Cowpeas, with 240 lbs. acid phosphate	15.2

Apparently the raw or Florida soft phosphate was beneficial, and the acid phosphate still more so, the increase with the latter being 5.8 bushels of seed per acre, which gives a fair profit after deducting the cost of the 240 pounds of acid phosphate used on an acre.

Fertilizing cowpeas between corn rows.—In 1900 on one plot only half of the acid phosphate was applied to corn, the remainder (120 pounds per acre) being reserved and drilled with Whippoorwill cowpeas July 7. There was practically a failure of both the corn and cowpeas on this series of plots, so that the products of the several plots were not harvested separately. However, so far as could be judged by the eye, there was never any difference in the growth of the vines directly fertilized with phosphate and those which must have drawn some of their phosphate from the fertilizer that was applied to the corn some months before.

NUTRITIVE VALUE OF COWPEAS AND COWPEA VINES.

The high nutritive value of the seed, the hay, and the green vines of the cowpea plant may be seen from the following figures adapted from Prof. W. A. Henry's book on "Feeds and Feeding:"

	Lbs. digestible.		
	Muscle formers	Starch, etc.	Fats
100 lbs. cowpeas (shelled seed) contain*..	17.3	63.1	.7
100 lbs. cowpea hay contain	10.8	38.6	1.1
100 lbs. green cowpea vines contain	1.8	8.7	.2

*Assuming same digestibility as for meal from Canada field peas.

Cowpea hay contains almost exactly the same amounts and proportions of digestible materials as wheat bran. The seed is more nutritious than wheat bran and far richer in protein,—the so-called "muscle formers,"—than is corn. In our feeding experiments with pigs it has proved itself better than corn when constituting only a portion of the grain ration. By feeding farm teams on a liberal allowance of peavine hay the amount of corn necessary can be reduced much below that usually consumed.

Cowpeas versus velvet beans as forage.—This comparison can be made on the basis of (1) palatability and nutritive value, (2) cost of growing and harvesting a ton of each, (3) productiveness, and (4) hardiness.

The number of analyses of velvet bean hay is insufficient to give an accurate determination of its exact nutritive value, in which, however, it is probably about equal to peavine hay. In palatability the advantage is decidedly with peavines.

We have found it practically impossible to use the mower in cutting velvet beans and when both crops are cut with the scythe our records show that the velvet

beans require more labor than cowpeas. Indeed we have not yet found a thoroughly practicable and economical means of cutting and handling velvet bean vines.

In regard to the yields of hay from the two plants, when grown side by side, the following are the results thus far at Auburn, the variety of cowpeas employed being the Wonderful or Unknown.

	Cowpea hay	Velvet bean hay.
Drilled crop, 1897, lbs. hay per acre	2420	3872
Drilled crop, 1897, lbs. hay per acre	8930	7300
Broadcast crop, 1898, lbs. hay per acre.....	4160	4480*
Broadcast crop, 1898, lbs. hay per acre	4160	2880†
Broadcast crop, 1898, lbs. hay per acre....	6400	5360

*128 lbs. velvet beans sown broadcast per acre; †64 lbs. velvet beans sown broadcast per acre.

On the score of productiveness our experiments are slightly in favor of cowpeas, though on other soils this result might be reversed.

As to the relative hardiness of the two plants, the velvet bean is undoubtedly superior. It suffers less from the attacks of leaf eating insects, and, though the young plants of the velvet bean are not exempt from the attacks of a fungous root rot, characterized by whitish to brownish, small, spherical, sclerotia on the stem near the surface of the ground, yet the velvet beans are much more resistant to it than are cowpeas, which in some parts of the Station farm are almost ruined by this disease. For example, in 1899, on adjoining plots, cowpeas were ruined by September 12, at least half the plants having died prematurely, the yield of seed being reduced to less than two bushels per acre, while velvet beans were perfectly healthy and extremely luxuriant.

Still more important as regards the relative hardiness

of the two plants is their susceptibility to injury from the attacks of the microscopic nematode worms that infest the soil, especially in gardens and orchards, in parts of the Gulf States. These worms enter the roots of many plants, cowpeas, cotton, peaches and numerous vegetables, causing swellings, which, as they become larger, result in depriving the infected root of its function of supplying water and food to the plant.

It is important for farmers to distinguish these nematode injuries from the beneficial tubercles naturally present.

Speaking generally and disregarding the advanced or corky stage of the nematode swelling, tubercles and nematode bumps may be distinguished by their position. The beneficial tubercles are located outside of the outer surface of the root, and to the side of the same; the injurious enlargements are usually spindle shaped and their position is such that the root seem to be growing through the center of the swelling. In other words, the root is enlarged symmetrically on all sides in the early stages of nematode injuries.

Cowpeas are very susceptible to injuries from nematodes. Velvet beans are highly resistant to such attacks, if not entirely exempt from them. We have been able to find no plain indications of nematode injuries on the roots of velvet beans.

This is a matter of much importance, especially when a choice must be made between these two legumes for growing in old garden spots, which are likely to be infested with nematodes, or with a fungus root disease.

In this connection it should be said that Orton and Webber, of the United States Department of Agriculture, found the Iron variety of

cowpeas to be resistant both to nematode attacks and to cowpea wilt, the latter being a fungus disease different from the one that is most destructive at Auburn.

The remedy for all these troubles consists in practicing such a rotation as will keep susceptible plants off of the infested or infected fields for at least a few years.

In brief, the cowpea as a forage plant is superior to the velvet bean in palatability and ease of curing and only inferior in hardiness or resistance towards the attacks of certain insects and fungous diseases.

Cowpeas versus beggar weed and soja beans as forage.

At Auburn the yield of cowpea hay has greatly exceeded that of beggar weed hay and has been superior in quality. The advantages in favor of beggar weed are its greater ease of curing, resulting from its more erect growth, and its practical or complete exemption from nematode injury. Beggar weed also seems resistant to the fungus root rot.

Compared with soja or soy beans, cowpeas at Auburn have averaged a heavier yield of hay and have been surpassed only in the greater ease with which the soy bean, on account of its erect growth, can be harvested. The cowpea has been able to make a fair growth on land too poor for soy beans.

Cowpeas in Various Mixtures for Hay.

The leaflets easily drop from the vines in curing unless special care is exercised. This loss can be avoided and the curing process facilitated by growing the peavines in combination with some grass that cures readily and which serves with its blades and fine stems to tie the whole mass together so that the leaflets of the legume are not lost. For this purpose crabgrass is one of the best, and the only disadvantage is that as a volunteer

growth must be relied on, there is some uncertainty as to the stand and as to the grass growing to sufficient height on the poorer spots.

We have found German millet useful in this respect. for fair and good soils. This grass makes it necessary to choose an early variety of cowpeas to sow it with, else the millet will be ready for the mower while the peas are entirely too immature. Whipporwill cowpeas and German millet make a fairly satisfactory combination, and the qualities of the New Era lead us to the hope that it will make a still more desirable combination with German millet. The usual quantity of millet seed is one peck, with a bushel of peas, per acre.

Possibly the later varieties might also be suitable for sowing with German millet, if the seed of the latter could be put in the ground a few weeks after the peas had germinated.

In one case we tried this, drilling a row of millet within six inches of the pea row. The millet was sown 17 days after the peas were planted and yet it ripened before the Wonderful cowpeas were ready for haying. This was also true in the case of Japanese millet, and with two millets which were untrue to name, and which seemed to be Hungarian millet and common fox tail millet, the latter very much like German millet. Apparently the millets did not add to the yield of hay, but in the same test the yield of hay was materially increased when Amber sorghum and Wonderful peas were drilled together May 14. These two plants were ready for mowing at the same date.

In the following table are given the yields of hay afforded by cowpeas alone and in various combinations, all such mixtures being sown broadcast June 24, 1898, the peas, sorghum and corn at the rate of 64 pounds, the millet at the rate of 16 pounds per acre. The soil was a light sandy upland and no nitrogenous fertilizers were used.

Yields of hay from cowpeas alone and cowpeas in various mixtures.

Plot	COWPEAS.	MILLET, Etc.	Yield hay pr acre
3N	Whippoorwill.....	German millet	4560
3S	Whippoorwill.....	Texas millet	4240
4N	Clay.....	Japanese barnyard millet	4240
4S	Clay.....		3860
5N	Whippoorwill.....	Japanese barnyard millet	4320
5S	Clay.....	White Kafir corn	4720
6N	Clay.....	Texas millet	3840
6S	Clay.....	Stowell's sweet corn	3520
7N	Clay.....		3780
7S	Black.....	Texas millet	3780
8N	Clay.....	Early Amber sorghum	5440
8S	Black.....	Early Amber sorghum	5040

The stand of all the millets and of sweet corn and Kafir corn was very poor. The Japanese and German millet ripened earlier than was desirable. Kafir corn (a non-saccharine sorghum) and Amber sorghum were the only kinds which added to the yield of hay produced by cowpeas alone. Even this increase may have been chiefly water, for our notes show that the hay from the sorghum mixture was more moist than the other kinds and doubtless in unfavorable weather it would have been more difficult to cure.

We hope to continue the search for a grass-like plant pre-eminently suitable for sowing with cowpeas. Such a plant should have a fine stem like German millet and a longer period of growth.

Until this ideal plant is found we would recommend German millet as an aid in curing the early varieties of peas and possibly as suitable for drilling in or working in with a weeder several weeks after the later varieties have been sown. Amber sorghum is recommended as a means of increasing the yield on good land, but not as a means of making curing easier.

Most Profitable Method of Utilizing Cowpeas as Stock Food.

It may be of interest to record here the fragmentary data relative to this point that are afforded by our experiments at Auburn. Only with the variety Wonderful or Unknown have we made accurate determinations of the amount of seed and the amount of hay produced when the conditions of soil, fertilization, and culture were absolutely identical, this being done by making hay of the entire growth on certain plots and by harvesting only the seed on adjacent plots.

Relative yields of seeds and hay made by Wonderful cowpeas.

	Bus. seed.	Lbs. hay.
In 1897, drilled cowpeas yielded per acre	11.0	2420
In 1898, broadcast cowpeas yielded per acre	6.7	6400
In 1899 broadcast cowpeas yielded per acre	7.9	2004
Average three years	8.5	3608

The 8.5 bushels of seed, with accompanying hulls, would weigh only about one-fifth as much as the weight of hay recorded above. Hence, it is evident that the most profitable use of the crop as stock food would be to utilize the hay rather than to wait for all the seed to ripen.

If, however, it should be impracticable to harvest and utilize the cowpea as hay, our next recommendation would be to pasture hogs or cattle on the pea fields, of course reserving a sufficient area to produce seed for the next year's planting.

With nearly mature cowpeas utilized in this way we obtained at Auburn the following returns for an acre of cowpea pasturage, after first deducting the cost of the additional food fed while the animals were grazing on cowpeas:

	Net return from 1 acre.
With milch cows in 1900 grazing on corn stalks and drilled cowpeas between corn rows (Ala. Bul. 114); butter at 20c. and beef on foot at 2 1-2c per lb.....	$4.47
With milch cows in 1901 grazing on corn stalks and drilled cowpeas between corn rows (only butter considered)	$5.28
With shoats sold at 3 cents per pound, grazed in 1897 on cowpeas yielding about 13 bush. per acre (Ala. Bul. 93)	$10.65
With shoats in 1900, sold at 4c per lb. grazed on ripe drilled cowpeas (about 10 bus. per acre)	$4.90

When the cows grazed on parts of the corn and pea field where the peas were few or small and overripe the value of the pasturage on an acre fell far below the figures given above for 1901.

We have successfully preserved peavines in the silo, and at all stages of growth from early bloom until first pods color. They should be run through a silage cutter, and the silo heavily weighted. If the vines are put in without cutting the silage is often inferior and always difficult to remove. Special care in packing and weighting uncut peavines is necessary.

Methods of Harvesting Cowpea Seed.

Picking cowpeas is slow and expensive work. The charge for picking is frequently half the crop. If picking cannot be done promptly the crop is frequently ruined by mildew or rot of pods and seed. Hence some more rapid method is desirable. Possible methods are (1) cutting the vines with scythe or reaper when most of the pods are ripe, and later running the product through the threshing machine or beating the peas out by the slow process of flailing; (2) pulling the vines when the crop is thoroughly mature and beating out the seed with a flail; and (3) the use of a peavine picking machine.

While the latter is a possibility, we are unable to report any test made here of a pea-picking machine. It is to be hoped that the pea picker may be further simplified and especially that its price, which, as quoted to us, was prohibitive, being several times that of a mower, may be greatly reduced.

In 1898 we made a test of pulling Wonderful cowpeas when fully matured and beating them out with a flail. Even with hands unaccustomed to the work, pulling was much more rapid than picking, the rate per man being one and one-fourth acres per day. The process of beating out the peas was much slower, and this tedious work, together with the increased loss from shattered peas when the vines were pulled, and the removal of the plant food contained in the roots, were serious objections to this method. Apparently under some conditions it can be used to advantage as compared with picking.

Cutting the mature vines with a scythe early in the morning when there was least danger from shattering, was quite satisfactory, especially with the New Era variety, as it doubtless would be with any bunch pea on which the pods all ripen at about the same time and from which the leaves are dropped by the time the pods are mature. Scything will doubtless be more satisfactory with peas sown late because of their more erect and less tangled condition. The blade should be kept sharp to avoid shattering.

We have not tried the mower in harvesting cowpeas for seed because so many of the peas after cutting would be trampled over by the team in making its next round. The work of the reaper in green peavines indicated that it would be a satisfactory machine for harvesting mature cowpeas where the vines are not tangled.

Preliminary tests in running peavines through a grain thresher with concave removed resulted in breaking about half the seed.

The very limited tests made here several years ago of two patterns of pea threshers, or hand machines, for beating out peas after the pods had been picked by hand, failed to show any great saving by the machines tested as compared with flailing. As the particular machines employed were afterwards claimed to be not fair represetatives of those now on the market, we must await the results of further tests before drawing conclusions.

Our purpose is to continue the experiments as to the best methods of harvesting cowpeas.

Curing Cowpea Hay.

Long exposure to sunshine causes the leaflets, the most nutritious portion of the plant, to drop. Hence cowpea hay should be cured largely in its own shade, that is, with as little exposure as practicable of the mass of the hay. This is the foundation principle in hay-curing, but its application will vary greatly according to the state of the weather and the succulence of the vines when cut. No definite rule can be given as to the necessary number of hours of sunshine, but a few examples will show the method pursued at this Station under same conditions:

1898—*Sept.* 13, A. M. Cut with scythe, leaving vines in small loose windrows. Windrows turned over with fork, having received about 8 hours of bright sunshine, and exposed leaves having become just crisp enough to rustle when touched, but not dry enough to cause any perceptible loss of leaves in handling; weather during preceding 24 hours had been dry but partly cloudy.

Sept. 14, 4-5 P. M. Piled vines in large cocks, where, the weather being fair, they were left until *Sept. 21,* when the vines, now dryer than necessary, were hauled and stored in barn.

If rain had been threatened hauling would have occurred about Sept. 15, or else canvas hay-caps would have been placed on the cocks.

1899—*Sept. 12.* Mowed Wonderful variety. Given 12 hours sunshine while spread in swath; then raked

and immediately cocked, in which condition it was left 48 hours before hauling. When hauled the hay contained somewhat more moisture than was thought safe for storing in large masses, though not too much for storing in a thin layer.

1900—*Sept.* 24, A. M. Mowed Wonderful cowpeas in full bloom and having a few colored pods, growth not rank and containing some crabgrass.

Received in swath 24 hours' exposure, including about 10 of bright sunshine.

Sept. 25, A. M. Raked into windrows, and eight hours afterwards, or before night the same day, hauled.

Ordinarily it is safest not to haul direct from the windrows, but to leave the partially cured hay in cocks for several days and, if necessary, to open out these cocks an hour or two before hauling.

A part of the same field of cowpeas last referred to was employed in testing the practicability of very rapid curing and of storing hay in barn in very green condition, as is sometimes done with clover in the North, and as has been advocated for cowpeas in the South when threatening weather hastens hauling.

1900—*Sept. 24.* Immediately after the morning dew dried off, or about 8 to 9 A. M., the vines were mowed and left undisturbed and exposed on dry ground to bright sunshine for eight hours; then immediately raked, hauled, and stored 1,525 pounds of half-cured hay in small tight house.

It is claimed that when hay is stored in a very green condition it should be tightly packed and not afterwards moved, however much heat it may develop. This hay was packed in three feet deep and covered with other dryer hay, and the house closed.

The weather remained fair and dry for two weeks after this hay was stored. In five days the tempera-

ture had risen to 122 degrees at a point fifteen inches from the wall. This seemed to be the maximum temperature and by October 4 the thermometer had dropped to 110 degrees and white mould was abundant.

When the material was opened April 4, 1901, the entire mass, except for a space of about six inches next to each wall, was entirely rotten, and not simply blackened, as sometimes happens with an inferior but serviceable article of peavine silage.

The amount of material taken out was only 545 pounds, or about one-third as much as was put in, a part of the loss being moisture, but a large part of it being dry matter driven off by fermentation. This is an extreme case, but other instances where heat and white mould have developed in hay, field cured for several days, but stored too green, raises the suspicion that in our moist climate hay cannot be stored in as moist a condition as is sometimes done in the North. We should avoid both extremes, of storing hay when too green, and of exposing it too long in the field at the expense of color and nutritive value.

If urged to outline a general course of procedure founded on average results here, we would suggest cutting one day, and 24 hours later raking into windrows, where the hay may remain 24 hours; then cocking, and, if practicable, leaving these cocks in the field for two or three days, at the end of which time they may be opened for a few hours before hauling, or hauled without opening, according to the condition of the hay.

Special devices, for example, frames on which the stack or rick is to be built, or small poles with horizontal base on which the cock is built, have been recommended for use in curing peavine hay. Our experience with canvas hay caps as covering for hay cocks during

wet weather is very satisfactory, though the first cost is considerable. By cutting the crop little at a time and at intervals of a week or more, the hay caps may be repeatedly used, and a few dozen caps may thus serve in the curing of a considerable area of cowpeas.

Additional experimental work in curing peavine hay is planned.

Composition of the Different Parts of the Cowpea Plant.

To obtain data as the relative value of leaves, stems, and other parts of the plant, both as food and as fertilizers, samples were taken of six of the varieties grown in 34-inch drills in the variety test of 1899. These plants had been sown in drills on June 23, so that when samples were taken September 12 they had been growing not quite three months, and in some varieties none of the pods had colored. The roots were dug out to a depth of six inches, which depth seemed to contain all the larger roots and nearly all of the smaller ones. If harvesting had been delayed a week or two, which, with all these varieties could have been done without their getting too old to make good hay, the yields would doubtless have been larger.

The average yield of the six varieties sampled was 1,745 pounds of hay per acre on the basis of the weights of the samples 41 days after the vines were cut, or 1,628 pounds of the same degree of dryness as the samples when analyzed two years later.

The following table shows in percentages what proportion of the entire plant consists of leaves, pods and blooms, coarse stems, fine stems, fallen leaves and stems, and roots with attached stubble about two inches long.

Percentages in entire air-dried plant of leaves, pods and blooms, fine stems, coarse stems, fallen leaves, and roots and stubble.

Variety.	Leaves.	Pods and blooms.	Fine stems and runners.	Coarse runners.	Total available for food	Fallen leaves & fine stems.	Roots and 2-in. stubble
	%	%	%	%	%	%	%
Miller	21.0	1.6	19.9	14.8	57.3	17.7	25.0
Whippoorwill	17.0	23.3	16.4	18.7	75.4	3.7	21.6
Iron	17.0	23.3	16.4	18.7	75.4	3.7	21.6
Wonderful	18.7	7.8	15.3	18.0	59.8	19.2	20.3
Jones White	21.3	13.0	30.5	16.2	71.0	14.3	14.5
Clay	19.9	5.9	13.0	12.3	51.1	22.9	26.0
Average, 6 varieties	19.1	12.0	16.2	16.4	63.6	15.5	21.0

The chief difference among varieties as shown in the above table is in the percentage of pods and blooms. Naturally this was greatest in the Whippoorwill, for this was the earliest variety, and when cut September 12 it had more large pods than did any other. This earlier maturity also makes the Whippoorwill show the highest percentage of its weight available for animal food, viz: 75.4 per cent. On the other extreme is Clay, which, when cut at this stage of immaturity, (only about 2 per cent. of pods having colored), had only about half the weight of the plant available for hay.

Taking the average of all varieties, 63.6 per cent. of the air-dry weight of the plant was contained in the hay.

The leaves, the most valuable portion except perhaps the pods, constituted 19 per cent. of the weight of the entire plant, or 30 per cent. of the weight of the hay.

Of the hay cut at a stage when on some varieties from 2 to 10 per cent. of the pods had colored, and when

on others no pods had colored, the pods and blooms averaged 12 per cent. of its weight.

The leaves of all six varieties were mixed together after being weighed, and in like manner composite samples of the other parts of the plants were obtained.

The table below gives the composition of leaves, stems, etc., each sample being made up of a mixture of the corresponding parts of all six varieties. The analyses were made by the Chemical Department of this Station. In noting the small amounts of moisture it should be borne in mind that the samples had been kept in an office building for two years before the analyses were made. Weevil injured the pods so that they were not analyzed. The presence of considerable sand on roots and fallen leaves explains the high percentage of ash.

Composition of the parts of the cowpea plant, cut Sept. Average of 6 varieties.

	Moisture.	Ash.	Protien—(muscle formers, etc).	Nitrogen—free extract. Starch, etc.)	Crude Fiber.	Ether extract. (Fat, etc.)
	%	%	%	%	%	%
Leaves	10.65	10.98	22.44	31.69	16.78	7.46
Fine stems, etc	8.97	6.87	11.88	30.74	43.59	1.75
Coarse stems	8.47	4.92	9.44	33.12	42.19	1.86
Fallen leaves, etc	9.75	20.78	10.44	31.96	20.45	6.62
Roots and stubble	5.25	24.75	8.63	3.82	56.25	1.48

Let the reader note that the leaves were nearly twice as rich in protein as the fine stems; we may also infer from the small amount of crude fiber in the leaves that they are much more digestible than any other parts analyzed. These considerations emphasize the importance of retaining the leaves during the curing of pea-vine hay.