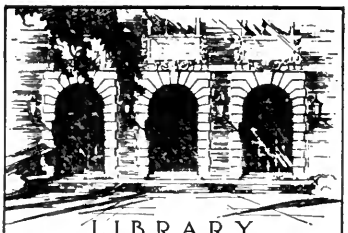

SORGHUMS AND SOYBEANS AS SILAGE CROPS for Milk Production

By W. B. Nevens and K. A. Kendall

Bulletin 578

NIVERSITY OF ILLINOIS · AGRICULTURAL EXPERIMENT STATION

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Urbana, Illinois July, 1954

Publications in the Bulletin series report the results of investigations made or sponsored by the Experiment Station

Sorghums and Soybeans as Silage Crops for Milk Production

By W. B. Nevens and K. A. Kendall[1]

ALTHOUGH CORN is still the chief crop grown for silage in Illinois, farmers in the state have shown increasing interest in ensiling other crops. The use of grasses and legumes for silage has, for example, become more widespread in recent years. Many Illinois farmers, however, prefer tilled row crops for silage, largely because they yield a high tonnage of forage, they are simple to harvest, the silage keeps well, and there is usually no need to add conditioners to the forage at the time of ensiling.

Among the tilled row crops other than corn that have held the interest of Illinois farmers who make silage are the sorghums (*Sorghum vulgare* Pers), particularly the taller varieties which produce large tonnages of forage. During the ten years 1938-1947, which include the period when the present study was made, about 11,000 acres of sorghums were grown annually in Illinois for silage. The use of corn for silage usually exceeds 150,000 acres yearly.

The principal reason for the growing of sorghums in this state is the belief that sorghum yields a greater tonnage of forage than corn. According to the U. S. Department of Agriculture, sorghum grown for silage averaged 9.8 tons an acre in Illinois from 1943 through 1950; during the same period corn grown for silage averaged 9.4 tons. The greater yield of forage from sorghum than from corn is often more of an apparent than a real advantage since under Illinois conditions sorghums are ensiled with a lower dry-matter content, so their dry-matter yield may be no more or actually less than that of corn.

While the sorghums are among the best-yielding forage crops in areas of low rainfall, particularly in the southwestern states, they grow well and produce large yields throughout most of the humid area of the United States. Because of their vigorous growth and heavy forage

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yields, they have attracted wide attention as potentially useful silage crops.

The types and varieties of sorghums differ widely in their characteristics, including growth habits (height of plant), length of time required to reach maturity, ability to withstand drouth, and yields of forage. The time at which a sorghum variety matures is one of the chief factors determining its adaptability and value as a silage crop. Late-maturing varieties are commonly grown in the South where seasonal conditions permit maturing of the grain and production of large amounts of forage. Early-maturing varieties are available for use in the North, but many farmers in Illinois have been so impressed with the larger-yielding late-maturing varieties that they have favored them for silage purposes. A distinct disadvantage of sorghum silage is often experienced when late-maturing varieties are ensiled before they reach a proper harvest stage. Silage made from sorghums too early in their development is usually sour and unappetizing and may cause an overlaxative condition in dairy cattle.

Because of the many problems and questions that arise in the use of sorghums as a silage crop, a series of trials was undertaken in which yields of a number of different types and varieties of sorghums were determined. A study was also made of the feeding value of sorghum silage in comparison with that of corn silage. Members of the sorghum species that were included in the investigations reported in this publication were sweet sorghum, or sorgo, kafir, milo, broomcorn, and Sudan grass (*Sorghum vulgare* var. *sudanense*). One corn hybrid was also included for comparison among the entries.

In some of the first silage investigations at this Station,[1] soybeans (*Glycine max*), then known as soja beans, received considerable attention. The present large acreage of this crop in Illinois, together with the rising interest in grass-legume silage, has raised questions concerning the value of the forage when this crop is ensiled alone and in combination with other forages. Soybeans can be grown in rows, in narrow drills, or may be interplanted with tall-growing crops such as corn and sorghum. The yields of forage of several varieties of soybeans were determined, and in addition the effect upon forage yields of interplanting soybeans with corn and with sorghums was studied.

An earlier publication of this Station[2] reports experiments in methods of making silage of Sudan grass and soybeans, yields of

[1] Composition and digestibility of corn ensilage, cow pea ensilage, soja bean ensilage, and corn fodder. Ill. Agr. Exp. Sta. Bul. 43. 1896.

[2] Legumes and grasses for silage: a report of experiments. Ill. Agr. Exp. Sta. Bul. 529. 1948.

broomcorn forage, and feeding value of silage made from broomcorn.

Specifically, the objectives of the investigation reported here were:

1. To obtain information on the yields for silage of sorgo, kafir, milo, broomcorn, Sudan grass, and soybeans when grown under central Illinois conditions.

2. To study the effects on yields of interplanting soybeans with sorghums.

3. To determine the protein content and protein yields of forage crops.

4. To compare the feeding value of sorghum silage with that of corn silage.

5. To study the effect on yields of forage of various factors, including late planting, the length of the growing period needed to reach the optimum stage for silage harvest, planting dates, interplanting, harvest dates, and variety.

PLAN OF INVESTIGATION

The land on which the crops were grown was, with one exception, highly productive land of the Station farm. Good soil practices, including liming, the growth of legumes, and the liberal application of barnyard manure, had been carried on for many years prior to the tests. In 1943, the first year of the trials, the successive plantings were made on a small field on the Station farm, with the rows about 10 rods long. The main crop harvested for silage, however, was grown on rented land, which was lower in productivity than the Station land. The rows on the rented field were about 80 rods long. In the other four seasons, 1944 through 1947, the plots were located on a field of the Station farm where the rows ranged in different seasons from 10 to 50 rods in length.

The sorghums and soybeans were planted with a corn planter in drilled rows 40 inches apart. During each of the five years (1943 through 1947) the same planter and the same planting adjustment rate on the planter were used. Drilling of the seed was repeated in the same rows as often as needed to obtain the desired thickness of stand. In the plots in which soybeans and sorghums were interplanted, an entire block of rows was first planted to a single variety of soybeans. The various varieties and types of sorghums were then planted by drilling them in the rows that had just been planted to soybeans. The sorghums were planted at slightly shallower depth than the soy-

beans in order not to disturb the soybean seed. The Sudan grass was planted with a grain drill in 7-inch drills and was not cultivated.

Because sorghum seed requires a warm soil for good germination, planting was done after the usual corn-planting period, except in one season in which successive plantings were made at two-week intervals. In that year (1944) the first planting was made May 12. The corn-planting period at Urbana is normally from May 10 to May 25, but in some of the seasons in this study planting was made in the latter part of this period or early in June because of rainy weather and also to avoid corn borer damage.

Measuring Forage Yields

Two methods of measuring forage yields were employed. The first, field sampling, was used for most of the determinations reported in this publication. The second, sampling and weighing the forage from a completely harvested block or field, was employed when the forage was ensiled.

Field sampling. The principal method of measuring forage yields for silage was field sampling. The yields were calculated from the weight and dry-matter content of representative samples of the standing crops. In the first season (1943) the field samples were taken at approximately 10-day intervals, starting August 14 and continuing until October 2. In the second season sampling was begun on August 18, and succeeding samples were taken at approximately two-week intervals until October 13. During the third season harvests were made on September 19 and October 5. The trials conducted during the last two seasons (1946 and 1947) were designed chiefly to confirm the observations made in preceding years on the comparative yields of the crops and varieties, and to provide further information on their value as emergency silage crops, that is, their yields and suitability for silage when planted late. Plantings were made in 1946 on May 28, June 11, and July 1, and in 1947 on June 12 and July 8.

A field sample consisted of the harvested plants from 8¼ lineal feet of row. The plants were immediately counted, bundled, and weighed in the field. Several plants totaling about 5 pounds in weight were at once selected and sacked for determination of dry matter. The balance of the bundle was discarded. In the case of crops interplanted with soybeans, a count was also made of the number of soybean plants in the sample. The dry-matter content of the soybean plants was determined separately.

The sacked subsamples were first dried to air-dry condition in a large forced-air drying chamber. All subsamples were finally dried in an electrically heated oven at 92° to 100° C.

Sampling the harvested crop. The second method used to measure the yield of forage was to weigh and sample the complete harvest from a block or field. Subsamples weighing 3 to 4 pounds were dried in an electrically heated oven at a temperature of 92° to 100° C. Portions of some of the subsamples were analyzed chemically for total protein content. The percentages of dry matter in the subsamples were used to calculate the acre-yields of dry matter.

Factors Influencing Crop-Yield Tests

Crop-yield tests are influenced by many factors. A few of the more important conditions under which these trials were conducted should be kept in mind when appraising the yields of the crops and the suitability of the various forages for silage purposes.

Productivity of soil. The crop comparisons were carried out on three different fields of the Dairy Science Station farm. The 1943 tests were conducted on two fields, one (Field E) high, and the other (Field N), medium in productivity. These fields were used for one year only. During the remaining four years of the trials, the test plots were located on a 50-acre field (P), a different portion of the field being used each year.

The productivity of the soil of field P was high as judged by the yields of fresh corn forage, which averaged 16½ tons an acre during the years 1943 through 1946. Average yields for the state are about 10 tons an acre. Frequent heavy applications of barnyard manure no doubt helped to maintain good forage yields. Seasonal conditions were favorable for growth of forage in each of the years.

Number and character of the entries. In these trials an attempt was made to select varieties or hybrids of the various crops under study that were known to be high yielding, and also to make limited tests of representative varieties or hybrids that seemed to offer possibilities as forage crops suitable for silage use. For the sorghums dwarf, early-maturing, and tall-growing late-maturing sorts were included. In a situation such as this, the mean yields of all the entries may not give a good index to the over-all value of the crop since the yields of each of the three groups of sorghums differ. It is obvious that a high proportion of low-yielding varieties might give an entirely different picture of sorghum yields than would appear if most of the entries consisted of high-yielding varieties.

The soybean entries, with one exception, consisted of varieties that are considered early- to medium-maturing for central Illinois. A late-maturing variety (Virginia) was one of four varieties grown in 1946. Had several late-maturing varieties been included, it is likely that considerably higher yields of fresh forage might have been obtained.

Physical limitations of the scope of the investigation permitted the use of only three varieties of kafir, four of milo, two of broomcorn, two of Sudan grass, and one of corn. The varieties selected were presumed to be reasonably well adapted to the soil and climatic conditions under which the trials were conducted.

The development of new high-yielding varieties or hybrids of any of the various forage crops studied may change the situation with regard to the relative value of some of the entries studied. The trials here reported, however, were not carried out in an attempt to find the highest-yielding sorts, but rather to study the suitability of the various crops for silage purposes when grown under central Illinois conditions.

Time and rate of planting. Wide variations in the yields of forage crops may occur as the result of planting too early, too late, or under conditions otherwise unfavorable to the development of that particular crop. In order to provide suitable growing conditions for the various crops and to reduce misjudgments concerning their forage yields, three successive plantings were made at 10- to 14-day intervals in 1943, 1944, 1945, and 1946, and two plantings 25 days apart were made in 1947.

An effort was made to plant each crop at each of the planting dates at the same rate. Presumably each crop has an optimum rate of planting for its maximum development under a particular set of soil and climatic conditions, but in these trials it was not possible to include a range of planting rates without greatly increasing the scope of the investigation. No doubt variation in rate of planting occurred as the result of differences in the size of seed in different years and other uncontrolled factors. Germination and seasonal differences affecting the growth of the young plants undoubtedly caused differences in the stands. The effect of such differences on the yields of forage were not measured by any of the procedures carried out in these trials. Visual inspection was relied upon to determine whether the stand was satisfactory for a particular crop and variety. Yield estimates for each entry were made on a portion of the plot that appeared to have a representative stand for that entry.

Statistical Analyses

In evaluating a large body of forage-yield data such as that which pertains to this investigation, there is danger of misinterpretation unless the results are carefully studied in the light of statistical analysis. The validity of the results was tested by analysis of variance. The conclusions that are based upon yield figures were drawn only after a detailed study of a large number of analyses of variance.

DESCRIPTION OF VARIETIES USED

Because of wide differences in the characteristics of varieties of a crop and the possible relation of variety to yield of forage, a brief description is given below of the principal varieties of each of the forage crops included in this investigation. The descriptions of the sorghums are largely based on Bulletin 349 of the Kansas Agricultural Experiment Station.[1]

Sorgos

The term "sorgo" refers to sorghums that have sweet, juicy stems and are commonly grown for forage or sirup. They are often referred to as saccharine sorghums. In this investigation two varieties of grain sorghum, one a dwarf grain sorghum and the other a milo, were included in the sorgo group as a matter of convenience in making comparisons and as a check on the method of yield determinations.

Atlas. Plants of Atlas grow to a height of 6 to 10 feet and require from 120 to 130 days to mature. The variety has a sturdy, leafy stalk, abundantly juicy and sweet. The heads are fairly compact, somewhat cylindrical in shape, with short branches well filled with white seed similar in shape to kafir but somewhat smaller. Atlas is superior to Kansas Orange in resistance to lodging, and its forage compares favorably with that of Kansas Orange and Sumac. Atlas is widely grown in states east of Kansas to the Appalachian Mountains. It is adapted to southern Illinois, but when grown in northern Illinois, it may not reach a suitable silage stage before frost.

Early Kalo. This variety is usually classified as a grain sorghum. Early Kalo grows to an average height of 42 to 50 inches and will mature in about 95 to 110 days. It has capacity to produce a high yield of grain. The slender stalks are somewhat dry and have from 8 to 12 leaves, producing cylindrical heads from 7 to 10 inches long. The seed

[1] Swanson, A. F. and Laude, H. H. Grain and forage sorghums for Kansas. Kan. Agr. Exp. Sta. Bul. 349. 1951.

is similar to pink kafir in shape and size, but of a pale reddish-yellow color.

Kansas Orange. This variety has been grown extensively and widely for silage. It grows to a height of 8 to 11 feet and ripens in 120 to 130 days. The heads are rather small and oblong in shape, with dark reddish-brown chaff and brown seeds. It is best adapted to the same areas as Atlas and like Atlas produces large yields of forage.

Leoti Red. Leoti Red is a sweet, juicy forage sorgo which grows from 6 to 7 feet high and matures in about 110 days. It has an open head with lax upper branches which droop. The seed is reddish-brown with red chaff.

Leoti is one of the sweetest forage varieties known, but the rind of the stalk is somewhat hard, which detracts to some extent from its feeding value. The variety also loses its leaves during high winds and in these trials was subject to lodging. Leoti is resistant to some of the bacterial leaf diseases.

Norkan. Norkan has the earliness and tonnage of Early Sumac and the white but somewhat smaller grain of Atlas. The plants are mid-early, mid-tall, and have stems slender, juicy, and a little less sweet than Early Sumac. The variety tillers freely. The plants have 10 to 12 mid-wide leaves. The variety, like Atlas, is widely distributed by the seed-trade houses in many sections of the country.

Early Sumac. Early Sumac is a highly valued forage sorghum. This variety grows from 5½ to 7 feet tall and matures in about 100 days. It appeals to farmers because of its uniformity, attractive appearance, earliness, ease of handling, and the fact that the stalks are juicy and sweet and not too large and coarse. Early Sumac has a small, red, somewhat bitter seed of limited feeding value.

Weskan. The forage characteristics of this variety are similar to those of Norkan except that the plants do not attain as large a size.

Corn

Because of other investigations in which the forage yields of a number of corn hybrids were being determined, only one corn hybrid (U.S. 13) was included in this trial. This hybrid is one of the most widely grown yellow corn hybrids. It has a strong root system, stiff stalks, and large thick ears with soft dent kernels. Under favorable conditions at the Illinois Station, forage yields reach 15 to 18 tons and grain yields 100 bushels to the acre. It is early to midseason in maturity for grain but reaches a suitable silage stage in 110 to 120 days.

Kafirs

The members of the sorghum group known as kafirs are grown for grain or for grain and forage. They usually do not grow as tall as the sorgos and the stems are less sweet.

Blackhull (usually known as Standard Blackhull). Blackhull kafir matures in 115 to 130 days. It grows from 5 to 7 feet tall and is characterized by juicy, stout, short-jointed stems; its 12 to 16 broad, stiff leaves are set close together, especially on the lower half of the stem. Standard Blackhull, in common with other varieties of kafir, is susceptible to kernel smut and has relatively high resistance to chinch-bug injury.

Pink. The normal height of Pink kafir is from 4 to 6 feet. The slightly juicy stalks are rather leafy and of medium size. Though Pink kafir is a grain sorghum, it often has been used for silage purposes.

Western Blackhull. Western Blackhull is similar to Standard Blackhull except that it matures earlier and the stalks are shorter. Western Blackhull grows from 4 to 5½ feet tall and ripens in 100 to 120 days.

Milos

The sorghums known as milos are primarily grown for grain but may also be used for forage. The short growing season they need to reach a silage stage and the possibility of late planting as an emergency forage crop made limited tests of several varieties of milo desirable. The varieties included were Cody, Caprock, Plainsman, and Sooner. These differ somewhat in their characteristics, but all are early-maturing and semi-dwarf, dwarf, or double-dwarf in type. At the Illinois Station they reached heights of 3½ to 4 feet. Characteristics of milos include rather dry stalks and large, oval, mostly pendant heads. Caprock, Plainsman, and Sooner are sometimes classified as grain sorghums.

Broomcorn

Broomcorn is grown primarily for the value of its brush, which is removed for the making of brooms. Previous tests at the Illinois Station, however, have shown that the forage may successfully be used for silage if the plant is harvested at a suitable stage of development.[1]

Black Spanish. Black Spanish has been in this country for fifty years but its origin is unknown. It usually grows to a height of 6 to

[1] Legumes and grasses for silage: a report of experiments. Ill. Agr. Exp. Sta. Bul. 529. 1948.

11 feet. The chaff is dark brown to black. The variety is relatively early.

White Italian. This variety has large stalks, grows taller, has less red color, and matures several days later than the Black Spanish. In these trials, White Italian lodged less than Black Spanish.

Sudan Grass

Sudan grass is sometimes spoken of as a grass sorghum, since it is one of the finer-stemmed members of the sorghum group.

Common. This variety grows to a height of 5 to 8 feet, has strong stems, and is early in maturity. It is subject to foliage diseases.

Sweet. Sweet Sudan grass does not grow quite so tall as the common, is later in maturity, and is more resistant to foliage diseases. It has sweeter stems and is better liked by dairy cattle than the common.

Soybeans

With one exception the varieties of soybeans used in these trials were of the seed, or grain, type. They are adapted for seed production in central and south-central Illinois. Chief and Gibson are larger growing and slightly later in maturity than the other grain types. The Virginia variety is late-maturing and is usually classified as a hay type.

FORAGE YIELDS OF SILAGE CROPS

As pointed out above, the objectives of this investigation were not confined to a comparison of silage crops on the basis of yield alone. A number of other factors, such as adaptability to soil and climatic conditions and feeding value, were considered. In appraising the merits of any crop from the silage standpoint, however, the yield per acre in terms either of fresh forage or of dry matter of the forage is of paramount importance.

Amount of fresh forage. The amounts of fresh forage (Tables 1, 2, and 3) produced by the various crops included in the trials, particularly the sorgo, kafir, broomcorn, and corn crops, were unusually large, being much above the state average for corn and sorghum. In 1943 the yields ranged from 15 to 29 tons to the acre, with many of the yields exceeding 20 tons (Table 1). Somewhat lower yields were obtained from these crops in 1944 (Table 2), even though planting was done earlier, usually an advantageous procedure. The difference was

Table 1. — Mean Yields of Silage Crops, Tons per Acre, 1943

(For detailed yields see Appendix Tables 8-12)

Crop	Dates of planting	Entries	Yield on harvest dates indicated											
			August 14		August 23		September 2		September 14		September 24		October 2	
			Fresh forage	Dry matter	Fresh forage	Dry matter	Fresh forage	Dry matter	Fresh forage	Dry matter	Fresh forage	Dry matter	Fresh forage	Dry matter
Sorgo, alone	June 1	7	21.7	4.1	20.8	4.3	21.5	5.0	22.3	5.3	23.1	6.4	20.3	5.6
	June 10	7	....	...	21.0	3.5	23.3	4.9	22.1	4.8	22.8	5.5	20.6	5.4
	June 21	7	....	...	22.5	3.2	23.1	4.2	23.1	4.9	22.4	5.3	21.8	5.4
Sorgo, interplanted[a]	June 1	7	22.8	4.4	23.3	4.4	20.6	5.4	24.2	6.3	21.7	6.3	20.9	6.2
	June 10	7	....	...	19.6	3.4	20.9	4.8	19.7	4.6	....	...	....	...
	June 21	7	....	...	18.8	3.0	19.9	3.8	20.9	4.3	....	...	....	...
Corn, alone	June 1	1	19.0	4.1	18.0	4.2	21.2	6.1	21.3	6.9	22.3	6.0	16.1	6.1
	June 10	1	....	...	18.6	2.5	20.8	4.2	20.4	5.2	20.8	5.7	21.4	6.8
	June 21	1	....	...	25.5	4.3	29.4	5.2	28.6	6.0	23.5	6.5	21.7	5.7
Corn, interplanted[a]	June 1	1	24.1	5.3	24.9	4.4	21.2	6.9	26.7	7.6	20.1	6.1	19.8	7.4
	June 10	1	....	...	22.6	3.6	20.2	4.3	22.2	5.9	....	...	....	...
	June 21	1	....	...	17.4	2.6	18.7	3.2	24.1	4.9	....	...	....	...
Kafir, alone	June 1	3	17.3	3.6	15.8	3.6	17.2	4.2	17.7	4.1	17.8	4.7	17.6	4.3
	June 10	3	....	...	15.5	3.2	16.9	3.6	16.5	3.5	16.0	3.7	15.7	4.2
	June 21	3	....	...	19.5	3.4	19.4	3.7	20.3	4.0	17.8	4.2	17.4	4.3
Kafir, interplanted[a]	June 1	3	20.0	4.4	18.6	3.6	19.6	5.1	19.7	4.5	17.2	4.4	14.9	4.4
	June 10	3	....	...	19.6	3.8	18.0	4.3	20.0	4.5	....	...	....	...
	June 21	3	....	...	14.8	2.5	14.8	2.9	17.0	3.4	....	...	....	...
Broomcorn, alone	June 1	2	19.9	5.5	19.8	4.9	19.7	6.3	20.2	6.6	....	...	18.6	6.6
	June 10	2	....	...	18.6	4.5	17.5	4.7	20.3	6.7	....	...	18.5	6.4
	June 21	2	....	...	21.3	4.3	26.4	7.7	23.0	6.0	....	...	22.0	7.8
Broomcorn, interplanted[a]	June 1	2	24.0	5.8	21.5	5.7	22.7	7.0	25.7	8.4	....	...	19.5	7.5
	June 10	2	....	...	19.6	3.8	18.0	4.3	20.0	4.5	....	...	....	...
	June 21	2	....	...	22.0	3.1	18.2	4.5	20.3	5.3	....	...	....	...
Soybeans, alone	June 1	4	10.5	2.1	13.1	2.6	12.2	2.8	12.5	2.8	11.4	3.2	6.6	2.4
	June 10	4	....	...	9.5	1.7	9.5	1.9	9.9	2.2	....	...	3.8	1.8
	June 21	4	....	...	8.8	1.6	10.0	1.9	11.2	2.5	....	...	4.5	1.5

[a] Interplanted with Illini soybeans.

Table 2. — Mean Yields of Silage Crops, Tons per Acre, 1944

(For detailed yields see Appendix Tables 13-17)

Crop	Dates of planting	Entries	Yield on harvest dates indicated									
			August 18-21		August 31		September 13		September 29		October 13	
			Fresh forage	Dry matter	Fresh forage	Dry matter	Fresh forage	Dry matter	Fresh forage	Dry matter	Fresh forage	Dry matter
Sorgo, alone	May 12	8	17.6	4.3	17.8	4.5	18.5	5.2	17.8	5.8	16.5	5.4
	May 26	8	21.7	4.4	19.7	4.3	22.8	5.9	20.7	6.5	16.8	5.2
	June 9	8	19.8	3.5	20.1	4.0	22.7	5.2	22.8	6.5	20.3	6.0
Sorgo, interplanted[a]	May 12	8	15.3	3.5	16.4	4.3	17.3	4.9	....	...	....	...
	May 26	8	18.4	3.7	17.5	3.9	17.8	4.3	....	...	....	...
	June 9	8	17.7	3.2	18.2	3.8	20.4	4.8	....	...	....	...
Corn, alone	May 12	1	12.4	3.5	13.1	3.9	8.1	3.4	....	...	7.7	5.8
	May 26	1	15.6	3.0	15.8	3.8	15.6	4.5	11.2	4.9	7.9	4.8
	June 9	1	20.8	3.3	19.2	4.0	18.8	4.4	21.7	...	20.7	7.5
Corn, interplanted[a]	May 12	1	15.8	4.0	15.0	4.6	14.3	4.5	....	...	....	...
	May 26	1	19.0	3.9	15.1	3.2	14.9	3.5	....	...	....	...
	June 9	1	18.2	2.9	17.0	3.2	21.1	4.9	....	...	....	...
Kafir, alone	May 12	2	17.2	4.3	16.5	4.3	16.4	4.9	14.2	6.0	12.3	4.6
	May 26	2	17.9	3.7	19.3	4.1	20.4	5.5	20.7	6.4	14.7	5.1
	June 9	2	15.8	2.7	17.6	3.5	20.9	4.7	22.5	6.0	20.0	5.6
Kafir, interplanted[a]	May 12	2	15.1	4.0	15.3	4.1	17.0	5.2	....	...	....	...
	May 26	2	17.2	3.2	14.8	3.3	15.5	4.0	....	...	....	...
	June 9	2	18.4	3.4	16.6	3.4	19.5	4.2	....	...	....	...
Soybeans, alone	May 12	4	10.0	2.3	12.2	2.8	12.6	3.0	7.2	2.6	4.5	2.5
	May 26	4	11.8	2.4	11.2	2.3	12.7	2.7	9.6	3.2	5.9	2.6
	June 9	4	9.3	1.7	8.0	1.7	10.6	2.4	9.6	2.6	7.2	2.1

[a] Interplanted with Chief soybeans.

apparently brought about by less favorable seasonal conditions. The low yields of fresh matter in corn at the last three harvest dates in 1944 were caused by early maturing and drying up of the forage.

The yields of fresh forage from these four crops in 1945, 1946, and 1947 (Table 3) were somewhat less, on the whole, than in previous seasons but were large in comparison with average state yields of corn and sorghum grown for silage. One of the reasons for the lower yields in 1946 and 1947 was the late planting, which was done to study the value of these crops for emergency use in case of failure or loss of an early crop.

The fresh-forage yields of soybeans were much below those of the four crops discussed above. A gross estimate of the yields during the five seasons would rate the yields of fresh forage in this crop at about half that of each of the other four crops (Tables 1, 2, and 3). The soybean varieties employed in the trials were medium-early to medium in maturity so that the fresh-matter yields during 1943 and 1944 declined sharply before the final harvest dates owing to rapid ripening of the plants.

Sudan grass proved to be a satisfactory silage crop from the standpoint of yields of fresh forage (Table 3). The yields were higher than the average state yields of corn or sorghum.

Amounts of dry matter. The yields of dry matter in all the crops except soybeans usually exceeded 3 tons and sometimes reached 7 tons to the acre (Tables 1, 2, and 3). This is above the state average, which is estimated to be 2.5 to 3 tons for corn and sorghum crops.[1] A yield of 3.5 tons may be considered good since this is about equal to the amount of dry matter in 4 tons of well-cured hay in the mow. Any yields that exceed 3.5 tons of dry matter to the acre may be considered large amounts for central Illinois conditions, so in these trials sorgo, kafir, broomcorn, Sudan grass, and corn were found to be high-yielding forage crops. In a few cases, especially for late plantings, the mean yields of these crops fell below 3.5 tons of dry matter.

The dry-matter yields of soybean forage, like the fresh-matter yields of this crop, were much lower than those of the other crops. The range of mean yields was from 1.4 to 3.2 tons of dry matter. The lowest yields were recorded at the last sampling date at a time when the crop was ripe or nearly so and many of the leaves had fallen.

[1] Assuming that these crops were harvested at a good silage stage, which in experiments at the Station has been found to be when the dry-matter content ranges from 25 to 30 percent.

Table 3. — Mean Yields of Silage Crops, Tons per Acre, 1945, 1946, and 1947

(For detailed yields see Appendix Tables 18-20)

Crop	Dates of planting	Entries	Yield on harvest dates indicated									
			September 19		October 5		September 6		September 26		September 25	
			Fresh forage	Dry matter	Fresh forage	Dry matter	Fresh forage	Dry matter	Fresh forage	Dry matter	Fresh forage	Dry matter
Sorgo	June 2, '45	8	19.5	4.8	18.4	4.6	....	...	....	...	....	...
	June 12, '45	8	19.0	4.3	21.0	4.5	....	...	....	...	....	...
	June 22, '45	8	25.6	5.0	25.1	4.8	....	...	....	...	....	...
	May 28, '46	6	....	...	....	...	23.9	5.1	26.0	7.5	....	...
	June 11, '46	6	....	...	....	...	....	...	18.7	4.7	....	...
	July 1, '46	6	....	...	....	...	....	...	20.3	4.0	....	...
	June 12, '47	6	....	...	....	...	....	...	....	...	15.8	3.2
	July 8, '47	6	....	...	....	...	....	...	....	...	18.9	3.1
Corn	June 2, '45	1	18.8	4.3	19.1	5.1	....	...	....	...	....	...
	June 12, '45	1	22.8	4.6	20.0	4.7	....	...	....	...	....	...
	June 22, '45	1	22.5	3.5	13.0	2.8	....	...	....	...	....	...
	May 28, '46	1	....	...	....	...	21.2	5.4	23.2	7.1	....	...
	June 11, '46	1	....	...	....	...	....	...	15.5	4.0	....	...
	July 1, '46	1	....	...	....	...	....	...	20.9	4.4	....	...
	June 12, '47	1	....	...	....	...	....	...	....	...	11.4	3.0
	July 8, '47	1	....	...	....	...	....	...	....	...	15.3	4.3
Kafir	June 2, '45	3	16.7	5.2	13.8	3.3	....	...	....	...	....	...
	June 12, '45	3	13.5	3.2	15.0	3.6	....	...	....	...	....	...
	June 22, '45	3	19.5	3.5	20.5	3.9	....	...	....	...	....	...
	May 28, '46	3	....	...	....	...	18.9	4.5	22.8	6.5	....	...
	June 11, '46	3	....	...	....	...	....	...	14.6	3.5	....	...
	July 1, '46	3	....	...	....	...	....	...	15.3	3.3	....	...
	June 12, '47	3	....	...	....	...	....	...	....	...	13.1	3.0
	July 8, '47	3	....	...	....	...	....	...	....	...	16.3	3.0
Sudan grass	June 2, '45	2	11.0	3.1	13.1	3.8	....	...	....	...	....	...
	June 12, '45	2	16.1	3.5	13.9	3.8	....	...	....	...	....	...
	June 22, '45	2	15.8	3.0	14.9	3.4	....	...	....	...	....	...
	May 28, '46	2	....	...	....	...	16.5	4.2	13.9	3.8	....	...
	June 11, '46	2	....	...	....	...	....	...	11.0	2.6	....	...
	July 1, '46	2	....	...	....	...	....	...	12.0	2.6	....	...
	June 12, '47	2	....	...	....	...	....	...	....	...	10.7	3.4
	July 8, '47	2	....	...	....	...	....	...	....	...	13.0	2.7
Soybeans	June 2, '45	4	7.8	2.0	7.6	2.3	....	...	....	...	....	...
	June 12, '45	4	7.3	1.7	8.0	2.1	....	...	....	...	....	...
	June 22, '45	4	7.7	1.8	8.1	2.2	....	...	....	...	....	...
	May 28, '46	4	....	...	....	...	12.2	2.6	11.1	3.2	....	...
	June 11, '46	4	....	...	....	...	....	...	9.1	2.4	....	...
	July 1, '46	4	....	...	....	...	....	...	6.6	1.5	....	...
	June 12, '47	4	....	...	....	...	....	...	....	...	5.1	1.4
	July 8, '47	4	....	...	....	...	....	...	....	...	6.2	1.4

FEEDING VALUES OF SORGHUM SILAGES

Forage yields alone are not an adequate measure of the feeding value of a crop. The usefulness of the various forages for silage purposes was studied (1) by determining the protein content and yield of protein to the acre and (2) by conducting feeding trials with silages made from sorghums (a mixture of sorgos and kafirs), Sudan grass, and broomcorn.

Protein Content of Forage Crops

One of the limiting factors in providing adequate rations for growing dairy cattle and for milk cows is a supply of protein. Most rations that do not contain a liberal proportion of legume roughage or some high-protein supplement supply insufficient quantities of protein. A study of the protein contents and protein yield per acre of a number of sorgos and kafirs and one corn hybrid was made to determine the comparative value of these crops as sources of protein.

Replicated plots of the crops shown in Table 4 were grown in a 5-acre block on land medium in productivity. Field sampling of the standing crops was carried out 101 days after planting, a time when most of the entries had reached a suitable silage stage, that is, when the dry-matter content ranged from 25 to 30 percent. Two sorgo varieties, however, had not yet reached this stage of development. Kansas Orange had a dry-matter content of only 23.7 percent, while Atlas sorgo was much less advanced, containing only 18.4 percent dry matter.

In corn at the silage stage, the ears are usually much higher in dry-matter content than the stalks and leaves. The sorgos and kafirs in this study displayed similar characteristics. Three of the early varieties of sorgo — Early Kalo, Norkan, and Early Sumac — showed dry-matter contents of the heads of more than 50 percent while the dry-matter content of the stalks and leaves of these varieties was about 20 percent. This situation showed early ripening of the seed while the remainder of the forage remained highly succulent.

All of the crops in this test showed good yields of dry matter to the acre, although the yields were not as high as they were in the portions of the investigation that were carried out on other fields. Presumably both Atlas and Kansas Orange had not reached their full potential yields since both varieties were still below 25 percent in dry-matter content at time of harvest. Early Kalo, a dwarf variety, was low in yield of dry matter.

Table 4. — Contents and Yields of Dry Matter and Protein for Sorgo, Corn, and Kafir Forage[a]

Entry	Dry-matter content			Yields of dry matter			Proportion of dry matter		Protein content[b]			Yield of protein per acre		
	Stalks and leaves	Heads or ears	Entire crop	Stalks and leaves	Heads or ears	Entire crop	Stalks and leaves	Heads or ears	Stalks and leaves	Heads or ears	Entire crop	Stalks and leaves	Heads or ears	Entire crop
	perct.	*perct.*	*perct.*	*tons*	*tons*	*tons*	*perct.*	*perct.*	*perct.*	*perct.*	*perct.*	*lb.*	*lb.*	*lb.*
Sorgos														
Atlas	17.7	27.8	18.4	3.7	.4	4.1	90.8	9.2	6.4	10.3	6.8	479	77	556
Early Kalo	19.4	54.5	29.4	1.5	1.7	3.2	47.1	52.9	7.3	10.2	8.8	223	352	575
Kansas Orange	21.4	41.9	23.7	4.7	1.1	5.8	80.5	19.5	5.8	8.9	6.4	544	203	747
Leoti Red	26.5	45.8	28.9	4.3	1.1	5.4	80.1	19.9	3.9	9.6	5.0	334	206	540
Norkan	20.4	57.6	27.9	3.0	2.1	5.1	58.2	41.8	7.9	9.6	8.6	467	407	874
Early Sumac	19.3	53.9	25.2	3.0	1.7	4.7	63.6	36.4	4.1	8.6	5.7	243	294	537
Weskan	21.9	43.7	25.4	2.4	.9	3.3	72.5	27.5	6.1	10.2	7.2	294	188	482
Corn														
U. S. Hybrid 13	20.5	38.7	28.0	1.7	2.3	4.0	43.0	57.0	6.3	8.2	7.4	215	372	587
Kafirs														
Blackhull	27.5	28.2	27.6	3.6	.6	4.2	85.1	14.9	5.9	8.9	6.4	433	114	547
Pink	24.5	46.0	29.3	2.9	1.6	4.5	65.2	34.8	4.6	9.7	6.3	266	302	568
Western Blackhull	21.2	40.8	25.1	2.5	1.2	3.7	67.5	32.5	4.7	10.9	6.7	234	262	496

[a] These crops were grown on rented land which was lower in productivity than the field on which the crops listed in Tables 8 to 12 were produced. Planting date, June 12; harvest date, September 21.

[b] Dry-matter basis.

The proportion of the dry matter that was contributed by the heads or ears varied greatly among the entries. The heads of Atlas sorgo were only partly developed and contributed but little to the dry-matter yield of this variety. Early Kalo sorgo and U. S. Hybrid 13 corn were well advanced in development, as shown by the percentage of dry matter in the forage, and contained more than half of their total dry-matter yield in heads or ears.

The protein contents of the forage (entire crop) of the various entries did not differ widely, all values falling within the range of 5.0 to 8.8 percent protein (Table 4). There were, however, rather wide differences between the protein content of the stalk and leaf portion of the forage and that of the heads or ears. In all cases the protein content of the heads or ears was higher than that of the stalk-leaf portions, in some instances being more than double that of the stalks and leaves.

The heads of Atlas sorgo, which were in early stages of formation, furnished only about one-fifth as many pounds of protein to the acre as did the Early Kalo and Norkan varieties, both of which were farther advanced in development. In some of the other varieties, however, the heads contained more than half of the protein yielded by the crop. More than three-fifths of the protein of the corn crop was contained in the ears. The acre yields of protein of the various entries ranged from a little less than 500 pounds in Weskan sorgo and Western Blackhull kafir to more than 800 pounds in Norkan sorgo. The mean yield for seven sorgos and three kafirs was approximately 600 pounds to the acre. These yields of protein are considered good but for most of the entries are considerably less in amount than that contained in a 3-ton crop of alfalfa hay, which normally furnishes 300 pounds of protein per ton or 900 pounds to the acre.

These trials indicate that there is an advantage in permitting the sorgos and kafirs to reach the recommended silage stage of 25 to 30 percent dry matter before harvest so that the seed with its relatively high protein content will have an opportunity to develop more fully than in forage harvested at an immature stage. At best, however, sorgo and kafir forage must be classed as low in protein as compared with the forages of such legumes as alfalfa and red clover.

Milk-Production Values of Sorghum Silage

The comparative feeding values for milk production of sorghum silage and corn silage were studied by means of a feeding trial with high-producing dairy cows.

The sorghum silage was made from the forage of the varieties of sorgo and kafir grown in the plots used for the determination of the yields reported in Table 20. About 65 tons of this forage was placed in a monolithic concrete silo on September 27. This harvest took place following the completion of the corn harvest, the objective being to permit the sorghum forage to mature as fully as possible before frost.

The silage corn was grown on another part of the same field and consisted of five corn hybrids, one of which was U. S. Hybrid 13. The four other hybrids had maturity dates nearly the same as that of U. S. 13. Both the sorghum forage and the corn forage were ensiled without the addition of water or conditioners of any kind. Both lots of silage were well preserved and in excellent condition for feeding.

The varieties of sorghum employed in these trials, when grown at Urbana, usually mature later than do the corn hybrids having maturity dates similar to that of U. S. 13. This is shown in the dry-matter content of the silage as fed. The sorghum silage contained 25 percent dry matter while the corn silage had approximately 30 percent dry matter.

The paired feeding plan was followed. This method calls for the feeding of both cows of a pair the same amounts of each of the feeds (silage, hay, and grain mixture). Careful selection of the cows was made so that the two cows of each pair were as nearly alike as possible in breed, live weight, stage of lactation, level of milk yield, stage of gestation, and feed-consuming ability. Two pairs of registered Brown Swiss cows and four pairs of registered Jersey cows were selected. One cow of each pair was assigned at random to Group I and the other cow to Group II.

The reversal plan of feeding trial was employed. Following a suitable preliminary period in which the level of feed intake of each pair was adjusted to the amount of the ration (silage, hay, and grain) both cows would consume, a 4-week trial was carried out in which Group I was fed sorghum silage and Group II was given corn silage. After a 1-week transition period in which the cows were gradually accustomed to the change, Group I was fed corn silage while Group II was given sorghum silage during a second 4-week period. Alfalfa hay of good quality and a grain mixture containing approximately 15.5 percent total protein were fed in addition to the silage and in the same manner, that is, each cow of a pair received the same amount of each kind of feed. The cows were weighed on three consecutive days at the beginning and end of each period. Results of the trial were measured in terms of amounts of milk produced, changes in level of milk yield, changes in

live weight, and in addition, general observations on the appetizing qualities of the silage.

The amounts of milk produced were larger (8 percent) during the feeding of corn silage than during the sorghum-silage periods (Table 5). This difference for the two rations was highly significant. When the group of cows fed corn silage during period I was changed to sorghum-silage feeding, the average daily milk yield per cow was 2.1 pounds less during the first week after the change than it had been during the last week of the previous period. On the other hand, the average daily milk yield per cow for the cows fed sorghum silage in

Table 5. — Results of Feeding Dairy Cows Sorghum Silage in Comparison With Corn Silage

Kind of silage	Number of cows	Average amounts of feed consumed per cow daily			Average production per cow daily		Average gain in weight per cow daily
		Silage	Hay	Grain	Milk	F.C.M.	
		lb.	*lb.*	*lb.*	*lb.*	*lb.*	*lb.*
Sorghum.....	12	32.2	10.0	7.5	23.6	27.2	−.15
Corn.....	12	32.2	10.0	7.5	25.5	28.2	−.17

period I and corn silage in period II increased during the first week of corn-silage feeding by 0.8 pound and continued to increase slightly during the second week.

Milk production in terms of fat-corrected milk (F.C.M.) was slightly larger (4 percent) during corn-silage feeding than during the feeding of sorghum silage. This difference, however, was not significant. During sorghum-silage feeding the percentage fat content of the milk was significantly higher than during the feeding of corn silage. The yield differences between the two rations were therefore less when computed on the basis of fat-corrected milk than when calculated only on the basis of pounds of milk.

The lower nutrient content of the sorghum silage than of the corn silage is presumed to account for the lower production of milk during the feeding of the sorghum silage. The average daily feeding of silage for each cow, which ranged from 30 pounds per head daily for four of the Jerseys to 42 pounds per head daily for the four Brown Swiss and averaged 32.2 pounds daily for all cows for the entire trial, provided approximately 1.6 pounds more dry matter when corn silage was fed than when sorghum silage was consumed. When milk yield is computed in relation to the amounts of dry matter consumed, it is found

that the cows fed corn silage produced 1 pound of milk for each 0.96 pound of dry matter of the entire ration, whereas during the feeding of sorghum silage, they yielded 1 pound of milk for each 0.97 pound of dry matter. Hence on the dry-matter basis the two rations were practically equal in milk-producing value. Milk production was limited during sorghum-silage feeding, however, by failure of the cows to eat it in large enough quantities to permit equalization of the dry-matter intakes of the two rations.

Most of the cows at first ate the sorghum silage with some reluctance, but after they had become accustomed to it they consumed it readily though not as freely as corn silage. Some of the cows fed corn silage, however, refused some of the cobs of the silage, the orts amounting to about 0.75 pound daily.

The live weight gains were variable, but the averages computed for the two experimental periods showed small daily losses per cow. This finding indicates that the average consumption of total digestible nutrients was slightly below the cows' requirements.

The criteria used as measures of the comparative feeding values of the two silages, namely, amounts of milk and fat-corrected milk (F.C.M.) produced, effect of ration change on level of milk yield, and live weight gains, indicate that the two silages differed only slightly in feeding value, the sorghum silage being less valuable than the corn silage. The lower value of the sorghum silage is attributed chiefly to its lower dry-matter content although the possibilities that this silage may also be lower in digestibility and in energy value per pound of dry matter are not precluded.

Milk-Production Values of Sudan Grass Silage

A mixture of Sweet Sudan grass and soybeans was grown in 7-inch drills for silage harvest. At the time of harvest the Sudan grass comprised approximately 70 percent of the fresh weight and 75 percent of the dry weight of the forage. The dry-matter content of the Sudan grass was about 29 percent and of the soybean forage 22 percent, while the dry-matter content of the forage as ensiled was approximately 27 percent. Sixty pounds of corn molasses was added to each ton of forage as it was ensiled. A total of 41 tons of forage received this treatment when ensiled in September.

A feeding trial in which comparison was made with silage of well-eared hybrid corn forage containing approximately 29 percent dry matter was carried out during January to March of the following

year. In the discussion which follows, the Sudan grass-soybean silage is referred to as Sudan grass silage. At the time of feeding, the Sudan grass silage contained nearly 50 parts per million of carotene while the corn silage contained only 25 parts per million. Both silages were well preserved and had a sharp acid taste. The Sudan grass silage had a water-soluble acidity content of 2.5 percent and the corn silage 2.0 percent. Both silages were in excellent condition except that during January exceptionally cold weather caused the silage next to the walls of the silos to freeze.

The milk-production values of the two silages were compared in a feeding trial with high-producing purebred dairy cows. The paired-feeding technique was used, employing three pairs of Brown Swiss, two pairs of Holsteins, and five pairs of Jerseys. The cows of a pair were as nearly alike as possible with respect to age, weight, capacity and level of milk production, and stage of lactation. Only three of the cows were pregnant (and these for only thirty days) at the time the

Table 6. — Results of Feeding Dairy Cows Sudan Grass Silage in Comparison With Corn Silage

Kind of silage	Number of cows	Average amounts of feed consumed per cow daily			Average production per cow daily		Average gain in weight per cow daily
		Silage	Hay	Grain	Milk	F.C.M.	
		lb.	*lb.*	*lb.*	*lb.*	*lb.*	*lb.*
Sudan grass...	20	32.2	10.6	8.7	28.8	31.1	−.18
Corn.....	20	32.2	10.5	8.6	30.3	32.3	+.37

trial began. One cow of the pair was assigned at random to Group I and the other to Group II. The cows of each pair were fed the same amounts and kinds of feeds daily except that one cow was fed Sudan grass silage and her pair mate was fed corn silage. The feeding of the various pairs differed, however, each pair being fed roughages in accordance with its feed-consuming ability. It was planned that silage would be fed at a rate of about 3 pounds daily and hay at the rate of 1 pound daily for each 100 pounds of live weight. Grain mixture containing 14.5 to 15 percent protein was fed at the rate of 1 pound for each 4 pounds of milk produced by Brown Swiss and Holstein cows and 1 pound for each 3 pounds of milk produced by Jerseys. Alfalfa hay of medium grade was supplied to all cows. The reversal plan of feeding was used as for the tests with sorghum silage (page 20).

The amounts of milk produced, calculated in terms of fat-corrected

milk, were 4 percent larger during the feeding of corn silage than when Sudan grass silage was fed. When the group of cows fed Sudan grass silage was changed to corn-silage feeding, the decrease in milk yield (F.C.M. basis) from the last week of period I through the first week of period II was only 3 percent, but for the group changed from corn silage to Sudan grass silage for the corresponding period there was a decline of 8 percent in F.C.M. production. During the feeding of Sudan grass silage the cows lost 103 pounds of weight while during corn-silage feeding they gained 207 pounds. The Sudan grass silage was consumed readily after the cows had become accustomed to it but as evidenced by occasional orts was not as appetizing as the corn silage. A summary of the results is given in Table 6.

It appears from the results of this feeding trial that the Sudan grass silage was slightly lower in feeding value than the corn silage. Presumably the corn silage was higher in its content of total digestible nutrients and thus supported milk yields and live weight better than the Sudan grass silage.

Milk-Production Values of Broomcorn Silage

The comparative milk-production values of broomcorn silage and of corn silage were studied in feeding trials with dairy cows. It was found that milk production and live weights were not as well maintained when broomcorn silage was fed as when corn silage was fed, although the differences were not large. A higher proportion of the broomcorn silage than of corn silage was refused, presumably because of fibrous, splinterlike pieces of stalk in the broomcorn silage. In one trial the cows fed broomcorn silage produced an average of 34.4 pounds of milk (F.C.M.) per head daily while during corn-silage feeding they produced 35.4 pounds daily. In a second trial 17 cows fed broomcorn silage averaged 36.3 pounds of milk (F.C.M.) per cow daily while their production when fed corn silage was 38.3 pounds of milk (F.C.M.) daily.

Chemical analyses of the silage showed that the fiber content of various lots of broomcorn silage ranged from 34 to 37 percent (dry-matter basis) while the fiber content of the dry matter of corn silage used in the feeding trial was about 22 percent.[1]

[1] Some further details of the feeding trial, together with figures showing the chemical composition of the silages, were published in "Legumes and Grasses for Silage: A Report of Experiments," Ill. Agr. Exp. Sta. Bul. 529 (1948).

FACTORS AFFECTING FORAGE YIELDS OF SILAGE CROPS

The yields of silage crops are influenced by a large number of factors. This investigation provided an opportunity for obtaining data on several of these. The numerical data covering the effects of these factors are shown in Appendix Tables 8 to 20 and the analyses of variance of the data in Appendix Tables 21 through 29.

Forage Yields of Late-Planted Crops

The results obtained in these trials, which extended over five seasons, indicate good possibilities of late planting of forage crops for silage purposes under central Illinois conditions. Late planting of a portion of the crop may be a useful procedure in providing forage at a suitable dry-matter stage over a longer period of time than when only one planting of the crop is made. Extending the silo-filling operation in this manner may be desirable when several silos on the farm are to be filled. Late planting may also be a useful emergency procedure.

Germination failures, insect damage, or other exigencies may necessitate replanting the crop or making other use of the land. One of the objectives of this investigation was to determine the suitability of the various crops for silage purposes when planted after the usual dates.

In order to compare the rate of development and yield of the forage crops, the plantings were arbitrarily divided into two groups, namely, those made on or before June 10 and those made after June 10. The rate of development is best studied by following the dry-matter content at various lengths of time after planting, and the dry-matter yield is best determined at stages at which the forage is suitable for ensiling (25 to 30 percent dry-matter content). A summary of the data is shown in Table 7.

It might be assumed that because of higher temperatures during the early part of their growing period, the late-planted crops would develop more rapidly than the early-planted crops, but judging from the figures in Table 7, the crops planted on or prior to June 10 differed but little in the rate of growth from those planted after June 10. The dry-matter content of the early-planted crop is nearly the same at a given length of time — for example, 81 to 90 days from planting — as that of the same crop when late-planted. The comparisons, however, were not carried much beyond the silage-harvest stage. The pos-

Table 7. — Rate of Development and Yield of Early-Planted and Late-Planted Silage Crops

Crops[a]	Data according to days from planting to harvest														
	71 to 80 days			81 to 90 days			91 to 100 days			101 to 110 days			111 to 120 days		
	Determinations[b]	Dry matter		Determinations[b]	Dry matter		Determinations[b]	Dry matter		Determinations[b]	Dry matter		Determinations[b]	Dry matter	
		Content	Yield		Content	Yield		Content	Yield		Content	Yield		Content	Yield
		perct.	*tons*		*perct.*	*tons*		*perct.*	*tons*		*perct.*	*tons*		*perct.*	*tons*
Sorgos															
Period I[c]	19	18.0	3.7	24	21.5	4.6	29	23.0	4.8	29	23.6	5.2	23	27.2	5.8
Period II[d]	12	17.9	3.7	18	20.1	4.5	14	22.6	4.6	24	23.3	4.7	7	22.3	4.3
Corn															
Period I[c]	3	18.3	3.3	4	20.5	3.9	5	26.0	4.6	5	27.4	5.4	3	29.4	5.6
Period II[d]	2	22.9	4.8	3	19.1	4.6	2	24.0	5.6	4	25.0	3.9	1	23.4	4.7
Kafir															
Period I[c]	9	20.1	3.2	12	21.1	3.6	15	22.9	4.2	15	26.3	4.6	12	26.7	4.8
Period II[d]	6	18.6	3.3	8	20.2	3.6	6	23.6	3.7	12	22.2	3.7	3	24.2	3.6
Broomcorn															
Period I[c]	4	25.7	5.0	4	25.6	4.8	4	32.5	6.5	2	32.3	6.6	2	34.2	6.4
Period II[d]	2	29.5	7.7	2	26.0	6.0	..	....	...	2	32.7	7.7	..	....	...
Sudan grass															
Period I[c]	..	....	...	..	....	...	..	....	...	3	27.8	4.0	..	....	...
Period II[d]	2	21.7	2.7	3	21.3	2.8	2	22.2	3.5	6	25.8	3.1	2	27.4	3.8
Soybeans															
Period I[c]	8	18.8	1.7	12	20.4	2.1	16	22.1	2.4	12	22.3	2.4	11	31.1	2.6
Period II[d]	4	19.7	1.5	8	22.5	1.8	3	24.5	1.8	12	28.1	1.8	3	28.4	2.0

[a] Varieties included Atlas, Early Kalo, Kansas Orange, Leoti Red, Norkan, Rox Orange, Early Sumac, and Weskan sorgos; U. S. Hybrid 13 corn; Blackhull, Pink, and Western Blackhull kafir; Black Spanish and White Italian broomcorn; Common and Sweet Sudan grass; and Chief, Gibson, Illini, and Lincoln soybeans.

[b] Number of individual determinations of dry-matter content and yield of dry matter. The means for dry-matter content and dry-matter yield are unweighted means of the varieties or hybrids.

[c] Planted on or before June 10.

[d] Planted after June 10.

sibility that the late-planted crops developed more rapidly after passing the usual silage stage is not precluded.

The values for percentage of dry-matter content which are shown in Table 7 indicate that broomcorn reached a suitable silage stage in a shorter time than the other crops. A period of 90 days or less was needed for broomcorn to reach harvest stage, while the other crops required growing periods of 100 to 120 days.

The yields of dry matter in sorgo, kafir, and soybean forages appear to have been reduced somewhat by late planting, but there was considerable variation among crops and varieties. The differences were more pronounced with soybeans than with the other crops and seem to indicate a distinct reduction in yield caused by late planting of this crop. This would be expected since soybeans are a short-day crop, that is, they approach maturity rapidly under the influence of short daylight periods.

Length of Growing Period Needed to Reach Optimum Stage

Choosing the best time or stage at which to harvest a silage crop in order to have both maximum yields of dry matter and sufficient moisture in the forage to insure good keeping conditions in the silo is one of the principal problems in silage-making. Determinations of the yield of forage and its dry-matter content provide the best solution to this problem.

Amounts of fresh forage. For crops grown alone good comparisons of the rates of increase in forage growth and the amounts of forage at various intervals after planting were obtained in 1943 and 1944. Crops from the June 1 planting (Table 1) were harvested at intervals of 10 to 14 days beginning on August 14, only 74 days from planting. It appears from these results that all the silage crops with the exception of soybeans had nearly reached their maximum yields of fresh forage by the first harvest date. All of the crops planted on June 10 were close to their maximum weights within 74 days from planting (August 23). Interestingly enough, the crops planted on June 21 were rapidly nearing their maximum weight at about the same number of days (73 in this case) after planting.

In 1944, the yields of fresh forage were somewhat less than in 1943, even though the plantings were made earlier in the spring. The sorgo and corn crops planted on May 12 and May 26 had reached or were rapidly nearing their maximum yields of fresh matter on August 18,

98 and 84 days, respectively, from the time of planting. Kafir was a little slower than sorgo and corn in reaching its full development of fresh-matter yields. It is possible that maximum yields were reached before the first harvests were made, although there is no recorded evidence to support this supposition. Except for kafir, the maximum yields of fresh forage in the crops produced from the June 9 plantings were attained by September 13, a period of 96 days from seeding. Except for the earliest planting (May 12), soybeans in 1944 had reached their maximum weights of fresh forage at about the same time as the other crops.

The yields of fresh forage declined when the forage crops advanced into the ripening stages. This was apparent for soybeans in 1943 and for both corn and soybean crops in 1944. The June 9 planting of corn, however, did not exhibit a decline in yield of fresh forage at the October 13 harvest date (Table 2) because the forage from that planting had not ripened to so great an extent as that from the two earlier plantings of this crop.

Amounts of dry matter. While there was little change in the yields of fresh forage after the crops had reached their maximum field weights, the amounts of dry matter continued to increase until advanced development caused a loss of dry matter, such as occurs in the ripening of leaves. Increases of 30 to 50 percent, and in a few instances as much as 70 percent, were noted in a number of the plantings (Tables 1 and 2).

The dry-matter yields in 1945, 1946, and 1947 (Table 3) were somewhat less than in 1943 and 1944. The comparatively low yields in 1947 are probably accounted for in part by the late plantings which did not give a sufficiently long growing season for maximum development.

Effect of interplanting. The interplanted crops (Tables 1 and 2) displayed much the same pattern of development as the crops planted singly, with respect to the length of time required to reach maximum yields of fresh forage. The largest weights of fresh forage to the acre were reached at or prior to the first harvest, while the maximum yields of dry matter in forage were not reached until three to four weeks later.

Effect of Date of Planting on Fresh-Forage Yields

These trials indicate that under central Illinois conditions late planting of crops for silage purposes is a reasonably dependable procedure under emergency conditions such as loss of an early planting

or in situations where it is desired to follow an early crop, such as winter rye pasture or a first harvest of alfalfa for hay, with a silage crop on the same field during the same season. Trials with corn, sorgos, kafirs, broomcorn, soybeans, and Sudan grass were carried out in the four years 1943 to 1946 to study the effect of late planting on yields of forage. Although the yields of fresh forage from late planting in some seasons were lower than those from early planting, the yields were satisfactory as judged by average yields of corn silage for the state (9.4 tons). For all crops except soybeans, the average yields of the late-planted crops exceeded 10 tons to the acre.

In evaluating the data obtained from field trials of forages, it must be kept in mind that weights of fresh forage form only a partial guide to forage yields. The yields of forage are best measured in pounds of dry matter because this is more closely related than weight of fresh forage to the feeding value.

Corn. It is quite evident that in normal seasons satisfactory yields of fresh forage may be obtained from late-planted corn. This is readily observed from Table 2, for example, where it is shown that the weights of forage from the May 12 planting had begun to decline by the time of the September 13 harvest, whereas the fresh forage yields from the May 26 and June 9 plantings were still as high or higher at the September 13 harvest as at earlier harvest dates. On October 13 the weight of fresh forage from May 26 planting had fallen to about half that of the earlier harvests from this planting but the fresh forage from the June 9 planting had not yet shown a marked decline.

Since only one corn entry was included in the trials, no statistical study was made of the data to determine the effect of the various factors, such as date of planting, upon yields.

Sorgos. There was clear-cut evidence that late plantings of sorgos may furnish good yields of fresh forage. In 1943 the yields of fresh forage at the different harvests were approximately the same regardless of the date of planting. In 1944 and 1945, on the other hand, the yields of fresh forage at the late harvest dates were significantly higher than those from early harvests. The 1946 season was less favorable to late planting, for the yields of fresh forage were highest from the May 28 planting and significantly lower from the June and July plantings.

Under the conditions of these trials, the sorgos retained their moisture content more tenaciously and were in suitable condition for silage for a longer period than corn. Of the seven varieties of sorgo planted June 1, 1943, only one was above the optimum silage stage of 25 to 30

percent dry-matter content on October 2, 123 days after planting (Table 8). Of the eight sorgos planted on May 12, 1944, only one exceeded 30 percent dry matter on September 13, 124 days after planting (Table 13). In both years, however, corn planted on the same dates as the sorgos was too near the ripening stage at the two harvest dates mentioned to keep well as silage, its dry-matter content being 37.8 and 42 percent, respectively.

In 1943 and 1945 there were differences in the response of the varieties to dates of planting but in 1944 varietal differences as affecting the date of planting were unimportant. The variety differences were not explained by insufficient or irregular stands since the stands in all cases appeared adequate.

Kafirs. The kafirs also were found suitable for use as a late-planted silage crop. They responded to late planting in a manner similar to that of the sorgos.

The fresh-forage yields of late-planted kafirs were significantly higher than the yields from early plantings in 1943 and 1944. In 1946 late plantings gave lower yields but the tonnage from all harvests was satisfactory. The 1945 results were variable and indicated no significant trend.

Broomcorn. The effect of date of planting upon the forage yields of broomcorn was studied in only one season (1943), when three plantings were made in June. Significantly higher amounts of fresh forage were obtained from the third planting than from the earlier plantings.

Soybeans. In 1943 the date of planting was responsible for a significant difference in the yields of fresh forage of soybeans. The yields from the first planting were higher than those of the later plantings. In 1944, 1945, and 1946, however, the differences between yields from the various plantings were without significance.

Sudan grass. In 1946 the yields of fresh forage from the planting made May 28 were significantly higher than those of the June 11 and July 1 plantings.

Effect of Date of Planting on Dry-Matter Yields

The changes in dry-matter yields of silage crops present a sharp contrast to those in the fresh-matter yields. In many cases the dry-matter yields continued to increase up to the last harvest date even though there was no corresponding increase in fresh-matter yields.

Early planting of the forage crops tested in these trials had a significant effect in increasing yields of dry matter in a majority of the

cases in which the effect of date of planting was studied. The advantage of early planting was greater when the forage was harvested at an early silage stage, that is, shortly after it had reached a dry-matter content of 25 percent. The date of planting had little effect on yields of dry matter when all plantings were permitted to grow until they were well advanced in development, that is, until after they had passed the usual silage stage of 25 to 30 percent dry-matter content. Late harvesting of the late plantings made it possible for the crops which normally require a long growing season, such as sorgos, to reach their full yield. Late planting was a distinct handicap to the yields of dry matter in Sudan grass and soybeans planted alone for forage.

During most of the seasons of these trials, late planting of corn, sorgos, and kafirs could have been used as an emergency procedure for the production of silage forage following the failure of early plantings or following early harvest of grass crops for silage.

The study of planting dates was primarily intended to provide information concerning yields during stages of development at which crops might normally be used for silage. The data on the effect of date of planting as it affects dry-matter yields are shown in the same tables as the data for the fresh-matter yields, Appendix Tables 8 to 29.

Corn. During 1943 and 1944, the dry-matter yields of the late-planted corn continued to increase for several weeks after the early-planted corn was ready for the silo so that last harvests showed little difference in yield between early and late plantings. In 1945 and 1946 late-planted corn was at a disadvantage, the yields of the late plantings being distinctly lower, while in 1947 the corn planted on July 8 gave a higher yield than that planted on June 12.

Sorgos. The data for sorgos planted alone at three different dates in 1943 (June 1, 10, and 21) show no significant effect of the date of planting upon the yields of dry matter in the forage harvested at five dates from August 23 to October 2 inclusive. On the other hand, in the same season significantly greater yields of dry matter for the early-planted crop (as determined at three harvest dates — August 23, September 2, and September 14) were obtained for the combined yields of interplanted crops, for interplanted crop alone compared with the single crop, and for the yield of the sorgo crop alone when interplanted with soybeans. Some varietal differences in response to date of planting were found.

No significant difference in yields of dry matter in sorgo forage resulted from planting at three different dates in 1944 and again in

1945 except in one instance of the crop alone when interplanted with soybeans. In this case, yields of the third planting were highest. In 1946 early planting of sorgos was distinctly superior to late planting in bringing about a greater yield of dry matter in the forage. The two plantings of sorgos made in 1947 gave practically the same yields of dry matter, although these results were considered too meager to justify statistical analysis.

Kafirs. The date of planting had but little effect upon the yields of dry matter in kafir forage. In 1944 and 1945 there was no significant difference caused by the short intervals between various dates of planting, but in 1943 and 1946 early planting proving advantageous in both seasons. The date of planting had no effect on dry-matter yields in 1947. Early plantings of kafir interplanted with soybeans in 1943 and 1944 were superior to later plantings in their yields of dry matter for the combined kafir-soybean forage.

Broomcorn. Broomcorn was grown only in one season (1943). Planting broomcorn alone at different dates had no significant effect on yields of dry matter. In the crop interplanted with soybeans, however, early plantings gave the highest yields of dry matter both for the combined yields of the two crops and for the broomcorn crop itself.

Soybeans. Early planting was decidedly advantageous in obtaining good yields of dry matter in soybean forage during three years of the trials (1943, 1944, and 1946), the differences being highly significant. Small differences were noted in 1945 but they had no significant trend. In 1947 the mean yields of dry matter from the June 12 and July 8 plantings were the same, but these yields were only half as large as those obtained in previous years from early plantings.

Sudan grass. Early planting of Sudan grass gave a significantly higher yield of dry matter in the forage than did later planting during the one season (1946) in which it was tested.

Forage Yields of Interplanted Crops

No sharply defined conclusion concerning the effect of interplanting forage crops with soybeans can be made. The results indicate that a number of factors influence the yields of interplanted crops. These include time of planting, kind of crop, growth habits of a variety, and character of the season. Rate of planting may also be a factor.

As explained above, interplanting of the silage crops with soybeans was carried out by replicating the plots and drilling into one set of

plots a seeding of soybeans in addition to the forage crop. The trials were conducted in the years 1943 and 1944. The variety used in the first year was Illini, while Chief was used in the second year.

Time of planting. In 1943 early interplantings tended to increase yields while interplantings made at later dates had less or no effect. Of the 46 comparisons resulting from the plantings on June 1, 1943 (Table 1), 37 favored interplanting and 2 showed no difference. Of the 24 comparisons available from the June 21 planting, all but one showed higher yields of forage from the crops grown alone.

A similar but less pronounced trend in which early plantings of interplanted crops were superior to later plantings is apparent in the 1944 comparisons for corn (Table 2). The May 12 plantings of corn favored interplanting and two-thirds of the comparisons based on the June 9 plantings favored the crop grown alone.

Kind of crop. Early interplanting of sorgos as compared with interplanting at later dates caused a significant increase in the yields of fresh matter and dry matter in 1943 and a significant increase in fresh matter of sorgos in 1944. Early plantings of corn responded well to interplanting. Interplanting with soybeans produced no significant differences in yields of the kafir and broomcorn crops.

Character of season. The 1944 results differed from those obtained in 1943. All of the 1944 comparisons of sorgo grown alone and sorgo interplanted with soybeans favored growing the crop alone (Table 2) while in the previous year the early plantings responded favorably to interplanting.

Variety. The growth habits of a variety within a crop species evidently is a determining factor in the response to interplanting. In these trials large-growing, heavy-yielding varieties of sorgo, such as Atlas and Kansas Orange, apparently hindered the growth of soybeans as compared with dwarf varieties. In 1943 soybeans interplanted with Atlas formed from 7 to 15 percent of the total crop and when interplanted with Kansas Orange 5 to 7 percent of the total crop (Table 9). On the other hand, soybeans interplanted with Early Kalo in 1943 comprised from 17 to 33 percent of the total crop, and in 1944 the results were similar. When interplanted with Atlas and Kansas Orange, soybeans comprised from 5 to 21 and from 14 to 26 percent of the total forage, whereas when interplanted with Cody, a dwarf, combine type, the soybeans formed 50 percent or more of the total crop at each harvest obtained from the May 12 and May 26 plantings (Table 15).

It appears from these results that variety is an important factor influencing yields of interplanted crops. The tall-growing crops presumably shade the soybeans to such an extent that growth is retarded.

Rate of planting. The effect of planting rate, that is, the spacing of the plants within the row, was not studied. It seems obvious, however, that wide spacing between the plants of a crop such as corn, combined with interplanting of soybeans, would result in a much higher proportion of soybeans in the total forage than would close spacing of the corn.

Effect of Harvest Date on Yields of Fresh Forage

The chief effect of date of harvest upon fresh-matter yields of forage was found to be related to the ripening of the crop. When harvests were made after the crop had begun to ripen and, in the case of soybeans, from which the leaves had begun to fall, the fresh-forage yields were lower than they had been at earlier harvests.

Corn. The yields of fresh forage of corn changed but little at the various harvest dates until after the forage had passed the stage when it contained 35 percent dry matter. Harvests made after this stage showed lower yields of fresh forage.

Sorgos. In all the comparisons of the effect of harvest date of sorgos on the yield of fresh forage, only one showed any significant effect of date of harvest. This one instance was in the yields of forage of sorgos grown alone in 1943, when the yields at the August 23 and October 2 harvests were slightly lower than those from harvests made between these dates.

Kafirs. No significant effect of date of harvest of kafirs was found. This crop, like the sorgos, requires a long growing season and the yields of fresh forage showed no pronounced decline caused by ripening.

Broomcorn. In only one of the four comparisons of the effect of harvest date on the yields of fresh forage in broomcorn was a significant effect found. This was for the yield of the crop alone when interplanted with soybeans in comparison with single planting. The differences in yield at the various harvest dates were small.

Soybeans. In both 1943 and 1944, the date of harvest had a highly significant effect upon the yields of fresh forage in soybeans grown alone. At the last harvest, ripening and loss of leaves caused the fresh-matter yields to fall to one-half or less of the earlier yields. The fresh forage of Illini soybeans planted June 2, 1945, contained 47.6 percent dry matter when harvested on October 5. This finding indicated near-

ness to a ripe condition and explains the decline in fresh-forage yields from 6.2 tons on September 19, when the crop contained 27.2 percent dry matter, to 4 tons on October 5 (Table 18).

Sudan grass. The data were considered too meager to justify statistical study of the effect of harvest dates upon the yield of fresh forage in Sudan grass.

Effect of Harvest Date on Yields of Dry Matter in Forage

Under normal conditions the dry-matter yield of a forage crop continues to increase until the maximum yield of dry matter has been reached. After that time, there may be a decline in yield caused by loss of leaves or leaching of nutrients from the fully matured portions of the plant.

The date of harvest was found to be one of the most important factors influencing the forage dry-matter yields of the crops under study. The yields continued to increase rapidly up to full development of the crop, and after that time to remain more or less stationary. Several successive harvests spaced at suitable intervals were required to demonstrate this finding.

Corn. The dry-matter yields of corn forage at successive harvest dates showed rapid increases up to full development of the crop. After that stage was reached, dry-matter yields remained practically stationary.

Sorgos, kafirs, broomcorn, soybeans. A total of 22 comparisons of the effect of date of harvest on the dry-matter yields of these crops in 1943 and 1944 was available for statistical analysis. The analysis of variance showed significant effects in 4 and highly significant effects in 16. The 2 comparisons in which no significant effect was found were those in which kafirs were interplanted with soybeans.

In 1945, three plantings were made of sorgos, kafirs, and soybeans. These were harvested at two different dates. Only for soybeans was a significant effect found for date of harvest. Slightly higher yields of dry matter were obtained at the second harvest than at the first.

Effect of Variety on Yields of Fresh Forage

Varietal differences in yields of forage crops are commonly observed. In these trials as many different varieties of each forage crop (except corn) were included as possible up to the limit of facilities for taking and drying samples. The data covering variety yields are shown in Appendix Tables 8-20.

Variety was an important factor contributing to differences in the fresh-forage yields of sorgos, a factor of some importance in kafirs, and a minor factor or one of no importance in the fresh-forage yields of the other crops. One of the reasons for the differences in the yields of the sorgos was the difference in growth habits of the various varieties, which ranged from dwarf to unusually large in size. The varieties of the other forage crops were much alike in their growth habits so that wide differences in yields of fresh forage were not expected. There were differences toward the end of the season, however, when forage weights declined because some varieties were nearer maturity than others.

Yields as high as 30 tons to the acre of fresh forage were produced by the large-growing varieties of sorgo while the tonnage from dwarf varieties seldom exceeded 15 tons. This is an important consideration in the choice of a silage crop.

Sorgos. The sorgo varieties included some large-growing, late-maturing sorts such as Atlas and Kansas Orange, and some medium-tall, medium-maturing varieties such as Norkan, Early Sumac, and Weskan. A dwarf grain sorghum, Early Kalo, was included during 1943, 1944, and 1945 for comparison.

Highly significant differences between varieties in their yields of fresh forage were found in each of the nine statistical comparisons of variety yields covering the three years. Variety differences at the two harvest dates in 1946 were not significant. The fresh-forage yields of Early Kalo and Cody ranged from one-third to two-thirds of those of Atlas and Kansas Orange. The yields of the other varieties were intermediate between these extremes.

Extremely high yields of more than 30 tons of fresh forage to the acre were recorded in several instances by Atlas or Kansas Orange. These yields are considerably above those of other sorgo varieties and also are higher than most yields of corn obtained in this study and in other corn-forage studies conducted at this Station.

Kafirs. The same three varieties of kafir were used throughout the five years of the study. Of the eight statistical comparisons of fresh-forage yields made in 1943 and 1944, four showed highly significant varietal differences, one a significant difference, and three no significant difference. The 1945 to 1947 data showed no significant difference in fresh-forage yields of varieties.

Broomcorn. When the two varieties of broomcorn were grown alone, highly significant varietal differences in yields of fresh forage

were found, the White Italian variety being higher than the Black Spanish. When broomcorn was interplanted with soybeans, no significant difference in yields was found between the two.

Soybeans. Four varieties of soybeans were grown in each of the five seasons of the trials. A significant difference in yields of fresh forage was found only in 1944 when variety differences in yield were noted toward the close of the season when the soybeans began to ripen and the dry-matter content rose sharply. The Illini variety was earliest in maturity, and its yields of fresh forage fell before declines in the forage weights of the other varieties were apparent.

Sudan grass. No significant difference in fresh-forage yields of the two Sudan grass varieties was found.

Effect of Variety on Yields of Dry Matter in Forage

Variety was a factor of prime importance in affecting the yields of dry matter of sorgos, the yields of dwarf varieties being only one-third to two-thirds as large as those of tall-growing late-maturing varieties. For the other forage crops, variety differences were of less importance, partly because fewer entries were included and partly because of apparent yield similarities of the varieties tested.

Sorgos. Highly significant differences between dry-matter yields of sorgo varieties were found for each of the eight statistical studies that were made of the 1943 and 1944 results, and for the one study of the 1945 data. No significant difference was found for the 1946 data.

As would be expected from observation of fresh-matter yields, Atlas and Kansas Orange were outstanding in their yields of dry matter, giving higher yields at most harvests than the other varieties. The yields of Early Kalo and Cody were lowest. The dry-matter yields of the remaining varieties were intermediate between these extremes with no distinctive order of placement for this characteristic.

Although Leoti Red produced good yields of dry matter, it proved unsatisfactory as a silage crop because of its lodging tendency. It was discontinued after the first season.

Kafirs. Of the four yield comparisons of kafir varieties in 1943, three showed highly significant differences in yields of dry matter and one showed a significant difference. In 1944 one comparison showed a significant difference and three lacked significance. No significant difference between varieties in the yield of dry matter was found in the other years, probably because of the small number of harvest data in each of those years.

Broomcorn. None of the four analyses of variance of broomcorn data showed significant variety differences in dry-matter yield, probably because only two varieties of this crop were included in the trials, and the data were thus limited.

Soybeans. In only one season was a significant difference found in the dry-matter yields of the various soybean varieties. In most cases varieties planted on the same day produced yields of dry matter that were not widely different at any particular harvest.

Sudan grass. Common Sudan grass in 1946 produced a significantly higher yield than did Sweet Sudan grass.

Effect of Thickness of Stand on Yields

Differences in kinds or varieties of forage crops may sometimes be explained by differences in stand. In these trials the stand was satisfactory except in one instance. It was obvious that significant yield differences could not be explained by the stand of the crop. Early work at the Kansas Agricultural Experiment Station showed that diverse planting rates of Red Amber Sorgo seeded in close drills made little difference in yields of forage.[1]

The relative thickness of stand of the various crops was determined by counting the number of plants per lineal rod at the time of taking the field samples. Since no attempt was made by hand thinning or otherwise to reduce the stand of the various entries to a uniform basis, considerable variation occurred (1) in the stand of a single entry at the successive plantings within a season, (2) between different entries of the same crop, (3) between crops, and (4) between seasons.

On the whole there were distinctive differences between the kinds of crops with respect to the thickness of the stand. A larger number of plants to the row was found in the sorgo entries than in the other crops. Among the sorgo entries, Kansas Orange, Early Sumac, and Weskan had an especially large number of plants to a lineal rod of row (Tables 8-20). The kafirs did not give quite as thick a stand as the sorgos, probably because of less tillering. The broomcorn stands were intermediate between those of the kafirs and sorgos. The number of soybean plants to the lineal rod of row was not widely different from that of the kafirs except for the third (June 9) planting in 1944 (Table 16), when the stand was lower than for other planting dates. The soybean stands for this date may have been adversely affected by weather conditions. The number of corn plants to the rod of row was markedly lower than in any other crop.

[1] U. S. Department of Agriculture Bulletin 1260. 1924.

There was little evidence to indicate that a reduced stand resulted from plantings made later than the initial one, except in the one instance mentioned above in connection with soybeans. When there is insufficient moisture to provide complete germination, the stand obtained in late plantings may be substantially reduced, but in the trials here reported, there were a number of cases in which the stand in the third planting of the season was highest. In only one instance (Table 20) was it found that the yield was limited by an insufficient stand.

The procedure followed did not include controlled planting rates in which a specified number of seeds were planted per foot or rod of row. No thinning was practiced. It appeared that thin stands of sorgos became thicker under favorable conditions of rainfall because of tillering. Such effects were less evident in the other crops.

Effect of Season

Fortunately the first four years during which these trials were conducted were favorable to high yields, although the dry-matter yields in 1943 and 1944 were somewhat larger than those in 1945 and 1946 (Tables 1, 2, and 3). The yields in 1947 were lower than those in previous years. Variation in forage yields of a variety occurred from year to year as would be expected.

The data made possible a visual comparison of one year's results with those of another, but no statistical study of yields as affected by season was attempted.

SUMMARY AND CONCLUSIONS

Field trials were carried out during five consecutive years, 1943 through 1947, for the purpose of determining the yields and suitability for silage of the forage of a number of types of sorghum, including sorgo, kafir, milo, broomcorn, and Sudan grass, and also soybeans of the grain type. One corn hybrid was included in the tests. Facts sought included acre yields of fresh forage and of dry matter; feeding value of sorghum silage in comparison with that of corn silage; and effect on yields of various factors, including length of growing period, planting dates, interplanting with soybeans, harvest dates, and variety.

The sorghums and soybeans were drilled with a corn planter in rows 40 inches apart. Cultivation was carried out as with corn. Three successive plantings at intervals of 1 to 2 weeks were made in four

years, and two plantings separated by a 26-day interval were made in the fifth year. In two years replicated plantings were made in which soybeans were interplanted with the sorghums and with corn.

Acre yields were determined from samples of the standing crop. In the first two years samples were taken at one- to two-week intervals beginning with early silage-harvest stage to late silage-harvest stage and less often in the other three years. The data were subjected to analysis of variance.

The chief unavoidable or uncontrolled factors are believed to have been: (1) variations in soil productivity from year to year because of differences in location of the plots; (2) differences in seasonal conditions (rainfall, temperature, etc.); (3) differences between varieties (for example, dwarf, early-maturing, and late-maturing sorgos); (4) variations in the thickness of stand; and (5) the sampling method, which like all methods of determining forage yields is subject to a number of errors.

Forage Yields

In these trials the fresh-forage yields of the sorgos, kafir, broomcorn, and corn were much above the reported average yields of corn and sorghum forage for Illinois. Many of the yields exceeded 20 tons and a few yields of more than 30 tons were obtained. Fluctuations in yield occurred from year to year, depending upon seasonal conditions. The milos and soybeans produced less fresh forage to the acre than did the other crops. Yields of fresh soybean forage were about half as large as those of sorgo, kafir, broomcorn, and corn. Sudan grass, which was medium high in yield, proved to be satisfactory as a silage crop which might be ensiled separately or mixed with another crop such as soybeans.

For central Illinois the estimated average yield of dry matter in corn and sorghum crops at the silage-harvest stage is approximately 2.5 to 3 tons to the acre. In most of these tests the yields of dry matter exceeded 3 tons and in a few instances reached 7 tons to the acre. Sorgo, kafir, broomcorn, and corn were found to be high-yielding forage crops while soybeans were comparatively low in yield.

Feeding Values of Sorghum Silages

Determinations were made of the protein content of the forage of sorgos, kafirs, and corn, as well as amounts of protein to the acre in the forage of each of these crops. Trials with milk cows were

carried out to compare the feeding value of corn silage with that of three kinds of sorghum silage — mixed sorgos and kafirs, Sudan grass, and broomcorn.

Protein content. Comparisons of the yield and protein content of the crops at a suitable silage stage showed that forage of sorgo and kafir is similar to corn forage in that (a) the dry-matter content of the heads was much above that of the leaf-stalk portion; (b) the heads showed early ripening while the leaves and stalks still retained a high proportion of moisture; (c) the proportion of the dry matter of the forage contained in the heads or ears at the date of harvest varied greatly among the entries, being low at early stages of development and larger at well-advanced silage-harvest stages; (d) the protein content of the heads or ears in all cases was higher than that of the leaf-stalk portion, in some instances being twice as great. The yield of protein to the acre for most of the entries was less than 600 pounds; a 3-ton crop of alfalfa hay usually contains about 900 pounds of protein.

Milk-production values of sorghum silage. The comparative values, for milk production, of sorghum silage (made from a mixture of sorgo and kafir forage) and corn silage were studied in a feeding trial with 12 high-producing dairy cows. The sorghum silage contained 25 percent and the corn silage 30 percent dry matter. The average amount of silage fed daily (32.2 pounds) provided 1.6 pounds more dry matter when corn silage was fed than when sorghum silage was fed. The cows fed corn silage produced 8 percent more milk and declined in milk yield less rapidly than the cows fed sorghum silage. The amount of milk produced for each pound of dry matter consumed was practically the same for both rations. In the case of the sorghum-silage ration, the consumption of silage was limited by failure of the cows to eat it freely.

Silage made from a crop of Sudan-grass-soybeans in which Sweet Sudan grass comprised 70 to 75 percent of the forage proved acceptable to dairy cows and was consumed readily after the cows became accustomed to it. Milk yields and live weights were not as well sustained during the feeding of Sudan grass silage as when corn silage was fed. It was demonstrated, however, that a Sudan-grass-soybeans mixture may be used as a silage crop with a high degree of success.

Silage made from broomcorn forage was rated only fair as a feed for milk production. About one-sixth of the silage fed was refused, presumably because of the hard, splinterlike pieces of stalk in the

silage. The silage had an unusually high fiber content. The corn silage with which comparison was made sustained milk yields at a higher level than did the broomcorn silage.

Factors Affecting Forage Yields of Silage Crops

Many factors affect forage-crop yields. Several of these factors were given special study.

Length of growing period. Harvesting the forage at intervals of 10 to 14 days from early-silage to late-silage stages showed that maximum yields of fresh forage were reached as early as 74 days after planting. The amounts of dry matter in the forage continued to increase, however, the increases amounting to 30 to 50 percent between the first and final harvest dates.

Date of planting. During the five years in which these experiments were conducted, late planting of silage crops proved an effective means of obtaining good yields of fresh forage. In some years late plantings yielded higher than earlier plantings, depending upon seasonal conditions.

Early planting of the forage crops under test had a significant effect in increasing yields of dry matter in forage in a majority of cases in which this factor was studied. This effect upon yields was more pronounced when all plantings were harvested early (on the same date) than when the crops were permitted to grow until all had reached full development.

Interplanted crops. Interplanting grain-type soybeans (Illini and Chief varieties) in the row with each of the varieties of sorgo, kafir, broomcorn, and corn in two seasons showed little over-all advantage for interplanting. A number of factors influenced the forage yields of interplanted crops. Interplanting at an early date tended to increase yields while interplanting at later dates had little or no effect. The character of the season also influenced the results. The forage crops differed from each other in their responses to interplanting, corn and sorgo showing greater response to this practice than did kafir and broomcorn. There were also differences among sorgo varieties in their forage-yield responses to interplanting.

Date of harvest. Most of the forage crops studied had reached their full yield of fresh forage by the time they were ready for harvest as silage (25 percent or higher dry-matter content) and continued to remain at approximately the same yield level for several weeks. Advancing into the ripening stage caused weights of forage to decline.

In sharp contrast to the yields of fresh forage, the dry-matter yields continued to increase rapidly up to full development of the crop, and after that to remain more or less stationary. The date of harvest, therefore, was one of the most important factors influencing the dry-matter yields of forage. Harvesting at too early a date meant a sacrifice of part of the potential yield.

Variety. For sorgos, the yields of both fresh forage and dry matter in forage were greatly influenced by the variety of the crop because several different types were represented. For the other forage crops, variety did not have an important influence, presumably because the varieties within a crop were closely alike in growth habit and length of time required to reach maximum yields.

APPENDIX TABLES

Table 8. — Yields of Silage Crops Planted June 1 and Harvested on Six Different Dates, 1943

Entry	Plants per lineal rod	Harvested Aug. 14			Harvested Aug. 23			Harvested Sept. 2		
		Dry matter content	Acre yield		Dry matter content	Acre yield		Dry matter content	Acre yield	
			Fresh forage	Dry matter		Fresh forage	Dry matter		Fresh forage	Dry matter
		perct.	*tons*	*tons*	*perct.*	*tons*	*tons*	*perct.*	*tons*	*tons*
Sorgos										
Atlas	74	17.9	25.5	4.6	17.6	22.1	3.9	24.0	25.8	6.2
Early Kalo	67	21.8	11.2	2.3	26.2	11.2	2.9	24.0	8.8	2.1
Kansas Orange	91	18.3	29.9	5.5	19.6	29.1	5.7	22.5[a]	29.4	6.6[a]
Leoti Red	64	17.0	23.8	4.1	18.7	20.7	3.9	22.4	22.6	5.1
Norkan	81	19.3	22.1	4.3	21.4	21.6	4.6	23.4	21.6	5.1
Early Sumac	114	18.7	23.4	4.4	20.7	24.9	5.2	23.7	24.9	5.9
Weskan	79	20.7	16.1	3.3	25.3	15.9	4.0	23.1	17.7	4.1
Corn										
U. S. Hybrid 13	21	21.7	19.0	4.1	21.6	18.0	4.2	28.6	21.2	6.1
Kafirs										
Blackhull	63	19.5	18.3	3.6	23.5	18.3	4.3	24.0	20.8	5.0
Pink	79	21.9	15.6	3.4	23.9	14.6	3.5	27.3	15.0	4.1
Western Blackhull	55	21.5	18.1	3.9	21.1	14.5	3.1	22.2	15.8	3.5
Broomcorn										
Black Spanish	76	29.0	18.8	5.7	25.3	17.5	4.4	35.3	18.5	6.5
White Italian	82	24.5	21.0	5.2	24.3	22.1	5.4	28.9[a]	20.9	6.0[a]
Soybeans										
Chief	69	20.9	9.1	1.9	19.5	11.2	2.2	24.3	12.5	3.0
Dunfield	62	21.1	10.6	2.2	22.8	14.0	3.2	24.2	10.9	2.6
Mansoy	51	18.7	10.6	2.0	17.2	14.5	2.3	20.1	13.4	2.7
Illini	65	20.4	11.7	2.4	22.4[a]	12.5	2.8[a]	24.4	11.8	2.9
		Harvested Sept. 14			Harvested Sept. 24			Harvested Oct. 2		
Sorgos										
Atlas	74	23.9	25.5	6.1	32.0	26.4	8.4	26.7	26.4	7.0
Early Kalo	67	20.7	10.4	2.1	23.8	9.6	2.3	29.3	8.3	2.4
Kansas Orange	91	25.6	27.3	7.0	27.7	31.2	8.6	31.3	25.3	7.9
Leoti Red	64	25.5	25.2	6.4	27.0	26.5	7.2	24.7	18.9	4.7
Norkan	81	21.2	23.5	5.0	27.6	22.6	6.3	29.2	19.1	5.6
Early Sumac	114	25.3	27.3	6.9	27.2	25.7	7.0	29.1	26.4	7.7
Weskan	79	20.7	17.0	3.5	26.9	19.8	5.3	23.7	17.6	4.2
Corn										
U. S. Hybrid 13	21	32.2	21.3	6.9	26.8	22.3	6.0	37.8	16.1	6.1
Kafirs										
Blackhull	63	24.4	21.7	4.4	24.9	19.0	4.7	26.8	21.5	5.7
Pink	79	21.0	20.9	4.4	28.3	17.9	5.1	23.8	18.2	4.3
Western Blackhull	55	33.3	10.4	3.5	26.4	16.5	4.4	23.5	13.2	3.1
Broomcorn										
Black Spanish	76	31.0	17.9	5.5	....	....	...	31.1	16.6	5.2
White Italian	82	33.6	22.5	7.6	....	....	...	38.6	20.6	8.0
Soybeans										
Chief	69	20.9	9.6	2.0	22.2	12.4	2.7	22.4	6.6	1.5
Dunfield	62	22.7	14.9	3.4	32.3	11.1	3.6	51.2	5.1	2.6
Mansoy	51	20.5	13.7	2.8	24.3	13.8	3.4	30.2	10.0	3.0
Illini	65	24.8	11.8	2.9	33.8	8.4	2.9	57.0	4.5	2.6

[a] Based on dry-matter percentages immediately preceding and following this sampling date.

on Six Different Dates, 1943

Entry	Harvested Aug. 14			Harvested Aug. 23			Harvested Sept. 2			
	Dry matter content	Acre yield		Part of total crop[a]	Dry matter content	Acre yield		Part of total crop[a]	Dry matter content	Acre yield		Part of total crop[a]
		Fresh forage	Dry matter			Fresh forage	Dry matter			Fresh forage	Dry matter	
	perct.	*tons*	*tons*	*perct.*	*perct.*	*tons*	*tons*	*perct.*	*perct.*	*tons*	*tons*	*perct.*
Sorgos												
Atlas	15.9	25.8	4.1	7	17.6	26.2	4.6	15	25.0	23.6	5.9	14
Early Kalo	20.1	17.4	3.5	26	20.6	13.1	2.7	33	27.9	12.9	3.6	17
Kansas Orange	18.7	31.0	5.8	5	17.5	30.8	5.4	6	25.3	27.3	6.9	7
Leoti Red	18.7	19.3	3.6	11	21.4	21.5	4.6	13	26.6	18.8	5.0	14
Norkan	20.9	20.1	4.2	7	19.1	22.5	4.3	12	25.6	20.3	5.2	12
Early Sumac	19.8	25.8	5.1	10	19.0	28.9	5.5	9	26.0	24.6	6.4	6
Weskan	20.6	20.4	4.2	14	20.2	19.8	4.0	18	26.5	16.6	4.4	11
Corn												
U. S. Hybrid 13	22.0	24.1	5.3	9	17.7	24.9	4.4	11	32.5	21.2	6.9	17
Kafirs												
Blackhull	21.2	20.8	4.4	16	17.8	21.3	3.8	37	24.2	21.5	5.2	12
Pink	22.4	19.2	4.3	9	20.2	19.3	3.9	15	26.8	20.5	5.5	18
Western Blackhull	21.8	20.2	4.4	16	19.5	15.4	3.0	30	27.2	16.9	4.6	24
Broomcorn												
Black Spanish	25.6	21.5	5.5	6	26.6	20.7	5.5	7	31.4	22.9	7.2	10
White Italian	23.0	26.5	6.1	5	....	22.0	5.9[b]	..	28.8	23.3	6.7	12

Entry	Harvested Sept. 14				Harvested Sept. 24				Harvested Oct. 2			
Sorgos												
Atlas	24.7	23.5	5.8	21	26.6	22.9	6.1	8	31.6	25.3	8.0	5
Early Kalo	26.5	14.7	3.9	36	26.0	10.0	2.6	23	31.3	9.9	3.1	29
Kansas Orange	30.4	32.6	9.9	3	29.0	29.3	8.5	5	32.4	28.4	9.2	3
Leoti Red	27.9	23.3	6.5	19	33.5	21.5	7.2	11	29.9	21.1	6.3	5
Norkan	22.3	25.6	5.7	7	29.1	21.3	6.2	7	25.5	20.0	5.1	12
Early Sumac	27.0	27.0	7.3	4	28.3	27.9	7.9	5	29.5	25.1	7.4	4
Weskan	22.1	23.1	5.1	18	22.5	19.1	4.3	9	26.7	16.1	4.3	14
Corn												
U. S. Hybrid 13	28.5	26.7	7.6	16	30.3	20.1	6.1	8	37.4	19.8	7.4	7
Kafirs												
Blackhull	23.6	20.3	4.8	31	18.1	28.8	5.2	21	31.8	15.4	4.9	16
Pink	20.9	22.0	4.6	17	25.7	19.1	4.9	12	30.9	17.5	5.4	14
Western Blackhull	24.7	16.6	4.1	22	23.9	13.8	3.3	15	25.4	11.8	3.0	30
Broomcorn												
Black Spanish	30.7	26.7	8.2	2	....	....	...	..	35.9	16.7	6.0	3
White Italian	35.0	24.6	8.6	7	....	....	...	..	39.8	22.1	8.8	3

[a] Proportion of dry matter of total crop which was contributed by soybean forage.
[b] Estimated.

Table 10. — Yields of Silage Crops Planted June 10 and Harvested on Five Different Dates, 1943

Entry	Plants per lineal rod	Harvested Aug. 23			Harvested Sept. 2			Harvested Sept. 14			Harvested Sept. 24			Harvested Oct. 2		
		Dry matter content	Acre yield		Dry matter content	Acre yield		Dry matter content	Acre yield		Dry matter content	Acre yield		Dry matter content	Acre yield	
			Fresh forage	Dry matter		Fresh forage	Dry matter		Fresh forage	Dry matter		Fresh forage	Dry matter		Fresh forage	Dry matter
		perct.	*tons*	*tons*	*perct.*	*tons*	*tons*	*perct.*	*tons*	*tons*	*perct.*	*tons*	*tons*	*perct.*	*tons*	*tons*
Sorgos																
Atlas	88	15.5	30.3	4.7	23.1	35.8	8.3	21.8	27.2	5.9	24.5	33.8	8.3	27.1	26.7	7.2
Early Kalo	70	22.2	13.3	2.9	26.2	13.0	3.4	24.7	15.1	3.7	19.4	10.2	2.0	24.0	9.6	2.3
Kansas Orange	92	15.3	29.7	4.5	21.6	27.0	5.8	25.7	35.1	9.0	26.2	25.4	6.7	28.7	30.8	8.8
Leoti Red	64	14.5	22.9	3.3	22.8	20.6	3.2	20.2	22.5	4.5	23.8	26.5	6.3	22.4	21.5	4.8
Norkan	84	17.7	16.7	3.0	22.0	25.2	5.5	19.5	17.9	3.5	21.8	25.0	5.2	23.5	17.3	4.1
Early Sumac	79	17.2	18.3	3.1	18.8	25.3	4.7	20.4	24.0	4.9	27.3	24.5	6.7	29.5	21.9	6.5
Weskan	66	17.4	15.5	2.7	23.0	16.1	3.7	18.4	13.2	2.4	25.4	14.3	3.6	26.9	16.1	4.3
Corn																
U. S. Hybrid 13	15	17.3	18.6	2.5	20.4	20.8	4.2	25.3	20.4	5.2	27.3	20.8	5.7	32.0	21.4	6.8
Kafirs																
Blackhull	42	13.6	20.4	2.8	20.9	19.2	4.0	22.0	19.7	4.3	18.8	18.7	3.5	26.3	19.4	5.1
Pink	60	29.0	11.1	3.2	21.4	21.3	4.6	21.2	17.3	3.7	20.1	16.4	3.3	27.6	14.6	4.0
Western Blackhull	33	23.5	15.1	3.5	20.4	10.2	2.1	20.9	12.6	2.6	32.8	13.0	4.3	26.9	13.2	3.6
Broomcorn																
Black Spanish	58	30.7	17.2	5.3	26.9	15.8	4.3	31.4	16.6	5.2	....	....	...	33.2	17.4	5.8
White Italian	70	18.5	19.9	3.7	25.8	19.2	5.0	34.1	23.9	8.2	....	....	...	35.2	19.6	6.9
Soybeans																
Chief	69	16.6	8.7	1.4	20.7	7.7	1.6	19.6	7.7	1.5	....	....	...	36.4	3.8	1.4
Dunfield	45	17.6	8.1	1.6	24.0	6.3	1.5	23.9	9.1	2.2	....	....	...	53.0	3.1	1.6
Mansoy	48	17.7	10.7	1.9	17.8	12.8	2.3	20.7	12.7	2.6	....	....	...	39.4	6.0	2.4
Illini	49	18.9	9.6	1.8	20.7	11.0	2.3	24.0	10.0	2.4	....	....	...	80.9	2.3	1.8

Table 11. — Yields of Silage Crops Planted June 21 and Harvested on Five Different Dates, 1943

Entry	Plants per lineal rod	Harvested Aug. 23			Harvested Sept. 2			Harvested Sept. 14			Harvested Sept. 24			Harvested Oct. 2		
		Dry matter content	Acre yield		Dry matter content	Acre yield		Dry matter content	Acre yield		Dry matter content	Acre yield		Dry matter content	Acre yield	
			Fresh forage	Dry matter		Fresh forage	Dry matter		Fresh forage	Dry matter		Fresh forage	Dry matter		Fresh forage	Dry matter
		perct.	*tons*	*tons*	*perct.*	*tons*	*tons*	*perct.*	*tons*	*tons*	*perct.*	*tons*	*tons*	*perct.*	*tons*	*tons*
Sorgos																
Atlas	66	12.4	25.5	3.1	13.8	28.1	3.9	21.7	29.9	6.5	22.6	30.3	6.8	27.1	24.9	6.7
Early Kalo	86	16.5	15.7	2.6	20.7	14.6	3.0	19.8	15.8	3.1	24.6	11.7	2.9	23.7	12.5	3.0
Kansas Orange	102	13.8	27.2	3.7	19.7	27.5	5.4	22.0	29.2	6.4	26.9	30.9	8.3	....	31.2	7.3[a]
Leoti Red	74	12.3	23.0	2.8	19.2	26.6	5.1	17.9	23.9	4.3	24.5	19.0	4.7	28.2	21.6	6.1
Norkan	99	16.2	23.3	3.8	18.2	23.5	4.3	20.5	22.3	4.6	21.4	21.9	4.7	26.3	20.8	5.5
Early Sumac	110	15.1	25.0	3.8	17.0	25.3	4.3	22.4	23.2	5.2	24.1	24.8	6.0	27.0	25.5	6.9
Weskan	87	15.0	18.4	2.8	19.8	16.4	3.3	24.2	17.7	4.3	19.9	18.0	3.6	25.0	16.4	4.1
Corn																
U. S. Hybrid 13	28	16.9	25.5	4.3	17.5	29.4	5.2	21.1	28.6	6.0	27.6	23.5	6.5	26.3	21.7	5.7
Kafirs																
Blackhull	61	20.3	20.2	4.1	17.0	19.4	3.3	17.8	21.4	3.8	23.8	20.2	4.8	24.7	18.5	4.6
Pink	82	15.6	20.1	3.1	20.7	20.4	4.2	24.5	19.4	4.7	27.9	17.0	4.7	24.7	16.6	4.1
Western Blackhull	66	16.1	18.3	2.9	19.3	18.3	3.5	17.3	20.1	3.5	19.9	16.1	3.1	25.4	17.0	4.3
Broomcorn																
Black Spanish	79	22.5	22.2	5.0	34.4	24.4	8.4	25.7	20.4	5.2	....	....	...	35.3	22.0	7.8
White Italian	99	17.5	20.4	3.6	24.6	28.3	6.9	26.2	25.6	6.7	....	....	...	30.1	24.8[a]	7.6[a]
Soybeans																
Chief	92	15.1	9.8	1.5	14.9	9.4	1.4	19.7	12.6	2.5	....	....	...	23.1	4.7	1.1
Dunfield	62	18.8	8.0	1.5	22.9	10.2	2.3	24.1	13.0	3.1	....	....	...	33.1	7.2	2.4
Mansoy	75	16.7	8.8	1.5	18.0	10.8	1.9	22.3	10.8	2.4	....	....	...	25.6	2.9	.8
Illini	78	21.2	8.5	1.8	20.0	9.6	1.9	25.7	8.3	2.1	....	....	...	47.9	3.2	1.5

[a] Estimated.

Table 12. — Combined Yields of Silage Crops Interplanted With Soybeans on June 10 and June 21 and Harvested on Three Different Dates, 1943

Entry	Harvested Aug. 23				Harvested Sept. 2				Harvested Sept. 14			
	Dry matter content	Acre yield		Part of total crop	Dry matter content	Acre yield		Part of total crop	Dry matter content	Acre yield		Part of total crop
		Fresh forage	Dry matter			Fresh forage	Dry matter			Fresh forage	Dry matter	
	perct.	*tons*	*tons*	*perct.*	*perct.*	*tons*	*tons*	*perct.*	*perct.*	*tons*	*tons*	*perct.*
(Planted June 10)												
Sorgos												
Atlas	17.9	25.1	4.5	9	24.3	22.2	5.4	13	21.4	24.8	5.3	13
Early Kalo	19.1	11.5	2.2	27	23.5	13.2	3.1	7	23.7	11.8	2.8	18
Kansas Orange	15.5	23.8	3.7	19	23.7	31.7	7.5	7	21.4	21.5	4.6	11
Leoti Red	14.7	21.1	3.1	16	21.3	23.9	5.1	8	28.3	22.6	6.4	14
Norkan	17.9	19.5	3.5	9	23.7	19.0	4.5	11	23.7	19.0	4.5	7
Early Sumac	18.4	21.2	3.9	15	22.1	23.1	5.1	10	22.0	22.3	4.9	8
Weskan	20.3	14.8	3.0	17	22.7	13.2	3.0	17	22.4	17.0	3.8	21
Corn												
U. S. Hybrid 13	15.9	22.6	3.6	22	21.3	20.2	4.3	19	26.6	22.2	5.9	10
Kafirs												
Blackhull	16.9	23.6	4.0	13	22.3	22.4	5.0	12	21.3	23.0	4.9	22
Pink	22.8	16.7	3.8	16	25.6	16.0	4.1	12	24.6	17.9	4.4	16
Western Blackhull	19.7	18.3	3.6	17	23.4	15.8	3.7	24	23.0	19.1	4.4	9
Broomcorn												
Black Spanish	26.5	22.3	5.9	5	29.3	22.9	6.7	6	29.0	25.2	7.3	6
White Italian	23.7	25.3	6.0	7	28.6	22.7	6.5	5	31.0	23.2	7.2	6
(Planted June 21)												
Sorgos												
Atlas	14.2	24.6	3.5	11	17.4	25.9	4.5	9	22.2	26.1	5.8	7
Early Kalo	17.1	12.9	2.2	9	18.2	15.4	2.8	11	20.3	13.3	2.7	7
Kansas Orange	13.6	23.5	3.2	13	20.3	25.1	5.1	4	19.8	30.3	6.0	7
Leoti Red	16.4	18.9	3.1	13	19.0	18.4	3.5	14	22.5	18.2	4.1	12
Norkan	....	16.7	2.6[a]	8	18.2	18.7	3.4	6	20.1	20.4	4.1	12
Early Sumac	17.1	21.0	3.6	17	21.9	19.6	4.3	5	20.8	23.1	4.8	21
Weskan	17.6	11.9	2.1	10	19.6	16.3	3.2	6	19.0	14.7	2.8	4
Corn												
U. S. Hybrid 13	14.9	17.4	2.6	8	17.1	18.7	3.2	3	20.3	24.1	4.9	10
Kafirs												
Blackhull	17.0	15.3	2.6	19	18.1	15.5	2.8	14	17.4	18.4	3.2	16
Pink	16.9	14.2	2.4	13	20.6	15.5	3.2	3	19.6	18.4	3.6	7
Western Blackhull	....	14.3	1.9[a]	20	20.3	13.3	2.7	11	22.4	14.3	3.2	13
Broomcorn												
Black Spanish	21.4	14.5	3.1	7	27.5	17.1	4.7	4	28.8	17.0	4.9	8
White Italian	....	14.8	3.3[a]	6	21.5	19.1	4.1	7	23.5	23.4	5.5	6

Table 13. — Yields of Silage Crops Planted May 12 and Harvested on Five Different Dates, 1944

Entry	Plants per lineal rod	Harvested Aug. 18			Harvested Aug. 31			Harvested Sept. 13			Harvested Sept. 29			Harvested Oct. 13		
		Dry matter content	Acre yield		Dry matter content	Acre yield		Dry matter content	Acre yield		Dry matter content	Acre yield		Dry matter content	Acre yield	
			Fresh forage	Dry matter		Fresh forage	Dry matter		Fresh forage	Dry matter		Fresh forage	Dry matter		Fresh forage	Dry matter
		perct.	*tons*	*tons*	*perct.*	*tons*	*tons*	*perct.*	*tons*	*tons*	*perct.*	*tons*	*tons*	*perct.*	*tons*	*tons*
Sorgos																
Atlas	62	23.4	17.5	4.1	20.6	21.3	4.4	26.8	19.2	5.1	29.8	24.7	7.4	29.3	16.1	4.7
Atlas × Leoti Hc 40-17	86	21.9	15.8	3.5	24.4	18.5	4.5	26.9	20.3	5.5	33.1	20.5	6.8	30.7	19.2	5.9
Atlas × Leoti Hc 40-13	68	25.7	14.9	3.8	26.8	11.2	3.0	29.3	12.4	3.6	34.8	12.4	4.3	31.2	11.5	3.6
Kansas Orange	114	23.3	24.5	5.7	24.5	21.0	5.1	29.0	26.4	7.6	31.8	22.3	7.1	31.0	22.6	7.0
Norkan	127	28.7	17.9	5.1	27.8	18.3	5.1	31.1	17.5	5.4	34.0	17.0	5.8	30.9	17.2	5.3
Rox Orange	92	26.2	21.1	5.5	26.5	18.3	4.9	27.6	23.3	6.4	33.1	20.4	6.8	35.9	18.4	6.6
Weskan	105	25.7	15.8	4.1	28.7	16.9	4.9	29.3	15.2	4.4	33.1	14.5	4.8	34.2	17.2	5.9
Cody	40	20.5	13.0	2.7	26.0	16.1	4.2	27.8	14.0	3.9	34.9	10.6	3.7	39.3	10.0	3.9
Corn																
U. S. Hybrid 13	18	28.4	12.4	3.5	29.6	13.1	3.9	42.0	8.1	3.4	....	....	...	76.1	7.7	5.8
Kafirs																
Blackhull	76	25.3	18.0	4.6	22.7	18.2	4.1	27.7	20.5	5.7	33.9	18.4	6.2	32.1	14.3	4.6
Pink	76	24.5	18.2	4.5	31.0	15.8	4.9	33.1	15.7	5.2	40.6	14.3	5.8	37.9	12.1	4.6
Western Blackhull	38	25.1	15.5	3.9	25.3	15.5	3.9	29.1	13.0	3.8	....	10.0	...	43.4	10.6	4.6
Soybeans																
Chief	50	22.2	10.2	2.3	23.9	11.5	2.7	24.2	14.0	3.4	34.4	7.7	2.7	52.3	6.0	3.1
Gibson	67	22.2	10.0	2.2	21.3	14.5	3.1	21.1	18.6	3.9	27.2	11.3	3.1	48.1	5.7	2.7
Illini	59	25.1	10.1	2.5	23.8	....	...	28.2	9.5	2.7	53.1	4.9	2.6	57.9	4.3	2.5
Lincoln	56	22.9	9.6	2.2	24.4	10.7	2.6	24.3	8.4	2.0	44.4	4.7	2.1	75.5	2.1	1.6
Milos																
Plainsman	74	....	....	...	27.1	14.3	3.9	26.4	10.3	2.7	....	....	...	....	....	...
Caprock	64	....	....	...	26.6	10.4	2.8	36.6	13.7	5.0	....	....	...	....	....	...
Sooner	50	....	....	...	34.1	10.6	3.6	32.6	10.3	3.3	....	....	...	....	....	...

Table 14. — Yields of Silage Crops Planted May 26 and Harvested on Five Different Dates, 1944

Entry	Plants per lineal rod	Harvested Aug. 21			Harvested Aug. 31			Harvested Sept. 13			Harvested Sept. 29			Harvested Oct. 13		
		Dry matter content	Acre yield		Dry matter content	Acre yield		Dry matter content	Acre yield		Dry matter content	Acre yield		Dry matter content	Acre yield	
			Fresh forage	Dry matter		Fresh forage	Dry matter		Fresh forage	Dry matter		Fresh forage	Dry matter		Fresh forage	Dry matter
		perct.	*tons*	*tons*	*perct.*	*tons*	*tons*	*perct.*	*tons*	*tons*	*perct.*	*tons*	*tons*	*perct.*	*tons*	*tons*
Sorgos																
Atlas	70	19.7	25.9	5.1	20.9	23.5	4.9	23.6	28.4	6.7	28.9	25.1	7.2	29.1	20.7	6.0
Altas × Leoti IIc 40-17	83	19.8	22.1	4.4	21.0	23.6	4.9	23.7	23.7	5.6	29.1	23.0	6.7	26.3	18.2	4.8
Atlas × Leoti IIc 40-13	86	20.5	19.4	4.0	21.6	18.2	3.9	27.3	20.8	6.7	29.1	18.0	5.2	31.9	11.2	3.6
Kansas Orange	66	20.6	27.2	5.6	19.6	19.4	3.8	24.8	33.6	8.3	31.4	27.3	8.6	33.2	25.2	8.4
Norkan	74	21.0	20.1	4.2	24.6	15.1	3.7	27.9	19.1	5.3	34.4	20.3	7.0	34.1	14.9	5.1
Rox Orange	66	20.0	25.6	5.1	21.7	21.8	4.7	27.0	20.9	5.6	31.4	23.0	7.2	30.8	18.0	5.5
Weskan	102	22.4	19.3	4.3	25.5	16.3	4.2	27.0	18.6	5.0	29.9	16.5	5.5	28.7	13.0	3.7
Cody	54	21.1	14.0	2.9	19.5	....	...	25.1	17.3	4.4	33.8	12.7	4.3	35.4	12.8	4.5
Corn																
U. S. Hybrid 13	19	19.3	15.6	3.0	24.0	15.8	3.8	29.0	15.6	4.5	44.0	11.2	4.9	60.5	7.9	4.8
Kafirs																
Blackhull	70	19.6	20.8	4.1	20.3	23.0	4.7	24.5	25.7	6.3	27.5	24.9	6.9	28.9	15.7	4.5
Pink	82	21.8	17.6	3.8	21.1	16.8	3.5	30.1	20.1	6.0	32.2	18.2	5.9	34.0	14.7	5.0
Western Blackhull	54	21.1	15.3	3.2	22.4	18.0	4.0	26.8	15.5	4.2	34.4	19.0	6.5	41.3	13.7	5.7
Soybeans																
Chief	51	21.1	11.5	2.4	20.3	10.2	2.1	20.4	12.5	2.6	37.4	11.6	4.3	41.8	5.1	2.1
Gibson	58	18.4	11.9	2.2	18.7	9.8	1.8	19.9	16.1	3.2	25.9	14.6	3.8	31.2	9.1	2.8
Illini	56	20.2	11.9	2.4	21.7	12.7	2.7	22.5	11.8	2.6	35.4	7.0	2.5	57.8	5.7	3.3
Lincoln	63	20.6	11.8	2.4	20.7	11.9	2.5	21.2	10.4	2.2	39.5	5.1	2.0	58.1	3.8	2.2

Table 15. — Combined Yields of Silage Crops Interplanted With Soybeans and Harvested on Three Different Dates, 1944

Entry	Harvested Aug. 21				Harvested Aug. 31				Harvested Sept. 13			
	Dry matter content	Acre yield		Part of total crop[a]	Dry matter content	Acre yield		Part of total crop[a]	Dry matter content	Acre yield		Part of total crop[a]
		Fresh forage	Dry matter			Fresh forage	Dry matter			Fresh forage	Dry matter	
	perct.	*tons*	*tons*	*perct.*	*perct.*	*tons*	*tons*	*perct.*	*perct.*	*tons*	*tons*	*perct.*
Planted May 12												
Sorgos												
Atlas	22.4	18.3	4.1	20	25.1	26.3	6.6	11	27.5	21.8	6.0	13
Atlas × Leoti Hc 40-17	22.6	15.5	3.5	9	25.2	20.2	5.1	18	25.3	19.0	4.8	21
Atlas × Leoti Hc 40-13	21.9	10.5	2.3	35	25.7	10.9	2.8	36	27.0	13.7	3.7	43
Kansas Orange	22.1	19.9	4.4	14	24.8	20.6	5.1	14	26.6	22.2	5.9	14
Norkan	24.2	12.8	3.1	16	28.4	14.8	4.2	14	30.6	16.0	4.9	20
Rox Orange	26.2	17.2	4.5	18	26.9	13.4	3.6	36	29.2	19.5	5.7	18
Weskan	....	16.5	3.2[b]	..	27.3	12.8	3.5	43	29.9	14.4	4.3	30
Cody	....	11.5	2.2[b]	..	25.0	12.4	3.1	58	26.2	12.2	3.2	59
Corn												
U. S. Hybrid 13	25.3	15.8	4.0	30	....	15.0	4.6	13	31.5	14.3	4.5	33
Kafirs												
Blackhull	....	14.7	4.7[b]	..	26.3	16.0	4.2	26	28.4	19.0	5.4	28
Pink	25.9	14.3	3.7	24	....	....	....	..	33.7	16.3	5.5	16
Western Blackhull	25.8	16.3	4.2	26	27.9	14.5	4.0	35	29.3	15.7	4.6	30
Planted May 26	Harvested Aug. 18-21				Harvested Aug. 31				Harvested Sept. 13			
Sorgos												
Atlas	19.4	24.2	4.7	13	22.8	20.6	4.7	21	23.9	24.7	5.9	5
Atlas × Leoti Hc 40-17	20.4	19.6	4.0	15	20.5	20.5	4.2	21	25.0	20.0	5.0	18
Atlas × Leoti Hc 40-13	19.7	11.7	2.3	26	23.9	16.3	3.9	39	21.3	12.7	2.7	56
Kansas Orange	20.9	21.5	4.5	16	23.6	14.8	3.5	26	22.7	20.7	4.7	26
Norkan	21.8	17.0	3.7	8	27.5	17.8	4.9	15	25.4	14.2	3.6	19
Rox Orange	21.9	22.8	5.0	12	24.5	15.9	3.9	28	26.8	20.5	5.5	11
Weskan	20.5	16.1	3.3	18	23.5	15.3	3.6	31	25.3	17.8	4.5	13
Cody	17.1	14.0	2.4	50	22.1	9.5	2.1	71	21.0	12.4	2.6	58
Corn												
U. S. Hybrid 13	20.5	19.0	3.9	18	21.2	15.1	3.2	34	23.5	14.9	3.5	34
Kafirs												
Blackhull	18.3	18.0	3.3	18	21.9	18.7	4.1	24	27.7	18.4	5.1	24
Pink	19.4	18.6	3.6	22	25.2	13.5	3.4	29	26.0	15.4	4.0	20
Western Blackhull	18.7	15.0	2.8	43	21.3	12.2	2.6	42	22.0	12.7	2.8	68

[a] Proportion of dry matter of total crop contributed by soybean forage. [b] Estimated.

Table 16. — Yields of Silage Crops Planted June 9 and Harvested on Five Different Dates, 1944

Entry	Plants per lineal rod	Harvested Aug. 21			Harvested Aug. 31			Harvested Sept. 13			Harvested Sept. 29			Harvested Oct. 13		
		Dry matter content	Acre yield		Dry matter content	Acre yield		Dry matter content	Acre yield		Dry matter content	Acre yield		Dry matter content	Acre yield	
			Fresh forage	Dry matter		Fresh forage	Dry matter		Fresh forage	Dry matter		Fresh forage	Dry matter		Fresh forage	Dry matter
		perct.	*tons*	*tons*	*perct.*	*tons*	*tons*	*perct.*	*tons*	*tons*	*perct.*	*tons*	*tons*	*perct.*	*tons*	*tons*
Sorgos																
Atlas	72	17.5	22.7	4.0	19.6	17.7	3.5	18.4	27.3	5.0	28.0	29.8	8.3	28.1	24.4	6.8
Atlas × Leoti Hc 40-17	84	20.9	22.6	4.7	18.2	22.3	4.0	22.5	22.1	5.0	25.5	27.8	5.8	26.4	25.3	6.7
Atlas × Leoti Hc 40-13	73	18.3	18.4	3.4	20.5	19.3	4.0	25.5	19.1	4.9	28.9	19.2	5.6	28.8	16.4	4.7
Kansas Orange	71	16.3	21.0	3.4	18.6	27.4	5.1	21.0	28.4	5.9	26.6	27.5	7.3	27.6	29.4	8.1
Norkan	88	18.9	16.8	3.2	21.2	20.8	4.4	25.7	22.0	5.7	30.1	21.1	6.4	29.1	17.3	5.0
Rox Orange	77	17.4	24.4	4.2	20.4	25.6	5.2	23.3	24.1	5.6	30.6	23.1	7.1	29.7	21.8	6.5
Weskan	100	16.9	20.7	3.5	22.2	17.3	3.8	27.4	18.2	5.0	....	16.1	...	....	14.1	...
Cody	46	15.7	11.8	1.8	20.0	10.0	2.0	23.4	20.4	4.8	29.0	17.4	5.1	31.3	14.0	4.4
Corn																
U. S. Hybrid 13	22	15.9	20.8	3.3	20.6	19.2	4.0	23.7	18.8	4.4	....	21.7	...	36.1	20.7	7.5
Kafirs																
Blackhull	89	15.9	20.3	3.2	19.1	21.1	4.0	19.2	22.0	4.2	20.3	26.0	5.3	25.5	23.4	6.0
Pink	101	19.5	12.3	2.4	21.3	17.5	3.7	22.0	21.5	4.7	30.6	22.6	6.9	29.4	17.3	5.1
Western Blackhull	54	17.5	14.9	2.6	19.9	14.3	2.9	26.9	19.1	5.1	30.7	18.9	5.8	30.0	19.2	5.8
Soybeans																
Chief	42	19.4	10.3	2.0	21.2	7.4	1.6	21.8	9.4	2.0	28.5	9.7	2.8	25.1	7.3	1.8
Gibson	47	18.5	8.5	1.6	21.0	7.7	1.6	23.2	12.8	3.0	23.2	10.2	2.4	26.3	10.7	2.8
Illini	42	17.9	10.1	1.8	20.0	7.5	1.5	22.7	10.1	2.3	28.0	8.9	2.5	45.7	4.4	2.0
Lincoln	40	18.7	8.3	1.5	20.1	9.3	1.9	21.5	9.9	2.1	29.0	9.6	2.8	31.1	6.2	1.9

Table 17. — Combined Yields of Silage Crops Interplanted With Soybeans on June 9 and Harvested on Three Different Dates, 1944

Entry	Harvested Aug. 18				Harvested Aug. 31				Harvested Sept. 13			
	Dry matter content	Acre yield		Part of total crop[a]	Dry matter content	Acre yield		Part of total crop[a]	Dry matter content	Acre yield		Part of total crop[a]
		Fresh forage	Dry matter			Fresh forage	Dry matter			Fresh forage	Dry matter	
	perct.	*tons*	*tons*	*perct.*	*perct.*	*tons*	*tons*	*perct.*	*perct.*	*tons*	*tons*	*perct.*
Sorgos												
Atlas	17.2	24.4	4.2	7	18.8	23.4	4.4	2	23.7	22.4	5.3	8
Atlas × Leoti Hc 40-18	....	....	...	..	20.7	20.3	4.2	5	22.9	25.8	5.9	7
Atlas × Leoti Hc 40-13	18.3	15.3	2.8	11	21.1	14.7	3.1	10	24.0	16.7	4.0	20
Kansas Orange	17.0	22.3	3.8	11	19.7	23.9	4.7	6	24.3	27.2	6.6	8
Norkan	19.2	16.7	3.2	9	21.6	17.6	3.8	5	23.5	18.7	4.4	9
Rox Orange	18.9	18.1	3.4	15	22.1	20.8	4.6	11	23.6	22.5	5.3	6
Weskan	19.1	16.2	3.1	10	20.9	15.8	3.3	6	23.4	17.1	4.0	8
Cody	20.2	9.4	1.9	26	21.1	9.0	1.9	16	24.4	12.7	3.1	23
Corn												
U. S. Hybrid 13	15.9	18.2	2.9	3	18.8	17.0	3.2	13	23.2	21.1	4.9	10
Kafirs												
Blackhull	16.2	18.5	3.0	7	18.5	18.4	3.4	15	19.8	19.7	3.9	18
Pink	18.9	17.5	3.3	3	22.0	15.9	3.5	9	21.1	20.9	4.4	9
Western Blackhull	19.9	19.1	3.8	13	21.4	15.4	3.3	9	24.6	17.9	4.4	21

[a] Proportion of dry matter of total crop that was contributed by soybean forage.

Table 18. — Yields of Silage Crops Planted on Three Different Dates and Harvested on Two Different Dates, 1945

Entry	Planted June 2							Planted June 12							Planted June 22						
	Plants per lineal rod	Harvested Sept. 19			Harvested Oct. 5			Plants per lineal rod	Harvested Sept. 19			Harvested Oct. 5			Plants per lineal rod	Harvested Sept. 19			Harvested Oct. 5		
		Dry matter content	Acre yield		Dry matter content	Acre yield			Dry matter content	Acre yield		Dry matter content	Acre yield			Dry matter content	Acre yield		Dry matter content	Acre yield	
			Fresh forage	Dry matter		Fresh forage	Dry matter			Fresh forage	Dry matter		Fresh forage	Dry matter			Fresh forage	Dry matter		Fresh forage	Dry matter
		perct.	*tons*	*tons*	*perct.*	*tons*	*tons*		*perct.*	*tons*	*tons*	*perct.*	*tons*	*tons*		*perct.*	*tons*	*tons*	*perct.*	*tons*	*tons*
Sorgos																					
Early Kalo	52	....	8.5	...	31.5	6.0	1.9	56	25.3	10.4	2.6	27.2	10.3	2.8	63	....	12.3	...	24.5	15.2	3.7
Atlas	42	20.9	21.1	4.4	23.9	18.7	4.5	59	24.5	22.7	5.6	20.6	24.3	5.0	91	15.9	31.8	5.1	20.4	32.4	6.6
Waxy Atlas (Hc 42-20)	51	20.7	18.2	3.8	24.1	21.7	5.2	70	23.0	25.4	5.8	18.6	28.7	5.3	88	17.6	26.4	4.6	17.2	26.5	4.6
Kansas Orange	64	24.3	27.5	6.7	26.5	27.0	7.2	74	23.1	30.2	7.0	21.0	33.0	6.9	87	14.7	31.5	4.6	16.9	27.2	4.6
Rox Orange	54	24.7[a]	17.6	4.3[a]	22.4	23.9	5.3	39	18.6	14.0	2.6	20.8	17.3	3.6	82	23.2	28.4	6.6	19.1	26.8	5.1
Early Sumac	109	18.4	26.7	4.9	28.2	22.0	6.2	70	21.3	20.8	4.4	21.5	21.3	4.6	115	16.6	29.5	4.9	17.1	29.5	5.1
Norkan	63	28.2[a]	21.7	6.1[a]	25.1	14.6	3.7	52	21.1	17.2	3.6	22.6	19.5	4.4	87	20.2	28.4	5.7	19.1	27.0	5.1
Weskan	55	25.3[a]	14.8	3.7[a]	21.9	13.0	2.8	48	22.3	11.5	2.6	22.6	13.5	3.0	54	22.9	16.1	3.7	20.5	16.1	3.3
Corn																					
U. S. Hybrid 13	15	23.1	18.8	4.3	26.6	19.1	5.1	19	20.3	22.8	4.6	23.4	20.0	4.7	17	15.4	22.5	3.5	21.3	13.0	2.8
Kafirs																					
Blackhull	48	33.8[a]	19.5	6.6[a]	25.5	13.6	3.5	37	21.2	14.0	3.0	21.5	18.1	3.9	74	17.6	21.3	3.8	17.9	24.9	4.5
Pink	53	30.0[a]	17.7	5.3[a]	26.2	11.2	3.0	52	25.9	15.9	4.1	26.4	13.0	3.5	62	....	19.4	...	21.0	21.0	4.4
Western Blackhull	38	27.9[a]	13.0	3.6[a]	21.4	16.5	3.5	29	22.9	10.6	2.4	24.8	14.0	3.5	46	17.1	17.9	3.1	18.5	15.5	2.9
Sudan grass																					
Sweet Sudan (351)	..	28.2[a]	11.0	3.1[a]	25.6	14.2	3.6	..	20.7	16.6	3.4	24.3	14.9	3.6	..	19.0	15.8	3.0	19.5	16.5	3.2
Common Sudan	..	24.3	....	...	33.2	12.0	4.0	..	23.6	15.5	3.6	30.4	12.8	3.9	..	25.5	....	...	26.1	13.2	3.5
Soybeans																					
Gibson	77	23.7	8.4	2.0	25.6	11.2	2.9	46	22.8	8.1	1.8	24.1	10.6	2.5	42	20.9	7.9	1.7	22.4	9.1	2.0
Illini	39	27.2	6.2	1.7	47.6	4.0	1.9	34	26.5	6.0	1.6	33.9	4.7	1.6	44	24.5	7.7	1.9	36.5	6.0	2.2
Virginia	58	25.2[a]	7.8	2.0[a]	25.0	8.4	2.1	51	22.6	6.9	1.6	24.9	9.7	2.4	55	24.9	6.6	1.6	25.1	8.4	2.1
Chief	46	25.6	8.7	2.2	34.1	6.8	2.3	36	24.2	8.0	1.9	27.4	6.8	1.9	45	23.5	8.5	2.0	26.1	8.7	2.3

[a] Difficulties were encountered in drying these samples. It is likely that these determinations are too high because of incomplete drying.

Table 19. — Yields of Silage Crops Planted on Three Different Dates, With One Set of Plantings Harvested on Two Different Dates, 1946

Entry	Planted May 28						Planted June 11				Planted July 1			
	Harvested Sept. 6				Harvested Sept. 26				Harvested Sept. 26				Harvested Sept. 26			
	Plants per lineal rod	Dry matter content	Acre yield		Dry matter content	Acre yield		Plants per lineal rod	Dry matter content	Acre yield		Plants per lineal rod	Dry matter content	Acre yield	
			Fresh forage	Dry matter		Fresh forage	Dry matter			Fresh forage	Dry matter			Fresh forage	Dry matter
		perct.	*tons*	*tons*	*perct.*	*tons*	*tons*		*perct.*	*tons*	*tons*		*perct.*	*tons*	*tons*
Sorgos															
Atlas	68	22.8	25.0	5.7	25.5	30.2	7.7	56	26.2	16.1	4.2	74	19.0	22.4	4.3
Waxy Atlas	78	23.2	24.4	5.7	26.4	25.4	6.7	56	25.1	18.6	4.7	106	16.9	22.4	3.8
Kansas Orange	82	22.9	23.0	5.3	32.4	31.6	10.2	58	23.1	22.0	5.1	92	19.9	16.6	3.3
Rox Orange	76	23.9	24.4	5.8	28.0	24.3	6.8	56	23.3	19.1	4.5	110	20.3	18.3	3.7
Early Sumac	89	....	24.3	...	30.0	24.1	7.2	46	23.8	19.9	4.7	116	19.3	22.9	4.4
Norkan	78	13.6	22.5	3.1	31.6	20.5	6.5	60	27.9	16.7	4.7	90	22.3	19.0	4.2
Corn															
U. S. Hybrid 13	21	25.5	21.2	5.4	30.5	23.2	7.1	22	25.8	15.5	4.0	20	21.0	20.9	4.4
Kafirs															
Pink	68	23.8	19.7	4.7	35.9	22.4	8.0	44	23.6	13.3	3.1	84	21.6	14.6	3.2
Western Blackhull	55	26.1	17.2	4.5	26.4	20.2	5.3	46	24.8	14.7	3.7	72	23.7	15.8	3.7
Blackhull	45	21.5	19.8	4.2	23.9	25.9	6.2	32	23.2	15.7	3.6	70	19.7	15.4	3.0
Sudan grass															
Common Sudan	..	30.5	14.4	4.4	28.7	14.7	4.2	..	28.0	11.1	3.1	..	23.8	11.6	2.8
Sweet Sudan	..	21.7	18.5	4.0	25.4	13.1	3.3	..	18.3	10.8	2.0	..	18.5	12.4	2.3
Soybeans															
Chief	71	21.3	12.1	2.6	26.0	11.2	2.9	44	27.8	10.3	2.9	64	23.8	6.8	1.6
Gibson	57	20.5	11.6	2.4	26.1	13.0	3.4	50	24.9	8.1	2.0	66	20.4	6.5	1.3
Illini	64	23.0	12.6	2.9	51.8	6.4	3.3	60	29.3	9.5	2.8	80	23.7	7.4	1.7
Virginia	78	20.0	12.3	2.5	22.4	13.8	3.1	66	21.5	8.3	1.8	70	25.5	5.8	1.5

Table 20. — Yields of Silage Crops Planted on Two Different Dates, 1947

Entry	Planted June 12, harvested Sept. 25			Planted July 8, harvested Sept. 25		
	Plants per lineal rod	Dry matter content	Acre yield	Plants per lineal rod	Dry matter content	Acre yield
			Fresh forage / Dry matter			Fresh forage / Dry matter
		perct.	*tons* / *tons*		*perct.*	*tons* / *tons*
Sorgos						
Atlas	52	17.7	19.3 / 3.4	67	14.6	19.7 / 2.9
Waxy Atlas	26[a]	17.6	8.9 / 1.6	77	15.6	18.8 / 2.9
Kansas Orange	68	21.4	20.7 / 4.4	69	16.7	18.3 / 3.1
Rox Orange	69	17.6	19.7 / 3.5	63	14.7	22.1 / 3.2
Early Sumac	64	23.5	14.6 / 3.4	120	19.2	17.3 / 3.3
Norkan	56	24.9	11.7 / 2.9	84	17.5	17.2 / 3.0
Corn						
U. S. Hybrid 13	18	26.5	11.4 / 3.0	20	28.2	15.3 / 4.3
Kafirs						
Pink	59	29.0	12.6 / 3.6	74	19.5	16.5 / 3.2
Western Blackhull	49	19.3	11.4 / 2.2	70	17.7	17.3 / 3.1
Blackhull	40	20.3	15.2 / 3.1	55	17.3	15.2 / 2.6
Sudan grass						
Common Sudan	..	33.4	11.1 / 3.7	..	23.0	11.7 / 2.7
Sweet Sudan	..	29.4	10.2 / 3.0	..	19.3	14.2 / 2.7
Soybeans						
Gibson	52	24.1	4.6 / 1.1	..	(Not planted)	
Illini	58	27.5	5.3 / 1.5	48	23.0	6.3 / 1.4
Lincoln	50	27.0	4.5 / 1.3	46	22.8	6.1 / 1.4
Chief	71	27.4	5.8 / 1.6	..	(Not planted)	

[a] Poor stand.

Table 21. — Analyses of Variance for Fresh Forage and Dry Matter of Silage Crops, 1943

(Yields of crops when grown alone)

Source	Sorgos		Kafirs		Broomcorn		Soybeans	
	Degrees of freedom	Mean square	Degrees of freedom	Mean square	Degrees of freedom	Mean square	Degrees of freedom	Mean square
			(Fresh forage)					
Total	104	....	44	....	22[a]	....	47	....
Planting dates	2	9.20	2	28.15*	2	52.58**	2	38.97*
Harvest dates	4	14.79*	4	2.78	3[b]	2.69	3[b]	101.24**
Varieties	6	551.98**	2	91.52**	1	71.07**	3	10.17
Harvest dates × planting dates	8	3.02	8	2.18	6	4.83	6	1.69
Harvest dates × varieties	24	4.67	8	3.94	3	3.96	9	2.26
Planting dates × varieties	12	13.65*	4	8.36	2	1.34	6	6.20*
Harvest dates × varieties × planting dates	48	5.71	16	5.84	5[a]	2.29	18	1.91
			(Dry matter)					
Total	103[a]	....	44	....	22[a]	....	47	....
Planting dates	2	4.39	2	1.20*	2	1.47	2	3.26**
Harvest dates	4	14.44**	4	1.20*	3[b]	6.06*	3[b]	.89**
Varieties	6	29.93**	2	3.15**	1	2.04	3	.79
Harvest dates × planting dates	8	.62	8	.10	6	1.52	6	.17
Harvest dates × varieties	24	1.29**	8	.34	3	2.82	9	.09
Planting dates × varieties	12	1.18*	4	.19	2	1.61	6	.31**
Harvest dates × varieties × planting dates	47[a]	.56	16	.44	5[a]	.59	18	.075

[a] One degree of freedom lost due to estimating one missing value.
[b] Data for fourth harvest date was missing; therefore only 4 instead of 5 dates were used.
* Significant at the 5% level of probability.
** Significant at the 1% level of probability.

Table 22. — Analyses of Variance for Fresh Forage and Dry Matter of Silage Crops, 1943

(Comparison of interplanted (crop alone) with single planting)

Source	Sorgos		Kafirs		Broomcorn	
	Degrees of freedom	Mean square	Degrees of freedom	Mean square	Degrees of freedom	Mean square
		(Fresh forage)				
Total	125	....	53	....	35	....
Method of planting	1	400.71**	1	93.88	1	7.94
Planting dates	2	8.75	2	4.43	2	.17
Harvest dates	2	15.71	2	9.18	2	17.65*
Varieties	6	515.90**	2	86.88**	1	39.90
Method × planting	2	24.98*	2	36.09**	2	81.04**
Method × harvest	2	2.25	2	.37	2	5.69
Method × varieties	6	9.44	2	2.61	1	19.80*
Planting × harvest	4	10.44	4	2.02	4	7.87
Harvest × varieties	12	1.23	4	5.98	2	1.82
Varieties × planting	12	18.06**	4	13.33	2	2.02
Error (2d and 3d order interactions)	76	5.73	28	5.62	16	4.35
		(Dry matter)				
Total	124[a]	....	52[a]	....	34[a]	....
Method of planting	1	8.59**	1	3.84	1	.22
Planting dates	2	11.92**	2	1.67	2	4.51
Harvest dates	2	22.16**	2	2.58**	2	11.36**
Varieties	6	19.87**	2	2.73**	1	.22
Method × planting	2	.99	2	2.91**	2	7.63**
Method × harvest	2	.02	2	.26	2	.57
Method × varieties	6	.30	2	.22	1	.40
Planting × harvest	4	.79	4	.33	4	1.29
Harvest × varieties	12	1.17*	4	.24	2	2.48
Varieties × planting	12	1.41**	4	.18	2	.32
Error (2d and 3d order interactions)	75[a]	.54	27[a]	.24	15[a]	.75

[a] One degree of freedom lost due to estimating one missing value.
* Significant at the 5% level of probability.
** Significant at the 1% level of probability.

Table 23. — Analyses of Variance for Fresh Forage and Dry Matter of Silage Crops, 1943

(Yields of crops alone when interplanted with soybeans)

Source	Sorgos		Kafirs		Broomcorn	
	Degrees of freedom	Mean square	Degrees of freedom	Mean square	Degrees of freedom	Mean square
		(Fresh forage)				
Total	62	....	26	....	17	....
Planting dates	2	23.19	2	10.45	2	43.72*
Harvest dates	2	8.59	2	6.05	2	20.04
Varieties	6	225.8**	2	31.09	1	1.74
Harvest dates × planting dates	4	12.05	4	3.74	4	4.91
Harvest dates × varieties	12	3.76	4	3.41	2	.35
Planting dates × varieties	12	13.32*	4	13.14*	2	7.94
Harvest dates × varieties × planting dates	24	4.72	8	2.36	4	4.94
		(Dry matter)				
Total	61[a]	....	25[a]	....	16[a]	....
Planting dates	2	9.81**	2	2.89**	2	11.29**
Harvest dates	2	11.66**	2	2.21**	2	5.91**
Varieties	6	9.48**	2	.83*	1	.01
Harvest dates × planting dates	4	.53	4	.41	4	.38
Harvest dates × varieties	12	.53	4	.18	2	.20
Planting dates × varieties	12	.87	4	.22	2	.01
Harvest dates × varieties × planting dates	23[a]	.48	7[a]	.11	3[a]	.093

[a] One degree of freedom lost due to one missing value.
* Significant at the 5% level of probability.
** Significant at the 1% level of probability.

Table 24. — Analyses of Variance for Fresh Forage and Dry Matter of Silage Crops, 1943

(Combined yields of crops when interplanted with soybeans)

Source	Sorgos		Kafirs		Broomcorn	
	Degrees of freedom	Mean square	Degrees of freedom	Mean square	Degrees of freedom	Mean square
		(Fresh forage)				
Total	62	....	26	....	17	....
Planting dates	2	54.12	2	43.10	2	66.37*
Harvest dates	2	10.20	2	5.45	2	17.96
Varieties	6	214.58**	2	38.82	1	3.64
Harvest dates × planting dates	4	14.20*	4	2.04	4	4.29
Harvest dates × varieties	12	2.18	4	1.19	2	.51
Planting dates × varieties	12	8.48	4	9.97**	2	4.70
Harvest dates × varieties × planting dates	24	4.30	8	.80	4	4.56
		(Dry matter)				
Total	61[a]	....	25[a]	....	16[a]	....
Planting dates	2	15.26**	2	6.43**	2	13.18**
Harvest dates	2	12.56**	2	2.38**	2	6.00**
Varieties	6	9.07**	2	.84**	1	.003
Harvest dates × planting dates	4	.64	4	.34*	4	.26
Harvest dates × varieties	12	.49	4	.02	2	.25
Planting dates × varieties	12	.51	4	.15	2	.01
Harvest dates × varieties × planting dates	23[a]	.45	7[a]	.064	3[a]	.058

[a] One degree of freedom lost due to estimating one missing value.
* Significant at the 5% level of probability.
** Significant at the 1% level of probability.

Table 25. — Analyses of Variance for Fresh Forage and Dry Matter of Silage Crops, 1944

(Yields of crops when grown alone)

Source	Sorgos		Kafirs		Soybeans	
	Degrees of freedom	Mean square	Degrees of freedom	Mean square	Degrees of freedom	Mean square
(Fresh forage)						
Total	118[a]	....	44	....	58[a]	....
Planting dates	2	131.40**	2	68.42*	2	9.82
Harvest dates	4	43.31	4	20.40	4	62.80**
Varieties	7	239.47**	2	113.10**	3	32.92*
Harvest dates × planting dates	8	11.87*	8	15.36**	8	8.05
Harvest dates × varieties	28	6.25	8	2.34	12	5.76*
Planting dates × varieties	14	5.67	4	1.43	6	3.82
Harvest dates × varieties × planting dates	55[a]	5.22	16	3.32	23[a]	2.57
(Dry matter)						
Total	116[b]	....	43[a]	....	58[a]	....
Planting dates	2	.59	2	.77	2	1.79**
Harvest dates	4	20.22**	4	9.23**	4	1.01**
Varieties	7	11.53**	2	.70	3	.80*
Harvest dates × planting dates	8	1.33**	8	.80	8	.21
Harvest dates × varieties	28	.66	8	.30	12	.29
Planting dates × varieties	14	.52	4	.18	6	.17
Harvest dates × varieties × planting dates	53[b]	.44	15[a]	.43	23[a]	.18

[a] One degree of freedom lost due to estimating one missing value.
[b] Three degrees of freedom lost due to estimating three missing values.
* Significant at the 5% level of probability.
** Significant at the 1% level of probability.

Table 26. — Analyses of Variance for Fresh Forage and Dry Matter of Silage Crops, 1944

(Comparison of interplanted (crop alone) with single planting)

Source	Sorgos		Kafirs	
	Degrees of freedom	Mean square	Degrees of freedom	Mean square
(Fresh forage)				
Total	142[a]	.....	53	.....
Method of planting	1	1265.58*	1	369.74
Planting dates	2	185.60	2	46.06
Harvest dates	2	38.42	2	6.38
Varieties	7	309.56**	2	102.84*
Method × planting	2	56.41**	2	50.17**
Method × harvest	2	6.37	2	7.00
Method × varieties	7	21.21**	2	10.81
Planting × harvest	4	18.83*	4	3.56
Harvest × varieties	14	6.79	4	5.35
Varieties × planting	14	5.92	4	11.00*
Error (2d and 3d order interactions)	87[a]	5.45	28	4.00
(Dry matter)				
Total	140[b]	.....	52[a]	.....
Method of planting	1	63.34	1	17.01
Planting dates	2	.04	2	1.95
Harvest dates	2	18.26*	2	4.70
Varieties	7	13.59**	2	3.43
Method × planting	2	3.80**	2	2.81**
Method × harvest	2	1.20	2	.97
Method × varieties	7	1.58**	2	.25
Planting × harvest	4	1.26*	4	.14
Harvest × varieties	14	.38	4	.31
Varieties × planting	14	.47	4	1.09*
Error (2d and 3d order interactions)	85[b]	.41	27[a]	.30

[a] One degree of freedom lost due to estimating one missing value.
[b] Three degrees of freedom lost due to estimating three missing values.
* Significant at the 5% level of probability.
** Significant at the 1% level of probability.

Table 27. — Analyses of Variance for Fresh Forage and Dry Matter of Silage Crops, 1944

Source	Yield of crop alone when interplanted with soybeans				Combined yields of crops when interplanted with soybeans			
	Sorgos		Kafirs		Sorgos		Kafirs	
	Degrees of freedom	Mean square	Degrees of freedom	Mean square	Degrees of freedom	Mean square	Degrees of freedom	Mean square
(Fresh forage)								
Total	71	....	26	....	70[b]	....	25[b]	....
Planting dates	2	166.35**	2	82.22**	2	34.45**	2	13.89
Harvest dates	2	7.28	2	1.75	2	17.98*	2	4.45
Varieties	7	211.87**	2	44.72**	7	140.73**	2	14.25
Harvest dates × planting dates	4	11.89	4	5.70	4	8.16	4	4.80
Harvest dates × varieties	14	5.18	4	3.90	14	3.79	4	2.89
Planting dates × varieties	14	4.96	4	11.52	14	5.06	4	3.79
Harvest dates × varieties × planting dates	28	5.06	8	3.87	27[b]	4.50	7[b]	3.15
(Dry matter)								
Total	69[a]	....	25[b]	....	68[c]	....	24[a]	....
Planting dates	2	1.58*	2	2.72*	2	.38	2	3.36**
Harvest dates	2	5.46**	2	.71	2	8.78**	2	1.84*
Varieties	7	10.76**	2	2.12*	7	7.26**	2	.76
Harvest dates × planting dates	4	.90	4	.06	4	.74	4	.03
Harvest dates × varieties	14	.44	4	.29	14	.28	4	.23
Planting dates × varieties	14	.39	4	.96	14	.23	4	.65
Harvest dates × varieties × planting dates	26[a]	.34	7[b]	.31	25[c]	.33	6[a]	.30

[a] Two degrees of freedom lost due to estimating two missing values.
[b] One degree of freedom lost due to estimating one missing value.
[c] Three degrees of freedom lost due to estimating three missing values.
* Significant at the 5% level of probability.
** Significant at the 1% level of probability.

Table 28. — Analyses of Variance for Fresh Forage and Dry Matter of Silage Crops Grown Alone, 1945

Source	Sorgos		Kafirs		Soybeans	
	Degrees of freedom	Mean square	Degrees of freedom	Mean square	Degrees of freedom	Mean square
(Fresh forage)						
Total	47	....	17	....	23	....
Planting dates	2	186.90**	2	56.40	2	.14
Harvest dates	1	.16	1	.13	1	.54
Varieties	7	233.69**	2	23.87	3	13.31
Harvest dates × planting dates	2	10.70	2	8.96	2	.40
Harvest dates × varieties	7	4.09	2	6.98	3	4.63*
Planting dates × varieties	14	18.23**	4	3.17	6	.71
Harvest dates × varieties × planting dates	14	4.05	4	10.42	6	.92
(Dry matter)						
Total	45[a]	....	16[b]	....	23	....
Planting dates	2	.65	2	1.09	2	.11
Harvest dates	1	.04	1	.68	1	.74**
Varieties	7	7.20**	2	1.99	3	.13
Harvest dates × planting dates	2	.04	2	2.36	2	0
Harvest dates × varieties	7	.25	2	.56	3	.09
Planting dates × varieties	14	1.55	4	.29	6	.09
Harvest dates × varieties × planting dates	12[a]	.70	3[b]	.79	6	.043

[a] Two degrees of freedom lost due to estimating two missing values.
[b] One degree of freedom lost due to estimating one missing value.
* Significant at the 5% level of probability.
** Significant at the 1% level of probability.

Table 29. — Analyses of Variance for Fresh Forage and Dry Matter of Silage Crops Grown Alone, 1946

Source	Sorgos		Kafirs		Soybeans		Sudan grass	
	Degrees of freedom	Mean square	Degrees of freedom	Mean square	Degrees of freedom	Mean square	Degrees of freedom	Mean square
(Fresh forage)								
Total	17	....	8	....	11	....	5	....
Planting dates	2	88.47**	2	63.04**	2	20.07	2	4.48*
Varieties	5	8.98	2	4.71	3	1.82	1	.20
Planting dates × varieties	10	9.94	4	2.69	6	5.36	2	.22
(Dry matter)								
Total	17	....	8	....	11	....	5	....
Planting dates	2	21.43**	2	9.74*	2	2.73**	2	.96*
Varieties	5	.59	2	.27	3	.14	1	1.04*
Planting dates × varieties	10	.79	4	.93	6	.13	2	.047

*Significant at the 5% level of probability.
**Significant at the 1% level of probability.

OTHER ILLINOIS PUBLICATIONS ON SILAGE

The following Illinois publications give information about silage crops, methods of making silage, and feeding value and money value of the silage. They can be obtained on request from the Information Office, College of Agriculture, Urbana, Illinois.

Grass and Legume Silages for Dairy Cattle. Circular 605. 20 pages.

Making High Quality Silage for Dairy Cattle. Circular 686. 24 pages.

A Method for Estimating the Money Value of Corn Silage. Bulletin 576. 16 pages.

Yield and Composition of Corn Forage as Influenced by Soil Fertilization. Bulletin 577. 20 pages.

3500—7-54—55179