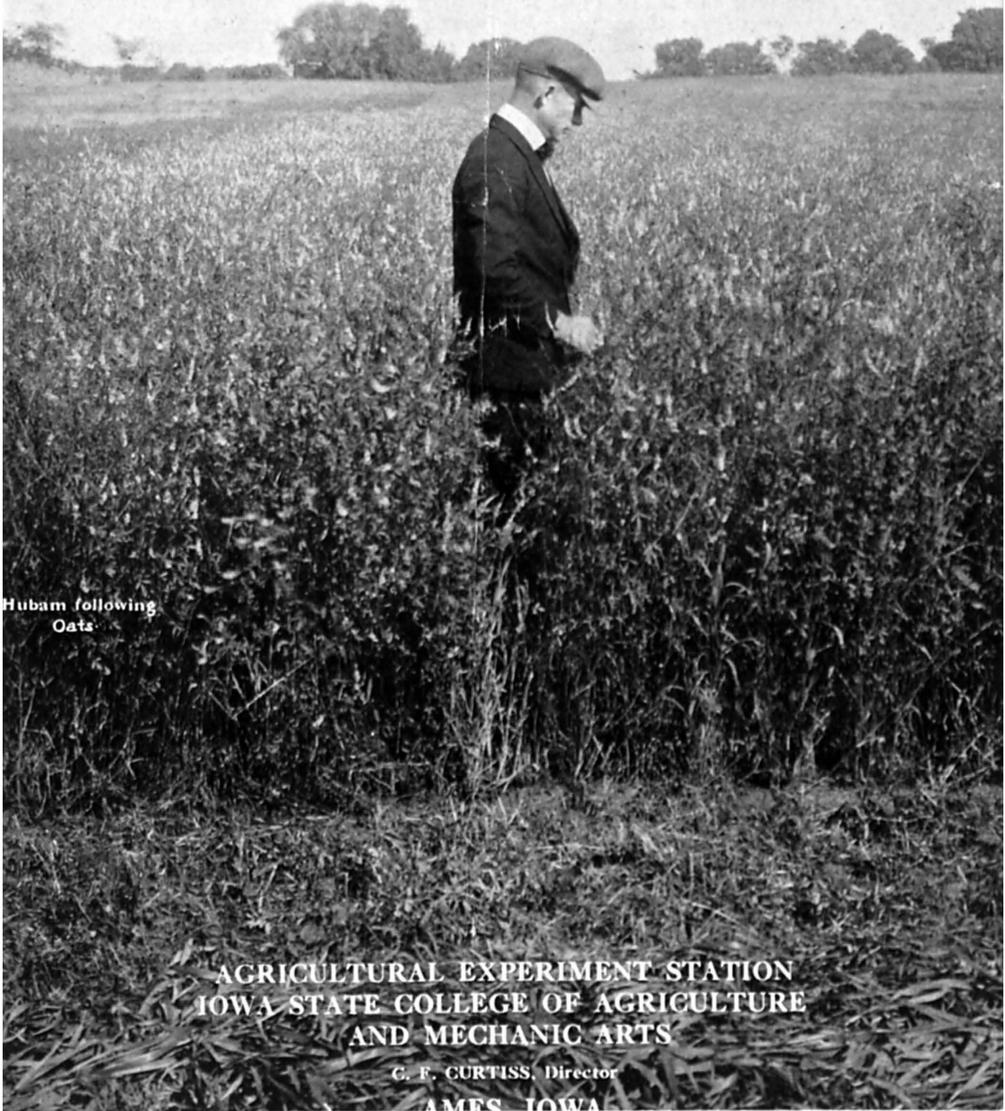


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# HUBAM CLOVER



Hubam following  
Oats

AGRICULTURAL EXPERIMENT STATION  
IOWA STATE COLLEGE OF AGRICULTURE  
AND MECHANIC ARTS

C. F. CURTISS, Director

AMES, IOWA

# HUBAM CLOVER

By F. S. Wilkins

Preliminary tests made by the Iowa Agricultural Experiment Station of Hubam, the annual white sweet clover discovered in 1916 by H. D. Hughes of the Farm Crops Section at this station, indicate that this crop will probably prove to be the best green manure crop to seed with small grain in the spring and plow down in the fall of the same year, on soils which are well drained and not acid.

These tests also indicate that it will make an excellent summer and fall pasture crop for cattle and sheep, as it makes a leafy and succulent growth following the removal of a small grain crop, or following the removal of a hay crop when seeded alone. They further indicate that Hubam clover will prove to be a satisfactory emergency leguminous hay crop to seed when red clover or alfalfa fail.

## VALUE ELSEWHERE IN UNITED STATES AND ABROAD

Hubam clover has been grown in every state in the Union, in every province of Canada, and in many foreign countries. Hundreds of reports from these different sections have been received from growers who have raised the clover under actual field conditions, nearly all of whom say that the clover has made a satisfactory growth.

The reports indicate that Hubam clover has a wide adaptation. It has been grown with success on many different soil types, in high and low altitudes, in the south and in the north; in sections of high rainfall and of low rainfall, as well as under irrigation. It usually can be grown anywhere that alfalfa or biennial sweet clover will grow. It often has been grown where these legumes have been unsuccessful. The extent to which Hubam will fit into the cropping systems in various sections remains to be determined.

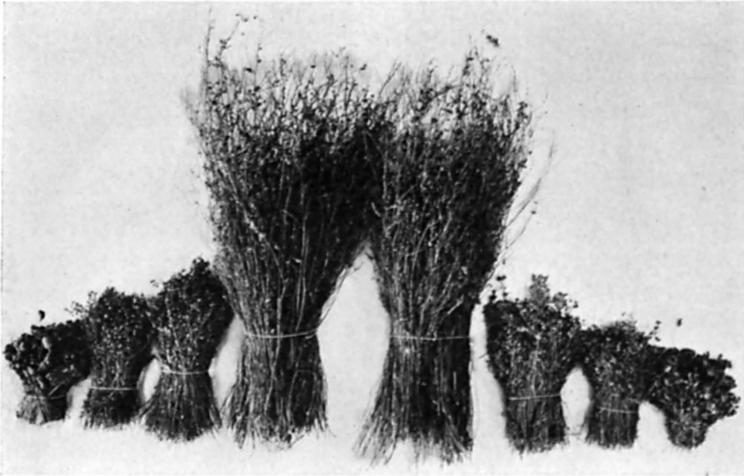
## VALUE AS BEE PASTURE

Reports from bee men everywhere leave no doubt but that Hubam clover is an excellent bee pasture. It has been tested extensively for this purpose by many of the largest bee men and firms. The crop produces an exceptionally good quality of honey. Hubam begins to bloom from two to three months after planting and flowers abundantly long after most of the other bee pastures are gone.

## PRESENT STATUS OF HUBAM CLOVER

In view of the many rather extravagant claims made for this clover by different persons, it may be well to say that the Iowa Station has never at any time even suggested that Hubam clover would replace all other clovers and prove of value under all conditions. That would be impossible. While the tests to date have shown an unusually wide adaptation and value under a great variety of conditions, it is undoubtedly true that for many uses and conditions some one of the biennial or perennial legumes is better suited.

Undoubtedly the most enthusiastic group of Hubam growers is the bee keepers. One of the largest bee supply houses in the world sees in Hubam clover the revolution of the honey-producing industry. This company has tested the clover thoroly during the past three years. The proven value of Hubam clover as a honey plant alone would seem to justify the atten-



• 1 2 3 4 4 3 2 1  
 Representative samples of (1) medium red, (2) biennial yellow sweet, (3) biennial white sweet and (4) Hubam clover following oats, spring wheat and barley at the Iowa Agricultural Experiment Station, 1920.

tion already given it. However, this use is secondary and incidental to its value as a field crop. Its chief merit lies in its potential value as a soil restorer when used as green manure following small grain to be plowed under the same year that it is seeded.

#### HUBAM CLOVER OUTYIELDS OTHER CLOVERS

Hubam clover has outgrown the biennial sweet clovers, red clovers and other clovers at the Iowa Station during the six year period which has elapsed since its discovery in the Iowa greenhouses in 1916. It outyielded all of these clovers in actual field tests in 1920 and again in 1921. Before 1920 the scarcity of seed prohibited seeding it in sufficient quantities to make weight comparisons with other clovers under actual field conditions.

In 1919 a small amount of Hubam was mixed with biennial white sweet clover. The mixture was seeded with Iowa 103 oats as a nurse crop. The oats were cut with a mower for hay June 1. The biennial sweet clover made an unusually good growth of one and one-half feet. The Hubam clover, competing with a thick stand of the biennial under the same conditions, grew to a height of 3 to 4½ feet and began to bloom.

In the spring of 1920 strips of Hubam, biennial white sweet, biennial yellow sweet, and medium red clover were seeded across plats of oats, spring wheat and barley grown on the highest, driest and poorest field of the college farm, but under conditions which were uniform for each clover. The small grain was cut with a binder when the grain was ripe. None of the clovers was high enough to cause any trouble in cutting or curing the small grain. In the fall, after each of the clovers had made its full growth for the season, representative areas of each were cut, dried and weighed. The air dry hay yields for each were as follows:

Hubam c'lover	1.525 tons per acre
Biennial white sweet clover	.505 tons per acre
Biennial yellow sweet clover	.306 tons per acre
Medium red clover	.248 tons per acre

**EXTENSIVE FIELD TESTS IN 1921 SUBSTANTIATE THE  
EARLIER TESTS**

In 1921 the experiment was repeated and mammoth red clover, alsike clover and alfalfa were added. Each of these legumes was seeded across plats of different varieties of oats. Each of the clovers except Hubam was seeded at the rate which previous experiments had shown to be best. Hubam clover was seeded at the rate of 15 pounds per acre. Because of its upright habit of growth it is believed that a somewhat heavier seeding should have been used. A perfect stand was obtained for all of the legumes except the Hubam clover, which was too thin, and the alsike clover, which was a failure.

The oats were cut with a binder about July 1. The clovers were cut and weighed October 4, after each had made its full growth for the season. Yields are given in table I below, in tons per acre of dry hay containing 8.6 percent moisture. Yields, together with the average length of each clover at oat cutting time and just before the clovers were cut in the fall, are given in the following table:

TABLE I—COMPARATIVE YIELDS OF HUBAM AND OTHER LEGUMES  
FOLLOWING OATS—1921

Legume	Yield (tons per acre)	Av. lgth. plants June 29 (inches)	Av. lgth. plants Oct. 4 (inches)
Hubam clover	2.07	25	42
Bi. Wht. Swt. Clover	1.85	18	22
Bi. Yel. Swt. Clover	1.56	18	22
Alfalfa	1.14	7	19
Medium red clover	.95	6	12
Mammoth clover	.92	6	10
Alsike clover	poor stand	4	8

The biennial clovers were green and succulent at the time of cutting and had lost few of their leaves. The Hubam clover continued to grow until the time it was cut. However, because of its stage of maturity (about one-tenth of the seed ripe) it had lost fully half of its leaves. These leaves fell to the ground to be returned to the soil as fertilizer. However, in spite of this loss and a stand which was considered to be too thin, Hubam clover outyielded biennial white sweet clover, its nearest competitor, by 12 percent, and medium red clover, the most popular clover in the cornbelt, by 118 percent.

The Hubam clover and biennial white sweet clover were seeded side by side both in 1920 and 1921 and the other clovers grew in plats adjoining. In both years the growing conditions for each legume were as nearly the same as it was possible to get them. In 1920 the plats were necessarily small because of the scarcity of Hubam clover seed. Yields were obtained by averaging the yields of representative areas of each. In 1921 the plats were each approximately one-seventh of an acre in size and yields are based upon total plat yields. In both years the forage from the plats was weighed green, shrinkage samples taken, dried, and air dry yields computed.

It cannot be predicted definitely that tests comparing Hubam and biennial white sweet clover under these conditions will show a significant advantage in yield of the annual over the biennial with these same strains when conducted over a series of years. However, there are strains of Hubam clover now on test in the breeding nurseries of the Iowa Station which show promise of being much superior to the present strains for seedling with small grain for green manure and pasture.



Alfalfa

Alsike



Mammoth Red

Medium Red



Biennial White Sweet

Hubam

Alfalfa, alsike, mammoth red, medium red, biennial white sweet and Hubam clover following oats at the Iowa Agricultural Experiment Station, 1921. In each picture the man stood the same distance from the camera.

## HUBAM HAS NOT INTERFERED WITH SMALL GRAIN HARVEST

Hubam clover has not interfered in the least with cutting and curing small grain at the Iowa Station during the two years that it has been seeded in this way under actual field conditions. Hubam clover makes a relatively slow early growth. The growth of the clover is still further retarded in the early stages by the nurse crop so that it makes its greatest growth after the grain is removed.

### COMPARISON OF NITROGEN RETURNED TO THE SOIL

As an average of two years' results, Hubam clover returned approximately one and one-half times as much organic matter to the soil in stems and leaves as biennial white sweet clover, in the first year of growth, when both followed small grain under actual and similar field conditions at the Iowa Station. Also, Hubam clover returned approximately three times as much organic matter to the soil as medium red clover in the same tests.

Hubam clover compared favorably with biennial white sweet clover and greatly exceeded medium red clover in pounds of nitrogen returned to the soil following oats in 1921. The pounds of nitrogen returned to the soil by Hubam, biennial white sweet, and medium red clover are given in table II. The table shows also percentages of nitrogen and weight of above-ground and root portions, as well as the percentage of roots to stems and leaves for each legume.

\*TABLE II—COMPARISON OF NITROGEN RETURNED TO SOIL BY HUBAM AND OTHER LEGUMES

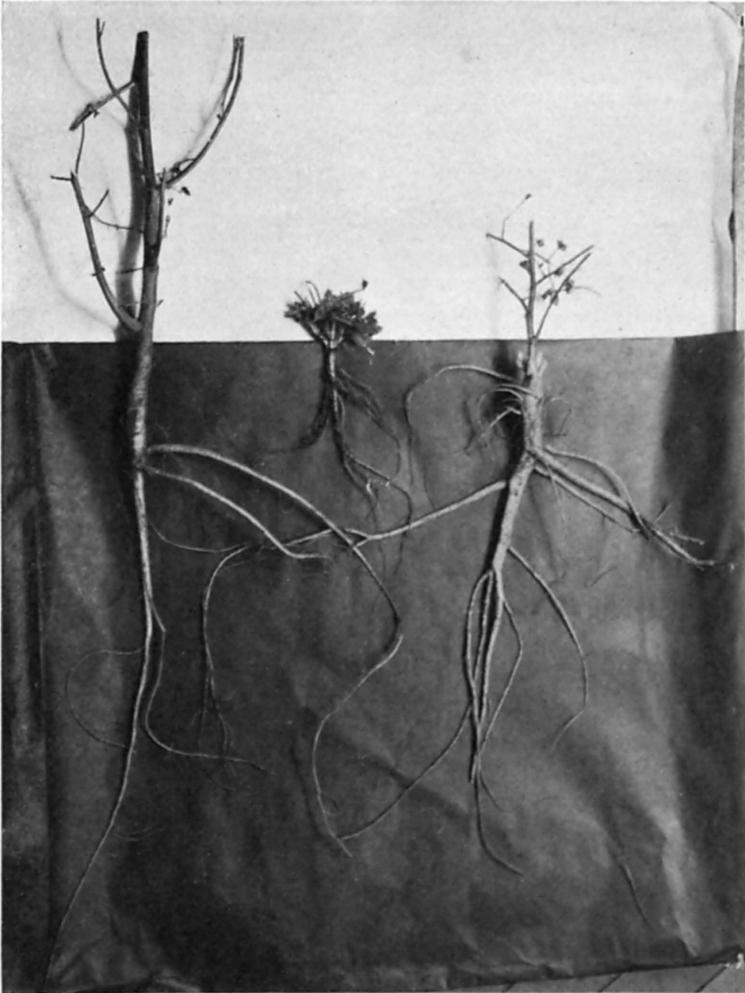
	Lbs. water-free material per acre		Percentage of roots to total weight	Percent nitrogen water-free basis		Lbs. Nitrogen per A. water-free basis		
	Roots	Leaves & stems		Roots	Leaves & stems	Roots	Leaves & stems	TOTAL
Hubam	1664.0	3784.0	30.54	2.48	2.43	41.25	91.95	133.20
Bi. Wht.	1451.3	3381.8	30.03	2.86	2.90	41.51	98.07	139.58
Med. Red	827.8	1736.6	32.28	2.29	3.43	18.96	59.57	78.53

As may be noted total nitrogen has been computed from analyses and weights of roots and above ground portions (stems and leaves). Approximately one-half of the leaves had dropped off of the Hubam clover while biennial white sweet and medium red clover had lost few of their leaves. If the weight of those leaves which fell from the Hubam clover and were thus added to the soil as fertilizer could have been computed, the results would be considerably more favorable for the Hubam.

Hubam clover has a further advantage because leaves taken when the plants were in full bloom contained 3.85 percent nitrogen, whereas the stems contained only 1.50 percent nitrogen, according to another series of analyses made by the Chemistry Section. The pounds of nitrogen returned per acre as computed from data at hand is 133.20 pounds for the Hubam, which is 6.38 pounds less than that returned by biennial white sweet clover and 54.67 pounds more than that returned by the medium red clover. It may be noted from the table that the biennial exceeded the Hubam by only one-fourth pound in total nitrogen per acre returned to the soil by the roots. It is interesting to note also that the percentages of roots to stems and leaves for the clovers are nearly the same; viz., 30.54 percent for Hubam; 30.03 percent for biennial white sweet, and 32.28 percent for medium red clover.

\* Detailed report of experimental methods used is not included because of lack of space. It has been mimeographed and is available for agronomists and others interested.

When the soil for root determinations was dug it was noted that the biennial white sweet clover roots were fleshy, succulent and branched. The Hubam clover roots were more slender, less succulent and little branched and extended much more deeply into the soil than did the biennial white sweet clover roots. The bulk of roots obtained from biennial white sweet clover was greater than for the Hubam, but they contained more moisture.



(Left to right). Representative roots of Hubam clover, medium red clover and biennial white sweet clover three and one-half months after seeding. The root of the biennial white sweet clover has a crown about one and one half inches below the surface of the ground and is large and succulent, being much larger in diameter than the stem. Hubam clover has no crown.

At the time of digging it appeared that the yield would be greater for the biennial. When the roots were dried, however, it was found that the Hubam clover roots outweighed the biennial white sweet clover roots by 14.65 percent. This checks closely with the weights of leaves and stems of the two clovers. Hubam clover was outyielded in green forage per acre but on a dry basis the Hubam clover outyielded the biennial by 11.9 percent. The comparisons of root growth give a preliminary indication of what may be expected when these legumes are grown following small grain under Iowa conditions.

#### **FALL PLOWING SAME YEAR IT IS SEEDED KILLS HUBAM**

It is believed that a green manure crop which will make a rank growth and which may be seeded with oats in the spring and plowed under in the fall of the same year, for corn the following year, will be of great value in Iowa. If the biennial sweet clovers are plowed in the fall of the same year seeded they will not be killed and will grow the following year as a weed in any crop that is planted on the land. Consequently, when the biennial sweet clovers are grown as green manure crops, to be followed by another crop the next year, plowing must be delayed until late in the spring when the biennial sweet clovers will be killed after they have started spring growth. From this standpoint also Hubam promises to become an important legume for green manure purposes.

Since biennial sweet clover cannot be economically fall plowed the first year it is seeded and Hubam clover is especially adapted to fall plowing, these two crops are competitive in Iowa to but a small extent. The indications are that each crop will have a distinct field of usefulness in the state of Iowa.

#### **IS HUBAM CLOVER LIKELY TO BECOME A WEED?**

Hubam clover is an annual which makes seed and dies the year it is seeded. It begins its spring growth slowly and therefore volunteer plants which may come from seed carried over from the previous year in the soil are easily killed by ordinary cultivation. If it should volunteer in a cultivated crop following small grain it could be killed easily. If Hubam clover should volunteer in a small grain crop it would be desirable. In such cases it might be fall plowed for green manure.

In a two or three year rotation it is possible with early strains of Hubam clover, which will mature seed following the removal of a small grain crop, to have the clover volunteer following small grain without reseeding. It will require several years of experimentation to determine if this will be more desirable than seeding ranker growing and later maturing strains with the small grain each year.

#### **BROADCASTED HUBAM CLOVER SUCCESSFULLY FIGHTS WEEDS**

Hubam clover grew in broadcasted fields at four different places on the station farms in 1921, the first year the clover was broadcasted alone at the Iowa Station. In each of these fields the clover outgrew and overcame the annual weeds, which started growing thickly about May 1. The annual weeds present in greatest numbers were wild buckwheat, smartweed and yellow and green foxtail. While the Hubam clover outgrew and overcame these weeds it did not choke them out entirely. However, the weeds were so few in number as not to be of consequence when Hubam clover was to be used for hay.

As Hubam clover grows slowly at first, it is necessary to get it started ahead of the weeds which begin to grow most rapidly about May 1. The indications are that Hubam clover should be seeded at about oat seeding time in the northern states.



Hubam clover in this field made an average growth of seven feet in 82 days.

In three of the fields where Hubam clover was broadcasted in 1921 the crop was seeded at the same time oats were being seeded in the vicinity of Ames. In the other field the crop volunteered from a seed crop the previous year.

#### **HUBAM CLOVER ALONE FOR HAY**

Hubam was broadcasted alone for hay in 1921 at rates of 4, 8, 12 and 16 pounds per acre in duplicate one-fortieth acre plats. The 16 pound rate of seeding proved best in that it yielded most and was nearly free from weeds. The clover was cut seven inches above the ground on June 30. At this time the plants averaged 36 inches in height and were in full bloom. The hay was of good quality and is now being fed to college stock.

The clover yielded 1.92 tons of air dry hay per acre and besides about half of the plants survived and made a second growth of 40 inches which was plowed under for green manure. If the clover had been cut at ordinary mower height instead of 7 inches from the ground, the yield would have been greater and the stand better for the second growth, as indicated by a height and time of cutting experiment conducted separately.

These results indicate the probable value of Hubam clover as an emergency hay crop. Iowa needs a rapid growing annual legume to seed in the spring for forage when red clover or alfalfa fail and which can be seeded either alone or with small grain. When Hubam clover seed becomes as cheap as other clover it will no doubt be used generally as an emergency hay crop in Iowa.

#### **HUBAM CUT WHEN BEGINNING TO BLOOM MAKES BEST HAY**

Hubam clover, cut at ordinary mower height when beginning to bloom, yielded 2.28 tons of air dry hay per acre in a height and time-of-cutting test conducted for the first time in 1921. For this test the clover was all seeded at the rate of ten pounds per acre. This seeding proved to be too thin to choke out the weeds. About 30 percent of the hay was foxtail.

The mixture of Hubam and foxtail, however, made hay of excellent quality on plats cut earliest.

Following removal of the first cutting the clover made a second growth of 34 inches, which was plowed down for green manure. Despite the unusually dry hot weather during June and July, about three-fourths of the plants survived. Cuttings made on a second series when one-half of the plants were in bloom, and on a third series in full bloom, yielded more, but the hay was coarser and less leafy. Also, the stand for the second growth on plats cut later was not nearly as good as for the earliest cutting.

For each stage of maturity the clover was cut at two different heights, ordinary mower height, and eight inches from the ground. Contrary to expectations, the clover, cut close to the ground survived the unusually dry hot weather of July better than that cut eight inches high.

The experiment was conducted in triplicate on one-fortieth acre plats. Yields and observations of individual plats indicated uniformly consistent differences for the various treatments.

#### HUBAM CLOVER WITH OATS FOR HAY

A mixture of Hubam clover and oats promises to make an excellent emergency hay crop. Oat hay is good alone but it is improved with the addition of legumes which are richer in muscle building foods. An experiment was conducted in duplicate for the first time in 1921 in which Hubam clover at four different rates of seeding (4, 8, 12 and 16 pounds per acre) was sown with Iowar oats seeded at the rates of 1, 2 and 3 bushels per acre. There was not a significant difference in yield for the various plats, but Hubam clover seeded at the rate of 16 pounds per acre with oats at the rate of 1 bushel per acre produced a mixture with the highest percentage of Hubam.

Even with 16 pounds of Hubam and only 1 bushel of oats per acre the percentage of clover hay to oat hay was so small that the oats could have been cut and cured for grain. Therefore, indications are that a seeding of 16 to 20 pounds of Hubam, with as little as one-half bushel of oats an acre and possibly a shorter strawed variety of oats, will give good yields of hay high in proportion of Hubam clover to oats.

An excellent second growth of Hubam clover free from weeds was obtained on all plats when the Hubam was seeded at the rate of 16 pounds an acre. The second growth was not cut but was plowed under for green manure. Final notes were taken November 10. At that time the clover averaged 36 inches high and the majority of the plants were blooming, and a small percentage ripening seed.

#### CHEMICAL COMPOSITION SIMILAR

Chemical analyses of Hubam clover and biennial white sweet clover indicate quite similar composition when the clovers are in the same stage of maturity. Table III gives the analyses of Hubam clover and biennial white sweet clover as made by the Chemistry Section of the Iowa Experiment Station:

TABLE III—ANALYSES OF HUBAM AND BIENNIAL WHITE SWEET CLOVER

	Percent protein	Percent nitrogen-free extract	Percent crude fiber	Percent ether extract (crude fat)	Percent ash
Hubam clover	14.32	39.06	33.76	1.79	5.27
Biennial white sweet clover	12.94	32.11	38.31	1.16	5.59

The composition of clovers is greatly affected by the stage of maturity and the growing conditions, as well as by other factors. The samples of Hubam clover and biennial white sweet clover analyzed for table III were taken just before each began to bloom. They were not grown in the same field nor in the same year. The analyses simply indicate, therefore, that Hubam clover and biennial white sweet clover have about the same composition when cut in similar stages of maturity and when grown under similar conditions.

Analyses of four samples of Hubam clover straw taken in different localities indicate composition similar to biennial white sweet clover straw. Reports from several feeders of horses and mules indicate that Hubam straw may be fed to these animals in place of hay with good results.

#### FARMERS URGED TO TRY HUBAM CLOVER

While Hubam clover has an unusually wide adaptation to climate and soil it is impossible for any one to predict how it will grow under the special conditions a farmer may have in his particular section on his farm. When there is doubt the Iowa Station recommends that the clover be tried in a small way for green manure, forage or seed.

It costs comparatively little to broadcast a narrow strip or small plot of Hubam clover with small grain or alone alongside of other clovers. Seed Hubam clover at the rate of 16 to 20 pounds per acre broadcast and beside it seed medium red and biennial white sweet clover. If it is at all likely that the soil needs lime it is advisable to spread some ground limestone on part of each plot. Clovers produce most satisfactorily on soils which are sweet. The seed of the biennial sweet and Hubam clover ought to be inoculated with nitrogen-gathering bacteria unless sweet clover or alfalfa have been grown on the land previously. These clovers may be inoculated from the same bottle of culture. The Iowa Experiment Association at Ames offers Hubam clover seed in small amounts to Iowa farmers to be used for green manure or forage purposes.

Hubam clover cannot be used generally for forage or green manure until the price of seed becomes relatively near the price of other clover seed. Quantity production will bring cheap seed rather quickly. While the crop is easy to grow and is as sure as most other crops, there is much



Hubam clover offers excellent opportunity to breed improved strains for green manure, pasture or hay. Wide differences may be noted in every habit of growth.

to be gained from experience in seed production. Farmers who have had no experience with the crop may well limit themselves to a few acres. Experiments and reports from growers indicate that the seed crop may be grown either broadcast alone or in cultivated rows.

#### **SHALL THE SEED CROP BE GROWN BROADCAST ALONE OR IN ROWS?**

Tests of the Iowa Station indicate that Hubam produces more seed when grown in rows. The average yield of hulled, clean seed of all broadcasted plats at the Iowa Station in 1921 was 166.1 pounds per acre, while the yield of hulled, clean seed of all plats grown in rows was 322.7 pounds per acre.

The cost of seed for planting is less when the crop is grown in rows. When planted broadcast for seed a seeding of from 8 to 12 pounds per acre will probably produce most satisfactorily. This is from three to four times as much seed as is required for planting in rows.

In most cases unless the grower is equipped with special cleaning machinery, which is expensive, he cannot produce seed entirely free from weeds when the crop is seeded broadcast. The broadcasted crop cannot be expected to crowd out all of the weeds. The few common weed seeds which remain after cleaning with the ordinary farm machinery do not materially lower the value of the seed for home use, but do reduce the value of the seed when placed on the market.

Some hand labor is usually required to produce seed free from weeds. Considerably more labor is required to grow a seed crop in rows than when broadcasted. The amount of hand labor required to grow the crop in rows is exceedingly variable with conditions. Most growers are agreed that if the crop is produced under favorable conditions the hand labor required for weeding should not exceed 5 to 10 hours per acre.

#### **RECOMMENDATIONS FOR GROWING HUBAM SEED CROP\***

**Choice of Soil:** Hubam clover will grow satisfactorily on most all types of soils which are not distinctly acid. With the high price of seed, however, it is advisable to grow Hubam clover on the best soil available. Like all other crops it produces best on fertile soils. If the crop can be planted on clean ground, preferably following clover or alfalfa the previous year, so much the better. Lime should be applied in case the soil is acid. Observations and reports from growers indicate that while Hubam clover may grow well on some soils which are acid the clover grows best on soils which are well supplied with lime. About a ton per acre of ground limestone more than enough to correct the acidity should be scattered on the land after it is plowed.

**Preparation of the Seed Bed:** The crop may best be grown on land which has been fall plowed. If a fall plowed piece of ground is not available it will probably be advisable to seed on land which grew a cultivated crop the previous year, as spring plowing is likely to delay seeding. It is apparently important to plant on a fairly firm seed bed. If the soil is loose it will be advisable to firm the seed bed with a roller or packer in addition to the ordinary preparation with disc and harrow.

**Inoculation of Seed:** Unless alfalfa or sweet clover have been grown on the land in recent years it is advisable to inoculate the seed. The clover cannot use the free nitrogen of the air unless these bacteria are present. Commercial cultures are easy to use according to directions. Soil from inoculated alfalfa or sweet clover fields may be used to inocu-

\* Recommendations for growing the seed crop are based largely upon a survey which gave definite and detailed reports from growers of 435,131 pounds of seed.

late the seed or may be scattered on the land at the rate of three hundred pounds per acre on a cloudy day and harrowed.

**Seeding:** Best results have been secured by seeding about oat planting time in the northern states. Hubam clover, like other common clovers, grows best with plenty of moisture. If seeded early when there is plenty of moisture in the soil the crop will become well established before most of the annual weeds have started.

Hubam clover may best be seeded at the depth which gives best results for other clovers. In most cases it should be seeded just as shallow as possible. There are some types of soils, however, where a little deeper seeding appears to give better results.

Hubam clover may be expected to give the best results in most cases when seeded at the rate of 3 pounds of scarified seed per acre in rows wide enough to permit convenient cultivation. Some growers favor seeding a little oats or wheat along the Hubam clover row to mark the row and allow for early cultivation.

The clover may easily be seeded in rows of proper width with an ordinary grain drill by stopping part of the holes. Many growers report satisfactory results when a corn planter is used. Special plates will need to be provided for the planter. The local implement dealer can either order the plates from the company or secure blanks and directions for drilling the necessary holes.

**Cultivation:** Cultivation should be started just as soon as possible. Many growers favor "blind plowing" just after seeding. This is possible if the clover has been seeded with a corn planter. The crop should be cultivated frequently and just as close to the plants as possible. Since the clover develops a tap root and few branching roots it is possible to cultivate close without injuring the young plants. Careful and thoro cultivation may make hand work unnecessary.

**Bees Valuable for Pollinating Flowers:** Bees are valuable producers of Hubam clover seed and Hubam clover is a valuable producer of honey. The Hubam clover seed growers state that it pays to induce bee men to set hives of bees near Hubam clover fields. The bees pollinate the flowers and cause a heavier setting of seed. One or two hives of bees per acre of Hubam is the general recommendation.

**Harvesting, Threshing, Hulling and Scarifying:** Experiences would indicate that the best machine so far developed to harvest Hubam clover seed is the ordinary grain binder equipped with pans to catch the shattered seed. The cutting may best be done when an average of two-thirds of the seed pods are ripe, since the seed shatters badly when mature. Cutting at night or when the clover is slightly damp will prevent shattering. Hubam requires about 10 days to cure and dry after being cut and then it may be threshed with an ordinary grain separator with a few adjustments. A regular clover huller is sometimes used for threshing. After threshing the seed may be hulled with the Ames Hulling and Scarifying Machine and cleaned with a fanning mill.

Plans and drawings of the scarifying machine may be obtained from the Farm Crops Section, Iowa Agricultural Experiment Station. This machine is easily built and does the work of hulling and scarifying effectively. The cost of building is small and the operating cost is low.

#### **VOLUNTEER HUBAM FOR SEED FOLLOWING A SEED CROP OF THE PREVIOUS YEAR**

Last season the Iowa Station grew a satisfactory crop of seed following a seed crop in 1920, which had been grown in cultivated rows. The land was given no preparation whatever and no additional seed was

planted. The land reseeded itself to Hubam clover from the shattered seed of the previous year. The crop yielded 171.2 pounds of hulled and cleaned seed per acre.

The station has received reports from many who have grown a satisfactory volunteer crop from shattered seed of the year before. However, others report unsatisfactory results from this method.

If it is desired to grow a volunteer crop the station believes it is advisable to disc lightly three or four times and harrow in the late fall. Discing will distribute and cover the shattered seed more uniformly and kill perennial and biennial weeds. It will also be advisable to hoe out any remaining biennial or perennial weeds or biennial white sweet clover plants which may be present.

#### **HUBAM FOR SEED WHEN PLANTED WITH SMALL GRAIN**

Experiments conducted by the Iowa Station indicate that Hubam clover cannot be depended upon to mature a seed crop following small grain in this latitude. Reports indicate that this method of seed production may be successful farther south. Hubam clover seeded with small grain made an excellent growth following the removal of the grain in each of the three years it has been grown in this manner at the Iowa Station. However, its maturity is retarded by the small grain to such an extent that it has not completely matured a seed crop before frost.

An early strain from Alabama which was grown in comparison with the Iowa strain did mature its seed following a small grain crop. This strain is about 3 weeks earlier in maturing than the Iowa strain or the late Alabama strain and makes a somewhat smaller growth.

#### **HOW HUBAM DIFFERS FROM BIENNIAL WHITE SWEET CLOVER**

Hubam clover makes its full growth, blooms, sets a seed crop and dies the same year it is seeded. Biennial white sweet clover makes a strong root growth the first year but makes its main growth, blooms, sets a seed crop, and dies the second year. Hubam clover and biennial white sweet clover are quite similar for a period of about two months from seeding. At the end of this period the Hubam begins to grow very rapidly. As soon as it begins to bloom it sends out longer branches and soon begins to lose its leaves just as the biennial does in the second year of growth. Since biennial sweet clover does not bloom until the second year, the first year's growth remains leafy and succulent until it is killed by freezes in the fall. Moreover, Hubam clover is more upright in its early stages of growth than is the biennial. The biennial is somewhat more decumbent. Hubam clover when flowering and setting seed in its first year of growth is similar to biennial white sweet clover when the latter is flowering and setting seed in its second year of growth. In fact, they are so similar at the time of flowering and setting seed that they grew together for many years over a rather large area near Newbern, Alabama, without the farmers in that community discovering that there were two distinct types, one making its growth in a few months and the other requiring two seasons.

The only reliable way to tell Hubam clover from biennial white sweet clover is to examine the roots of the plants. Hubam clover develops no crown buds because it is an annual and lives but one year. Biennial white sweet clover develops crown buds during its first season of growth. These crown buds, which lie dormant during the winter, are the source of the second season's growth. The seed of Hubam clover cannot be distinguished from the seed of biennial white sweet clover even by expert seed analysts.

### IF YOU BUY HUBAM SEED BE SURE IT IS GENUINE

Since Hubam clover seed cannot be distinguished from the biennial, the only way for the buyer to be sure he is getting genuine Hubam is to buy it from a strictly reliable source and preferably direct from the grower. The Hubam grower or dealer should furnish either a certificate or other bona fide proof that he is selling genuine Hubam clover seed. The importance of being sure of the source of the seed cannot be over emphasized.

### DIFFERENT STRAINS OF HUBAM CLOVER AND HUBAM CLOVER BREEDING

There are now several distinct strains of annual white sweet clover which are quite different. Several experiment stations other than the Iowa Station have strains which they have developed. Two distinct strains were found growing wild in Alabama. One of these is quite similar to the Iowa strain, which the other is from two to three weeks earlier. It is to be expected that some of these strains are better adapted for special purposes than others. It remains for the experiment stations to compare the various strains for specific purposes.

The Iowa strain was originally made up from a composite mixture of 22 different kinds found at the Iowa Agricultural Experiment Station. Each of these kinds reproduced markedly true before they were mixed. These different kinds were mixed before being distributed by the Iowa Station in order to allow for selection and adaptation to widely different conditions. The strain which the Iowa Station is using in its production tests, with the exception of those tests where other strains are seeded in comparison, is truly representative of the samples which have been sent out from the station.

The Iowa strain of Hubam clover, therefore, consists of a composite mixture of many different kinds of plants. These plants vary from those which grow to a height of 6 or 8 feet to those which grow less than a foot high and ripen seed very early. Wide differences may be noted also in every habit of growth. With such wide variations the crop offers exceptional possibilities for improvement by breeding. Strains now in test at the Iowa Station indicate that superior strains may be originated within the next few years for specific purposes, such as green manure, pasture and hay. Perhaps the most important line of investigations with Hubam clover at the Iowa Station consists of these extensive breeding operations. One man devotes practically his entire time to this work.

Occasional plants produced from genuine Hubam clover seed do not set seed at all the first year and some are distinctly biennial in habit. It is quite likely that those plants are hybrids between Hubam clover and biennial white sweet clover. If Hubam clover is grown on a different field each year, hybrids or true biennials which do not set seed the first year will be eliminated quickly.

### HISTORY AND DISTRIBUTION

Hubam was discovered in 1916 by H. D. Hughes of the Farm Crops Section at the Iowa Agricultural Experiment Station. It is a rapid growing annual legume closely resembling biennial white sweet clover from which it probably originated. It was first distributed in the spring of 1918 when the Iowa Station sent seed samples not only to all of the experiment stations in the United States, but also to 60 of the large seed companies as well. Additional samples of seed were distributed in 1919 to any one who asked for seed and who sent a stamped,

self addressed envelope. In the spring of 1920 over 45,000 samples were sent out. The samples went not only to every state in the union, but also to many foreign countries. In 1921 several thousand more samples were distributed.

The possibility of making an early distribution of Hubam clover to *other stations* for trial to determine its range of adaptation was considered following preliminary trials in 1916 and 1917. In November, 1917, an annual white sweet clover article contributed by the Office of Forage Crop Investigations of the United States Department of Agriculture and printed in a scientific journal failed to state that the clover was first called to the attention of the author and was first observed by him at the Iowa Station. The appearance of this article brought about an immediate, general distribution of seed.

Following the publicity incident to the distribution of seed in 1918 and 1919 reports were received from a considerable number of individuals who had observed occasional plants of annual white sweet clover in seedings of the biennial. These reports have come from several states and in nearly every instance where the source of the seed could be traced it was found to have come from Alabama. Following the distribution of small samples of seed to the different experiment stations in 1918 a letter of acknowledgment from the late Dr. Cyril G. Hopkins of the Illinois Experiment Station stated that the annual type of white sweet clover had been selected by a member of their crop breeding section. More recently the United States Department of Agriculture reports in circular 169 that a few plants of the annual variety have been observed growing wild in the vicinity of Washington, D. C. In July, 1920, H. D. Hughes of this station found over a hundred acres of the annual white variety growing wild in the vicinity of Newbern and Uniontown, Alabama.