

Catch Crops for Forage and Green Manure.

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By the term catch crops is commonly understood a crop which is used to occupy the soil at a time when it would otherwise be vacant, whether this vacancy is caused by the failure of one of the regular crops of the farm or coming between the time of harvesting one crop and the planting of the succeeding one. The catch crop occupies a field which in the more common farm practice would remain bare or unproductive during the interval of the growing of the crop. It is often an emergency crop, that is a crop not at first planned for but introduced to supply a want which is a consequence of an accident or unforeseen conditions.

A rigid regard for the teachings of farm economy would make "catch crops," as regular members of our rotation as any of the crops of the farm. It is not more true that "Nature abhors a vacuum" than that the good farmer abhors a bare field.

The increased labor in the care of crops in subsequent years resulting from the germination of the countless weed seed developed in the idle field, will make heavy inroads upon the owner's time and money. The catch crop may be made to keep down these weeds and at the same time improve the mechanical condition of the soil; and these are two of the chief advantages of growing catch crops.

The catch crop feeds on food material which is made soluble and thus retains it for use in the next crop, where it might otherwise be leached away.

A catch crop, in so far as possible, should combine the following characteristics: cheap seed; rapid growth; ability to thrive when sown broadcast; freedom from characters, either of root or seed, which will cause it to become a troublesome weed; a deep vigorous root system; the ability to take part of its nitrogen from the air; hardiness; ability to stand frost and to grow at a low temperature; and to be of

value either for forage or for soil improvement.

Perhaps no one plant combines all of these characteristics but there are a number which possess enough of them to be practical catch crops for Kansas farmers. The particular crop to be used in any locality will depend largely upon the location, climate, soil, and the use to be made of the crop.

In this article only such crops as promise to be of value to the Kansas farmer will be considered. This will include sorghum, Kafir corn, oats, millet, rye, and rape, of the non-leguminous crops; and cowpeas, soy beans, and hairy vetch of the leguminous crops.

There seem to have been very few experiments carried on in Kansas in which catch crops were a prominent feature, but experiments carried on in other states and the few that have been tried in Kansas indicate that catch crops can be made a source of profit and at the same time increase the fertility of the soil.

A very large per cent of the cultivated land in Kansas has been cropped continuously for the last twenty, thirty, or fifty years with but very little, if any, manure or other fertilizer returned to the soil. These fields are becoming depleted in their productiveness and the intelligent farmer can readily see that the time has come when something must be done to restore and maintain the soil fertility.

When forage is the main object or the soil is very deficient in humus it may be desirable to grow some of the non-leguminous crops as a catch crop, as these crops generally give a larger yield of forage than do the legumes. Hence they may produce more hay or more humus if plowed under.

Green plants are readily decomposed when plowed under, and form humus more readily than does the more mature vegetation. Humus is a necessary and important factor in all soils, not only for the plant

food it contains but also for the physical effect it has on the soil. Humus effects the temperature of the soil in a beneficial manner. By reason of its dark color a soil rich in humus often shows, under the direct rays of the sun, a higher temperature than light colored soils under similar conditions, but the general effect of a sufficient humus supply in the soil is toward diminishing extremes in soil temperature, so that a humus soil should be cooler in the day time and warmer at night; and cooler in summer and warmer in winter than purely mineral earth, especially sand.

Clay soils and sandy soils are in physical texture at opposite extremes, a loam grading in this respect between clay and sand. Humus benefits each soil, but by working in opposite directions. It makes clay less stiff when wet and more crumbly when dry; more porous, with freer access of air, thus it favors those changes that are dependent on the oxygen of the atmosphere, such as nitrification. It lessens the puddling of clay and makes it more pervious to water, thus favoring drainage in a wet season and the upward capillary movement of water in a drought. On sand the effect of humus is always to make the soil more coherent, more retentive of water with less tendency to leach.

Non-leguminous crops.

These crops are those which do not give to the soil any essential chemical element which it has not taken from it, but which are mainly grown for forage and the production of humus.

Oats are often used as a catch crop when green pasture is desired. They can be sown early in the spring, and as they grow at a low temperature the crop will make a good pasture for calves and pigs before wild pasture grasses have started, thus the droppings of the animals are left on the field, and if the oats are not pastured too

closely, by the last of May there is a good covering of green manure which can be plowed under and the field sowed to millet or similar crops.

Oats are sometimes left until they begin to head and then are cut for hay and the ground plowed and put into some summer crop. This gives a crop of very good hay, but it is doubtful if the soil is benefited any.

Again, oats may be sown in the late summer or early fall for pasture and as a cover crop, especially in orchards. When sown in this way the grain makes a good growth in the fall and will furnish a good supply of pasture, but if sown in orchards only such animals as will not injure the trees should be allowed to pasture on the crop. Oats are considered preferable for sowing in orchards because they make a ranker growth than other crops, such as rye or wheat, thus forming a better covering for the ground in the winter, and as they are killed by the winter freezing oats do not appear as a weed to exhaust the soil fertility and moisture in the spring but furnish a good coat of manure to be plowed under.

Rye, when used as a catch crop, is generally sown in late summer, either on stubble ground or in the corn after it has reached the roasting ear stage. The crop may be pastured during the fall, winter, and early spring, and then plowed under and the field planted to a spring crop. In this way the farmer may secure a considerable amount of pasture and not interfere with his regular plan of cropping; the animals will leave as much fertility on the soil as they take off, and if there is a fair growth to be plowed under in the spring considerable humus may be added to the soil. However rye will draw upon the soil moisture and if the spring is dry plowing under of a crop of rye may have a detrimental effect upon the succeeding crop.

Millet is a rather shallow rooted crop, but it makes a rapid growth and has a tendency to make the ground mellow, upon which it is raised. It is sometimes sown after an early maturing crop as a catch crop, with very good results.

At the Kansas Experiment Station, in 1903, Siberian millet sowed June 24" required 81 days to mature, was two feet high, and made a yield of cured fodder of 1.59 tons per acre. The same year millet sowed July 1st had matured and was cut by August 21st, making a yield of 2.23 tons of hay per acre. This was a remarkable yield in a short time and shows that Siberian millet can easily be grown after wheat, rye, or oats, provided the ground is in such condition that the seed will sprout soon after sowing.

On my farm in Smith County, in 1905 Hungarian millet sowed in wheat stubble July 22", matured and stood 18 inches high by Sept. 1", but was not cut until two weeks later, when it yielded .4 tons of hay per acre. The seed was sown with a press drill and put in too deep, which probably accounts for the light crop. Allowing the crop to stand fully two weeks after it was ripe, when many of the leaves had fallen, was another reason for the low yield.

The plot sowed to millet last year was sown to oats this spring. The oats on this plot have made a better growth than on similar plots which were sown to Kafir corn and sorghum, but are inferior to a similar plot sown to cowpeas and a check plot which received the same culture but had nothing sown on it.

Millet sown as a catch crop will furnish a good pasture for cattle, sheep, or hogs at a time when other pastures are dry, or the crop may be left and cut for hay or plowed under for green manure.

Kafir corn and sorghum are so very similar in their growth, habits, and effects upon the soil that they will be treated together.

Sorghum contains more sugar than does Kafir corn, hence if the fodder is coarse it is more likely to sour, and for this reason if cut for fodder it should be fed in the fall or early part of the winter. If sorghum is sown thickly so that the canes grow slender and leafy, the hay is not likely to sour when properly cured. Sorghum is more likely to poison cattle if pastured and for pasture Kafir corn is considered the safer crop, although sometimes Kafir corn causes cattle to bloat.

If forage or a large amount of humus is the immediate demand there are probably no other crops so well suited for emergency crops or for catch crops as Kafir corn and sorghum, since these crops are great drought resisters and will make a very heavy growth in a short time. I have known these crops to be planted as late as August and yet make a good crop of excellent forage.

In 1903 in a late pasture test at the Kansas Experiment Station, Kafir corn and cane were sown July 1". On August 20" the cane varied in height from 2-1/2 to 4-1/2 feet, and the Kafir corn averaged 2-1/2 feet high. These crops were pastured along with other crops from August 21" to Sept. 20", the cattle seeming to prefer corn, soy beans, and cowpeas when first turned on these crops, but later pastured mainly on the cane and Kafir corn. There was a large part of these crops trampled down and wasted, which when plowed under furnished considerable humus for the soil, and this with the manure from the cattle added somewhat to the fertility of the soil, besides giving a month's pasture at a time when native pastures were dry.

On my farm, along with other catch crops I planted two plots each of sorghum and Kafir corn. One plot of each being listed and one drilled in with a grain drill. The disked plots were planted in wheat stubble July 20". The wheat stubble on which the drilled crops were to be planted was plowed and harrowed July 21" and the seed

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drilled in July 22". There was a light rain July 23" and a heavy rain July 25". The seed sprouted nicely within a few days. The listed plots were cultivated with a long knifed monitor and afterward harrowed and later given a second cultivation. All the plots made a fair growth and by Sept. 13" the Kafir corn ranged from 2-1/2 to 3 feet high and the sorghum averaged more than 3 feet in height. Each crop made a good growth of leaves, the Kafir corn more than the sorghum.

The sowed plots made a thick even growth; the stalks were slender and bore numerous leaves. On Sept. 13" the canes averaged nearly 2-1/2 feet in height.

The first killing frost occurred on the night of Oct. 17". All four plots were harvested on the 18" and the fodder put in shocks and left to cure until Nov. 12", when it was weighed. The yields of cured fodder per acre were as follows:

	lbs.
Sowed Kafir corn	4400
" sorghum	6000
Listed Kafir corn	2380
" sorghum	2000

The fodder was of excellent quality and was readily eaten by both horses and cattle, there being practically no waste.

The land upon which sorghum and Kafir corn was grown was double disced and sown to oats this spring and at this date, June 8", the oats are small and have a sickly yellow color, while other plots sown to cowpeas, and one which remained fallow and which was plowed and harrowed at the time of seeding the catch crops, have produced a good growth of oats, which have a healthy dark green color. This shows that while I was getting a twenty-five bushel wheat crop and a large amount of excellent fodder from the same land in one year I was also depleting the fertility of the soil. However, had the crops been pastured on the ground or plowed under for green manure the resulting

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oat crop might have been much larger.

If these crops are used as catch crops, whether they are to be harvested and the fodder taken from the field or not resolves itself into a question of "Present versus Future returns." If forage is scarce and the soil is fertile it will probably be profitable to cut the crop for hay, but it should be remembered that in doing this the soil is being heavily taxed and will not maintain its fertility under such continuous cropping. On the other hand, if the soil is deficient in humus, being either too sandy or too clayey, the physical condition can be greatly improved by sowing these crops after a crop of small grain has been harvested and then plowing the green growth under in the fall.

While these crops do not give back to the soil any necessary element which the crop has not taken from the soil yet there are no other crops which will produce such a large amount of forage; and where forage or humus is the main object these crops undoubtedly excel others as catch crops.

Rape is a plant mid-way between the turnip and the cabbage, and furnishes a very succulent feed. The plant grows rather rank and has large spreading leaves which shade the ground almost perfectly after it has grown to be from one to two feet high, which usually takes it about four weeks from seeding. It is best adapted to rather cool moist climate, but it can be successfully grown in many of the warmer and drier sections of the country.

Rape will endure quite severe cold weather and thus will last a long time after the ordinary pasture succumbs to frost. At the Oklahoma Experiment Station, fall seeding made a fair growth and withstood the December freezing. Rape is usually ready for use in about 8 or 10 weeks from the date of seeding, although it may be pastured much

sooner if necessary.

The chief use of rape is for pasture for hogs, sheep, and poultry. It is especially good for sheep. At the Wisconsin Experiment Station, where much attention has been given to growing rape for forage, a trial of the value of this crop for pasture resulted in a gain of 413-1/2 pounds of mutton from 9-3/4 tons of rape and 1439.8 pounds of grain, (wheat and oats). Experiments at the same Station with hogs showed that while excellent when combined with grain, rape does not give sufficient nourishment when fed alone. It was demonstrated that where fattening pigs were fed rape in conjunction with a grain ration, one acre of rape had a feeding value equivalent to 2657 pounds of grain, and that young pigs thrive better when pastured upon rape than on clover, grain being fed in both cases.

Cattle relish rape but when turned on it they waste considerable and it is reported that it taints the milk of dairy cows.

Any ground that will grow good corn will produce good rape. It responds readily to good preparation of the soil but when grown as a catch crop it will not often be possible to pay so much attention to the preparation of the seedbed.

Professor Hitchcock, in U.S. Farmers' Bulletin No.164, states that "Often fine rape may be grown on land that has already produced a crop of some early maturing cereal, such as rye, oats, or barley." "As soon as the crop of grain is removed the land is plowed or disced and at once seeded to rape."

At the Kansas Experiment Station last year (1905) a very good crop of rape was grown in wheat stubble by simply seeding with a disc drill directly behind the binder as the wheat was being harvested.

Rape may be grown in the corn fields, being seeded at the time of the last cultivation or afterward, but it has not been so successful

when grown this way as the corn takes the moisture needed by the rape.

Professor Burnett of Nebraska recommends sowing rape in the spring with some grain crop, such as wheat or oats, allowing the rape to take possession of the field when the grain crop is cut. He states that "In Minnesota and the Dakotas, with a good stand of rape in the stubble, sheep can be turned in about three weeks after cutting the grain." "Such a field will support 10 or 15 sheep per acre and keep them growing six weeks."

Professor Hitchcock says that "Each year finds the area in which rape is grown extended until it now includes much of the spring wheat region of the Northwest, where it is grown chiefly as a catch crop."

The above experiments indicate that rape can be made a profitable catch crop in Kansas, especially for the farmer who is raising sheep, and hogs.

As a green manuring crop rape, owing to its containing a large amount of water, does not produce a very large amount of vegetable matter, but what there is decays readily when plowed under, and when the crop is pastured there is generally a considerable amount tramped down, which when turned under adds materially to the productiveness of the soil.

Leguminous crops.

So far only such crops as are mainly valuable for forage and the production of humus have been considered. Now we will consider those crops which are mainly of interest because of their ability to increase the fertility of the soil and at the same time produce a fair amount of valuable forage.

As nitrogen is the one element most lacking in nearly every soil and as this element is absolutely necessary for the production of crops in general, a system of culture which will furnish this element

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is very desirable. Leguminous plants, through the bacteria which live on their roots, gather the free nitrogen from the air, where it exists in unlimited supply, but in such a condition that it cannot be utilized by plants. The nitrogen thus gathered is deposited in the seeds, leaves, stems, and roots of the plant. Chemical analysis has shown that from one-fourth to one-half of the nitrogen of these plants is found in the roots, so if the upper part of the plant is removed for forage there still remains a good supply of nitrogen for the succeeding crop.

Where a field can be kept in legume crops for four or five years, alfalfa, where it can be grown successfully, is the best crop to use in restoring the fertility of the land, clover answering the same purpose in a two or three year rotation where it is well adapted for growing. It takes a long time to rotate these crops on the several fields of a farm, and it is often desirable to keep certain fields continually under cultivation. Thus it becomes necessary to use some annual crop which may in a measure fill the place of the clover or alfalfa. If crops can be grown which will not interfere with the growing of the regular crops of the farm and yet fertilize the soil and furnish sufficient forage to pay for their culture it is greatly to the farmer's interest to grow such crops. Experiments indicate that such crops are found in vetches, soy beans, and cowpeas, when grown as a catch crop after small grain or sown in the corn field at the time of the last cultivation.

Hairy vetch is very similar to peas, the plants bearing slender leaflets, small blue flowers, and a small seed about the size of a No. 2 shot. The seed of this plant was imported into the United States by the Department of Agriculture at Washington, in 1886, and since that time it has been experimented with in a number of states and gives promise to become one of our prominent leguminous crops.

The benefits from hairy vetch are fall, winter, and spring pasture, and vetch hay in combination with other crops, fertilization of the soil by means of the nitrogen gathered from the air, and the mechanical improvement of the soil due to the addition of humus, which increases the capacity of the soil to hold water and withstand drought.

Hairy vetch is now cultivated successfully over a very large area of country. In the North it is used as a summer crop. In the South it is grown largely for winter pasture.

The Colorado Station reports that "It will thrive on the lightest kind of soil and when sown in the fall will keep the land from blowing during the spring months, afterward adding a large amount of humus and fertility to the soil. The roots are bountifully supplied with tubercles. If this plant is sown in early September it will produce a considerable growth to be plowed under in April or May, or if allowed to mature will ripen seed in early July."

The Ohio Experiment Station reports that hairy vetch will withstand the winter freezing in that climate.

It is recommended by those who have experimented to sow the vetch with some grain crop in order that the grain may give support to the vines. The hardy character of the crop makes the vetches particularly adapted for growing as catch crops, since vetch may be sown in the summer or fall after other crops have been harvested, and pastured in late fall and early spring, and then plowed under, thus adding fertility to the soil and giving considerable pasture besides.

As a forage crop hairy vetch has been very satisfactory. Prof. Hecker of Nebraska reports an average of 20 pounds of milk from a cow pastured on vetch, while the same cow pastured on cowpeas only averaged 16.59 pounds, though he states that the cowpeas were not an average crop. In the same experiment he found that the vetch did not

produce as much forage as did oats and peas, Indian corn, Kafir corn, or sorghum.

In a test to determine the value of vetch for green manure at the Michigan Experiment Station it was found that 12 per cent of the nitrogen of hairy vetch exists in the roots, tubercles, and stems below the line where a mower would cut in mowing. In the same test it was calculated that the average crop of vetch would supply 180 lbs. of nitrogen per acre, 159.2 being in the hay and 20.8 in the roots. In a similar test the Delaware Experiment Station found that an average crop of vetch yielded 121.2 lbs. of nitrogen per acre, 108 lbs. being in the hay and 13.2 lbs. in the roots. This nitrogen if purchased in the form of commercial fertilizers would cost about 12¢ per pound. If the average crop of vetch yields 150 pounds of nitrogen per acre, such crop plowed under or pastured off, allowing the manure of the animals to be left on the field, would replace \$18.00 worth of commercial nitrogen, besides leaving the soil in a better physical condition, and if the crop was pastured there would be a large amount of animal flesh which would add to the money value of the crop.

These calculations indicate that it is well worth while to try hairy vetch in different parts of Kansas, especially by sowing it as a catch crop after small grain.

There seems to be but little data on soy beans used as a catch crop, but as this plant is a good drought resister and will mature in about 100 days from the time of seeding there is no reason why it can not be grown as a catch crop. The greatest difficulty seems to be that the plants are relished by all animals and the crop is often seriously damaged by grass hoppers, rabbits, and web-worms. Sheep are exceptionally fond of the plant, while cows and pigs eat it greedily.

The soy bean is more particularly valuable for ^{the} seed though it is

grown for the forage. The seed is very rich in protein, containing about 34 per cent. In order to procure seed it is best to plant in rows so that the beans can be cultivated.

On July 20" last year (1905) I listed 1/8 acre of Early Yellow soy beans in wheat stubble. The beans made a good start, when the young plants were eaten down by rabbits. The plants readily sent out new shoots however and got ahead of the rabbits when the crop was attacked by the web-worm and the plants almost denuded of leaves. Again the beans threw out new leaves, though there was no rain for a month and the weather was extremely hot and dry. The grass hoppers also ate the soy beans badly, but in spite of all these disadvantages the plants bloomed and set from 4 to 12 pods on each vine, and matured considerable seed before frost. The yield was not determined but had there been a larger field and not so many pests undoubtedly the beans would have made a profitable crop.

As shown above, the things in favor of the soy bean as a catch crop are, its power to gather nitrogen from the air; its drought resisting qualities; its richness in protein and fat; and its palatability to stock: while the points against it are that it requires cultivation for best results, and is eaten by so many pests. The crop is also difficult to harvest for seed, requiring the use of a bean harvester, or else pulling by hand.

Cowpeas are perhaps the crop which in general excels all others for planting as a catch crop in Kansas. This crop makes a good growth in a short time and both the fodder and grain are eaten readily by horses, cattle, sheep, and hogs, when the stock have once become accustomed to the feed.

Cowpeas are a great drought resister and are not attacked much by any of the pests that destroy soy beans. The plant has a spreading

vine thickly set with leaves, which have a high feeding value. In several of the Southern states cowpea hay is considered to be equal in feeding value to clover or alfalfa.

In Alabama cowpeas are used extensively as catch crops after early maturing crops, or planted in the corn between the rows. This practice has been extending north until in the last few years Arkansas, Oklahoma, Missouri, Colorado, and Kansas, have reported very profitable results from using cowpeas in this way.

The Oklahoma Experiment Station, in Bulletin No.22, published in 1897, recommended cowpeas as an excellent crop to be plowed under for green manure; and since that time cowpeas have been found to be very valuable as a catch crop.

In Bulletin No.59 of the Oklahoma Station, Professor Burtis says, "The crop may be planted at any time from after corn planting until after wheat harvest, and in some cases later. It should be used more as a catch crop than it is, for instance after wheat and oats." He recommends listing in the stubble, the peas may be given little or much cultivation, as time affords, and a fair growth of vines may be obtained. The land is enriched and cultivated and not left to grow up to weeds, and with little preparation the land is ready for the next crop. He also recommends plowing and sowing broadcast or with a drill, for pasture and green manure. He states that "Experiments at the Oklahoma Station show that seed sown on ground from which a crop of oats or wheat has been removed will produce from 1-1/2 to 2 feet of growth by the first of September." He also says; "When cowpeas are planted for green manure it is an excellent practice to turn hogs or cattle into the field about the time the peas are ripening." ***** "Young pigs thrive amazingly on the succulent foliage and pods and the quality of pork raised on such diet is very fine. An acre of ripening cowpeas will pasture from 15 to 20 hogs for several weeks, and the

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gain in fertility from the droppings of the animals will more than counterbalance the value of the food eaten, thus the gain of the animals is clear profit."

In the Oklahoma annual report for 1904 & '05, Director Fields says: "Cowpeas being a hot weather plant are especially well adapted for summer planting as a catch crop following wheat, oats, and other early crops". "Cowpeas are the best drought resisting crop and drought seldom cuts the yield below a profitable point. No season has been too dry in Oklahoma but what during some portion of it there was enough moisture to grow a crop of cowpea hay. Cowpeas are seldom subjected to the ravages of insects or plant diseases while growing, and they are entirely proof against the ever present chinch bug." At the Oklahoma Station cowpeas seeded as late as the middle of July had completely covered the ground on September 15", with a growth of vines 2 to 3 feet in height, containing many pods and blossoms.

The above experience would indicate that under favorable conditions a good crop of cowpeas could be grown after a wheat crop in any part of Kansas, as all of our wheat is harvested before the middle of July and we seldom have much frost before the 15" of September.

At the Arkansas Station it was found that cowpeas planted July 8" made a good crop of hay and some seed before frost and that the early maturing varieties matured in from 67 to 80 days.

At the Alabama Station young pigs pastured on nearly mature cowpeas and supplied with some corn in addition gained nearly three times as much in weight as a similar lot of pigs fed exclusively on corn. After deducting the value of the corn fed the cowpeas returned, in the form of pork, \$10.65 per acre.

At the Michigan Station cowpeas made a good covering of vines 13 inches high in 2-1/2 months.

At the Colorado Station beets planted on cowpea stubble land

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produced 3-1/2 tons of beets per acre more than was harvested from similar land on which cowpeas had not been grown.

At the Kansas Station experiments in rotation of crops have been started. The purpose is to add nitrogen to the soil by growing cowpeas as a catch crop after wheat and in the corn. Cowpeas are planted in the corn after the last cultivation. So far the cowpeas have given very encouraging results both after the wheat and in the corn, but the data is not yet in available form for publication.

In my experiment on my farm in Smith County last summer I selected a part of a field which was practically uniform. The whole plot had been in wheat. The wheat was harvested with a header about July 8", leaving about 18 inches of stubble. The experiment was not started until July 20", when 1/4 acre each of sorghum, Kafir corn, soy beans, and cowpeas were planted with a lister. On July 21" I plowed under 1-1/4 acres of stubble lying next to the listed plots, and on July 22" I sowed 1/4 acre each of the following crops: sorghum, Kafir corn, millet, and cowpeas. The other 1/4 acre was harrowed and left as a check plot. The sowed crops were planted with a shoe drill having the ordinary force feed and a large per cent of the cowpeas were broken so that this crop did not make a good stand, but what did grow made a fair growth, not being effected by pests as were the soy beans in the cultivated plots.

The cultivated plots were all gone over with a long knifed monitor, then harrowed, and later given one cultivation. The soil was moist when the seed was put in and two good rains followed in a few days, so that the seed all came up promptly. However after the first week there was no rain for a month but the crops all withstood the drought well, except the millet, which did not make a good growth. The listed cowpeas made ^ugrowth from 12 to 15 inches in height, while the sowed peas averaged 10 to 12 inches high. The listed peas showed

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the best color and had a heavier crop of leaves. The roots were well supplied with nodules and a good many pods were set but no seed matured. The results of these experiments with the several crops are given under their respective heads in this article.

The tables following show a comparison of the different crops in these experiments:

Experiment with listed forage crops, after wheat, planted July 20, 1905.

Crop	Depth of listing	Depth of subsoiling	Seed covered	Number of seed dropped at once	Distance between drops	Date of sprouting	Date of coming up	Date of cutting	Date of weighing	Yield per acre
	inches	inches	inches		inches					pounds
Early Amber sorghum	4-1/2	2	2-1/2	3 to 5	11	7-22	7-24	10-18	10-28	2000
Kafir corn	4-1/2	2	2-1/2	3 to 4	11	7-22	7-24	10-18	11-3	2380
Cowpeas	3	2	2	4	11	7-22	7-24			
Soy beans	3	2	2	5	11	7-22	7-25			

Experiment with sowed forage crops, after wheat, crops planted July 22-1905.

Crop	Seed per acre bushels	Depth planted inches	Date of sprouting July	Date of coming up July	Date of harvesting Oct.	Date of weighing Nov.	Yield per acre pounds
Kafir corn	1	2	24	26	18	12	4400
Cane	1-1/4	2	24	26	18	12	6000
Cowpeas	1-1/8	2	23	25	18	12	604
Millet	3/4	1/2	24	26	18	12	832

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The vines of the listed cowpeas and the soy beans were left on the ground and disced under last spring, and the whole plot was double disced and sowed to oats. The season has been very dry and none of the oats made a very heavy growth, but the grain on the listed soy bean and cowpea plots has a better color and was two or three inches higher than the oats on any of the other plots on June 10". The next best in color, and growth are the oats on the ground which grew the sowed cowpeas, and this grain is but slightly better than that on the check plot which was plowed and harrowed at the time the catch crops were seeded but upon which no crop was planted.

On the date given the oats on the millet plot were slightly better than those on the sorghum and Kafir corn plots, while the grain on the listed Kafir corn and sorghum plots, though very yellow and sickly was better than the oats on the plots which grew the sowed Kafir corn and sorghum. The oats on the sowed plots were very short and yellow and were badly burned by the continued dry weather, and it is doubtful if the crop will pay for harvesting, if there is no rain in the near future.

This experiment shows very nicely the effect of the several crops on the soil. While I expected that the sowed cowpeas would show the best results on the oats this year I account for the superiority of the oats on the listed cowpea and soy bean plots by the fact that the vines of the sowed plots were cut for hay and removed from the soil while the crop was allowed to remain on the listed plots, also the listed plots were cultivated and a soil mulch maintained throughout the summer and fall while the sowed plots had no culture. It is probable that had the vines been left on the sowed plots and plowed under or had they been pastured off and the manure from the animals left on the field, this plot would have shown equal or better results in the growth of the oats than did the ground which grew the listed

peas and beans. However after the vines were removed from the sowed plot there was still a benefit to the soil from having grown cowpeas as a catch crop, as shown by the better growth of the oats on this plot as compared with the check plot.

The Kafir corn and sorghum plot while yielding much the more profitable crop last year demonstrates the detrimental effect on the soil of growing these crops after another crop and then removing all of the forage. These crops grew late in the fall and left the soil robbed of moisture and available plant-food, and as the winter and spring have been very dry the ground is hard and dry and the result will probably be that the catch crop under the given conditions will cost the crop of oats this year while the legumes produced some forage and at the same time increased the chance for a crop this year.