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BETTER LAND UTILIZATION IN KENTUCKY

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By GEORGE ROBERTS

A study of the land and crop statistics of Kentucky in the census of 1920 shows a distressingly poor utilization of the lands of the state as a whole.

The following table shows some of the more important of these statistics:

Land area of Kentucky, acres	25,715,840
All land in farms, acres	21,612,772
Improved land in farms, acres	13,975,746
Woodland on farms, acres	6,018,280
Other unimproved land in farms, acres	1,618,746
Number of farms in the State	270,626
Average number of acres per farm	79.9
Average number of improved acres per farm	51.6
Number of people living on farms	1,305,000
Percentage of population living on farms	54.0
Average number of people per farm	4.8
Percentage of people living on farms in United States	30.0

Harvested crops in 1919 amounted to 6,303,182 acres, or 45.1 per cent of the 13,975,746 acres of improved land. Allowing 4 acres for the house site, barnyard and garden, the land thus occupied amounts to 1,082,504 acres. These acreages deducted from the total improved acreage leaves 6,590,060 acres to be accounted for as pasture land, or about 47 per cent of the total acreage classed as improved land.

The harvested crops of the state amount to about 24 acres per farm as an average. The average yield per acre of staple crops for the five-year period, 1918-1922, according to the United States Department of Agriculture Year Book, are:

Corn, bushels	26.8
Wheat, bushels	11.2
Oats, bushels	21.5
Hay, tons	1.2
Tobacco, pounds	861

Cost of production studies conducted by the Department of Farm Economics of the College of Agriculture of the University of Kentucky show that these yields do not more than cover cost of production. This means that the farmer and those members of his family engaged in the production of crops received only day wages for the labor they put upon the crops.

The total annual value of all products of the soil does not amount to more than $1,000.00 per farm. Live stock kept upon farms of this productiveness cannot return a very large income. Liberal estimates place the value of all live stock and poultry in Kentucky at about $100,000,000, or slightly under $400.00 per farm. On this basis, the total value of the products of the soil and the live stock averages about $1,400.00 per farm, or $280.00 per person living on farms.

To show that these estimates are probably too liberal, the following data are submitted:

In 1922 the average acreage of staple crops per farm was as follows: (Fractions disregarded.)

Corn, acres	12.0
Wheat, acres	2.5
Oats, acres	1.0
Hay, acres	4.0
Tobacco, acres	2.0
	21.5

The census of 1920 shows the average acreage of all harvested crops to be 23.5 acres per farm. Assuming these as a fair estimate of the usual acreages, the average value of harvested crops per farm according to the average farm prices for 1917 to 1921 and for 1922 would be:

	1917-21 Price	1922 Price
Corn, 12 acres	$365.64	$231.84
Wheat, 2.5 acres	54.25	33.92
Oats, 1 acre	17.62	10.25
Hay, 4 acres	87.28	72.48
Tobacco, 2 acres	398.68	331.50
Miscellaneous, 2 acres	60.00	40.00
Total, 23.5 acres	$983.47	$720.00
Estimated value of all live stock, exclusive of poultry, January 1, 1923		355.00
		$1,075.00

According to the estimates of the United States Department of Agriculture, the value of all crops for 1923 was $237,600,000, while the value of live stock exclusive of poultry on January 1, 1924, was $82,000,000, making a total average value of all crops and live stock of $1,180 per farm. The average value of poultry is about $40 per farm.

It must be remembered that only a small part of this is for sale, because most of the products of the soil are consumed by the farm family and by live stock, while most of the live stock is used for work stock and food for the family.

It can readily be seen that there is not much margin left to spend upon family and community welfare. It may be said safely that Kentucky's school system and the road system will never be what they should be until the earning capacity of the 54 per cent of the people living on farms in Kentucky is increased. In this connection it should be remembered that about 20 per cent of the population of the state lives in towns and villages of 2,500 or less and are chiefly dependent upon farm trade for their business.

While it is true that farmers are suffering severely from low prices for farm products, including live stock, it is not possible for them to be prosperous on the present crop yields at any prices that they are likely ever to obtain in normal times.

Live stock is a means of obtaining larger profits from crops, and the profit of keeping live stock will vary with the profit in producing crops. It is significant that the important live stock industries in Kentucky are found in regions of high productiveness. Live stock is a good means of helping to keep soils productive, but it will not render naturally unproductive soils productive. A profitable live stock industry can not be maintained on the crop and pasture yields obtained on the larger part of Kentucky lands.

Since the average size of Kentucky farms is small, the land must be utilized to the very best advantage if the family is to have sufficient income to satisfy the legitimate demands of modern life.

The proper utilization of the land requires:

1. That the land in harvestable crops be so treated that it will produce crops with a margin of profit.
2. The use of a cropping system adapted to soil conditions and to the type of farming best suited to available markets for crop and live stock products.
3. The production of good pastures thru the proper treatment of the soil and the use of pasture grasses suited to the soil.
4. Larger production of live stock in order to utilize the large acreage of pasture land now utilized far below its possibilities.
5. The production, as far as possible, of the food supply of the family and the feed for live stock.

1. THE TREATMENT OF THE SOIL.

In order to increase the yields of crops so that there will be a margin of profit, more legumes must be brought into the cropping systems of the state. According to the census of 1920, there were the following acreages of legume crops for harvest in the state in 1919:

Clover alone, acres	107,266
Mixed clover and timothy, acres	256,158
Alfalfa, acres	56,211
Cowpeas and soybeans for hay, acres	35,020
Total, acres	454,655

In this state, mixed clover and timothy usually contains very little clover, but counting the crop a legume, the total legume acreage as shown above is only one acre in 14 of the harvested crops, while only one acre in about 60 is in clover. Counting all legumes except mixed clover and timothy, they amount to about one acre in 30 of the harvested crops.

It may be possible that there is a considerable acreage of clover in the state that is not harvested, but observation leads to the conclusion that most of the clover that makes much growth is harvested for hay.

Less than one acre of clover or other legumes in 4 of the harvestable cropping system will not maintain sufficient nitrogen for profitable production and this amount will be sufficient only when the legume crop is properly utilized by turning under, pasturing or feeding with careful saving and return of manure. A good supply of leguminous hay is just as necessary to a profitable live stock industry as it is to the maintenance of fertility.

The fact that more clover is not grown is almost positive evidence that it cannot be grown under existing soil conditions in the greater part of the state. Experiments prove this to be the case.

Results of tests on the various soil experiment fields have also shown the remedy for the failure of clovers. These experiment fields are located in Muhlenberg, Christian, Logan, McCracken, Graves, Shelby, Madison, Laurel and Taylor Counties, and represent practically every type of soil in the state.

In all cases the treatment of the soil with limestone and phosphate has made the growing of clover possible. Sixty-four crops of clover have been grown on these fields in rotation with other crops in the last 8 years. The average yield per acre of these 64 crops has been 1,052 pounds on soil not fertilized, while it has been 3,294 pounds on soil treated with limestone and acid phosphate, an increase of 2,242 pounds per acre. Soybeans in rotation on the same fields have yielded for the same length of time 2,419 pounds of hay per acre on the unfertilized soil and 3,869 pounds per acre on soil treated with limestone and acid phosphate, a gain of 1,450 pounds per acre. One of the rotations used is corn, soybeans, wheat and clover. The average yield of corn on the treated and untreated soil has been 31.2 bushels and 42.8 bushels, respectively, a gain of 11.6 bushels per acre. Another rotation used is tobacco, wheat and clover. The average yield of wheat in the two rotations on untreated soil has been 8 bushels per acre, while on treated soil it has been 17.7, a gain of 9.7 bushels per acre.

The yield of tobacco in these rotations has been 492 pounds on untreated soil and 1,009 on the treated soil, a gain of 517 pounds per acre. It should be stated that all these fields are located on land that was badly worn and that these averages include the low yields obtained in the early years of the work when the yields were necessarily low.

It will readily be seen that these increases will pay the cost of treatment and give a large margin of profit on the investment. An initial application of 2 tons of limestone per acre will last from four to six years. After this, one ton every four to six years should be sufficient, except for growing alfalfa. An average of 200 pounds of acid phosphate per acre will be sufficient. The cost of treatment at this rate will average about $3.50 per acre per year, while the increase in crops exclusive of tobacco will be worth at least $10.00 per acre per year at very low prices for farm crops. The value of the tobacco crop may be increased by $50.00 to $100.00 per acre by the proper use of lime, phosphate and legumes. After a few years, liming may be left off and the rate of fertilizer application may be reduced provided manure is being returned. In this event the cost becomes very small.

Some farmers are so located that they cannot use limestone. In such cases, much improvement can be made in crop yields by the use of phosphate. On the average, acid phosphate produces about one-third to one-half as much crop increase as limestone and acid phosphate together. Rock phosphate used alone at the rate of 400 pounds per acre per year has given 30 to 40 per cent greater returns than acid phosphate used alone at the rate of 200 pounds per acre per year, the cost of the two being about the same. In the case of rock phosphate it is better to use 1,000 to 1,500 pounds at an application, which will be sufficient for three to five years.

Where phosphate is used without limestone or limestone is used without phosphate, clover does not generally succeed very well. There are, however, some important exceptions. On the highly phosphatic soils of the central Bluegrass region, limestone is often the only treatment that is needed in order to get clover.

On some soils that are only very slightly acid, or sour, such as those in the neighborhood of Campbellsville, rock phosphate alone often produces just as good results on clover as limestone and acid phosphate. The results of experiments in the state lead to the conclusion that it is not often advisable to use rock phosphate with limestone. Legumes for acid soils will be discussed under the next head.

2. THE CROPPING SYSTEM.

The cropping system will be determined in a large measure by the size of the farm, the markets available, the type of soil, the kind of fertilizer treatment possible to give the soil, and the preference of the farmer for crops or live stock.

As already stated, an essential of all cropping systems is a legume in the rotation once in three or four years. If the land will grow red clover or can be made to grow it by the proper treatment, there is no better legume for the rotation. If the soil will not produce clover and limestone cannot be used, a liberal treatment with phosphate will sometimes produce a fairly satisfactory growth. If clover cannot be grown, soybeans or cowpeas may be used. As an average of all the soybean crops grown on the Kentucky soil experiment fields, the yield has been 2,400 pounds per acre on unfertilized soil and 3,000 pounds per acre on soil treated with 200 pounds of acid phosphate per acre.

Results on the soil experiment fields show that Japan clover (Lespedeza) is a satisfactory legume where limestone cannot be used. Japan clover is generally looked upon as a crop to occupy worn land where nothing else will make a satisfactory growth. Under such conditions it does not make a tall growth, but makes a dense mat that prevents washing and after a long time improves the soil to some extent. The reason for this attitude toward Japan clover is that generally farmers have not seen it grown under favorable conditions; that is, where it was properly fertilized. If fertilized with a phosphate, it will in favorable seasons make good yields of hay. On the Mayfield Experiment Field in a rotation of tobacco, small grain and Japan clover, in which acid phosphate was used at the rate of 200 pounds per acre per year, Japan clover has produced from 1,250 pounds to 5,690 pounds per acre for 6 years, except in one case when it failed to reseed itself sufficiently and was not cut. If this year is left out, the average yield for the other five years is 2,567 pounds per acre.

Tobacco in this rotation has produced an average yield of 1,035 pounds per acre, against 559 pounds on unfertilized soil with no legumes. During the last three years, wheat has been used in the place of rye in this rotation and the average yield has been 18 bushels per acre, against 4 bushels on the unfertilized land without a legume.

On the Greenville Experiment Field, an average of 4,160 pounds of Japan clover hay per acre for two years was produced on land fertilized with acid phosphate.

In order to get satisfactory yields of Japan clover, it should be sown in late winter or early spring at the rate of about 12 pounds per acre and allowed to reseed itself in the fall. The second year's crop will be one that will make the heavy yield. It is too expensive to seed heavily enough to make a heavy yield for the first year's cutting. It is a good plan to sow the seed on wheat or rye, which may be pastured or harvested. Acid phosphate should be drilled in with the grain at the rate of 200 to 300 pounds per acre, unless the tobacco or other crop preceding the grain has been fertilized broadcast at the rate of 400 to 500 pounds per acre.

In the case of very badly worn land, no crop is superior to sweet clover for rapid restoration, provided the soil can be limed or naturally contains sufficient lime. The latter is often the case where numerous fragments of limestone are mixed with the soil, as is the case in many of the northern counties in Kentucky.

The following example will illustrate how sweet clover will improve unproductive soils.

In the spring of 1916 a piece of land on the Berea Experiment Field was treated with two tons of limestone and 300 pounds of acid phosphate per acre and seeded to sweet clover. The next year the clover was cut for seed and produced 275 pounds of marketable seed (in hull) per acre, which was worth at that time 15c per pound, or $41.25 per acre. (A strip was left unlimed on which the clover was a total failure.)

The clover straw was returned to the soil and plowed under and the ground was planted to corn the next year. The season was a very dry one, but the yield was 40 bushels per acre against 20 bushels on the untreated land.

Sweet clover seeded in the corn did not give a stand and rye was used for cover crop, but the next spring a good stand of clover appeared in the rye. This made a fair crop the following year, yielding 1½ tons of hay per acre, following the cutting of which the ground was prepared and seeded to soybeans, yielding 1½ tons of hay per acre. The yield of soybeans on untreated ground was 1,570 pounds per acre. The field was planted to corn again in the spring of 1921, the yield being 43 bushels per acre against 10.3 bushels on the untreated soil.

In 1922 the crop was soybeans, with a yield of 2,500 pounds per acre against 1,000 pounds on untreated soil, the season being a very dry one. As no manure was returned to the soil during this time, as should be done in good soil management, the improvement noted has been due to the limestone, acid phosphate, sweet clover and one crop of sweet clover straw turned under.

However, on an adjoining piece of similar ground, manure was used in 1921 on a red clover sod at the rate of 6 tons per acre in connection with limestone and acid phosphate. The yield of corn was 74 bushels per acre. Where 6 tons of manure was used without lime or phosphate, the yield was 51 bushels and on untreated land it was 10.3 bushels, while as stated above, the yield on the sweet clover ground where the sweet clover was removed in the previous year was 43 bushels.

A very striking example of the need of the average cultivated soils of Kentucky for legumes to furnish nitrogen is found in the first year's results on the Hopkinsville Experiment Field.

In the spring of 1922 one piece of ground was treated as follows: Ground limestone was applied at the rate of two tons per acre and acid phosphate 200 pounds per acre. The ground was seeded to cowpeas, which were turned under, followed by wheat with 200 pounds more of acid phosphate. Yield of wheat 32.2 bushels per acre (Currell's Prolific).

At the same time four other pieces of ground were limed at the rate of two tons per acre and treated with 400 pounds of acid phosphate per acre. The four pieces were planted to corn, tobacco, soybeans and oats, respectively. These crops were all harvested. The land was broken after oats and disked after the other crops. Currell's Prolific wheat was sown after all of them at the same time as on the cowpeas ground, 200 pounds of acid phosphate per acre being used at seeding time. The yields of wheat were:

	Bushels Per Acre
1. After corn	9.3
2. After tobacco	16.9
3. After soybeans	10.6
4. After oats	13.2

Compare these yields with 32.2 bushels following cowpeas turned under. These results show conclusively that the lack of nitrogen is a big factor in keeping down yields on this soil. However, it is not necessary that the legume be turned under. It may be pastured down or may be fed and the manure returned. Most of the soils of Kentucky need nitrogen, but either lime or phosphate or both are necessary for the growing of legumes in sufficient quantity to produce it. Nothing can be more clearly demonstrated than this need has been demonstrated on the Kentucky soil experiment fields and on many farms. It is also clearly evident that a profitable live stock industry cannot be built upon a profitless cropping system.

3. PASTURES.

Let us now turn our attention to the six and one-half million acres of land that must be accounted for as pasture land. People who have traveled over the state and observed agricultural conditions will not question the statement that outside of the Bluegrass region there is very little good pasture. Lands that produce the low crop yields previously noted cannot produce good pastures. The same fertility is required to produce good pastures as is required to produce grain and tobacco. In fact, the yield of pasture grasses on unfertilized and fertilized land will be in about the same ratio as for corn, wheat, clover and tobacco in the experiments already given.

However, this is not the worst feature of pasture conditions on this six and one-half million acres of land. Much of it has never been seeded to pasture grasses at all, but has either been dropped out of the cropping system because too poor to cultivate or has been laid out to "rest". The growth consists of weeds and wild grasses. In some cases Japan clover gets in, but its growth is small for reasons already stated.

If all the counties that can at all be classed as bluegrass counties are eliminated, on the assumption that the pastures are all that they should be (they are not, because of depleted soil) there are some four to five million acres of pasture lands that are in the condition described above.

The statement has been made previously that soil that will not produce satisfactory crops for harvest will not produce satisfactory pastures. Many farmers seem to think that when soil has become unprofitably productive for harvestable crops it will restore itself if seeded to grass and allowed to remain for a few years. The seeding is usually light and without fertilization. Under these conditions there is a slight improvement as measured by the first crops following the grass, but it is only temporary.

That proper treatment of the soil is as essential for good pasture as for other crops is shown by the results on some of the soil experiment fields. Results have already been shown for red clover, sweet clover and Japan clover, part or all of which should be included in pasture mixtures in most pastures.

Some grass mixtures were grown on four of the experiment fields on fertilized and unfertilized soil. The average yield of hay on the unfertilized soil was 1,300 pounds per acre; on soil treated with acid phosphate, 1,900; and on soil treated with acid phosphate and limestone, 3,700. The mixture was red clover, alsike clover, orchard grass and tall meadow oat grass on some fields and the clovers and timothy on others.

Pasture is the only really cheap feed produced on the farm. But a profitable live stock industry cannot be built upon pastures that will produce no more than the unfertilized pastures of the state are producing, and this includes nearly all of the pasture area outside of the Bluegrass region.

The average total value of the live stock per farm in Kentucky ranges from $300.00 to $400.00. This is not enough live stock to yield much income, no matter if it were produced at a profit. There will not be much increase in live stock until the pastures are improved and the yield of harvested crops is increased. Of course the increase in production and increased live stock should go hand in hand, or to state it better, every step forward in crop production should be followed by a step forward in live stock production.

To state it in another way, stocking up an unproductive farm with live stock will not make it productive. At best, in live stock feeding only about two-thirds of the plant food removed in crops can be returned to the soil in the manure. After land has been put in a condition to produce well, live stock is without doubt the best means for the Kentucky farmer for disposing of his crops, for Kentucky can not compete with the grain and hay growing regions of the middle west in the production of these crops for direct marketing. We should not increase the acreage of tobacco, so we must find some other way to utilize our land.

There is much land in Kentucky so subject to washing that it should be kept in grass most of the time, and live stock becomes a necessity for its profitable utilization. There is also much cut-over land and land grown up in bushes that would make good pastures if cleared and properly fertilized.

The farms of Kentucky are on the average so small that they must be utilized to the limit if a return is to be gotten that will make a satisfactory support for the family. Better pastures and live stock are a part of the solution. With our pasture lands properly handled, they will be in condition to put to harvestable crops when the demand justifies it. When lands are not needed for harvested crops, it is always good business to have them in grass for the purpose of improving them, provided the soil has been so treated that it will grow grass and clovers. There is less loss of fertility from land in grass than when any other crop is grown upon it.

THE SEEDING OF PASTURES.

The following mixtures are recommended for varying conditions in the state:

1. For the Bluegrass region:

a.	Red clover	3 lbs.
	Alsike clover	1 lb.
	Timothy	4 lbs.
	Bluegrass	10 lbs.
		18 lbs.
b.	Red clover	3 lbs.
	Alsike clover	1 lb.
	Timothy	3 lbs.
	Orchard grass	8 lbs.
		15 lbs.

Where the land is limed, 2 pounds of sweet clover may be seeded with the mixture. If it is desired that it should reseed itself some more seed should be sown the second spring. The first sowing of sweet clover should be inoculated.

For the thinner bluegrass soils a little Japan clover may well be included in the mixture.

When other seeds are added to the above mixtures, the quantities of some of those named may be reduced so that the total will range from 15 to 18 pounds.

2. Outside the Bluegrass region the following mixtures are recommended:

a. Well drained limed land:

Red clover	2 lbs.
Alsike clover	1 lb.
Sweet clover	2 lbs.
Japan clover	3 lbs.
Red top	2 lbs.
Timothy	3 lbs.
Orchard grass	5 lbs.
	18 lbs.

b. Unlimed well drained lands:

Alsike clover	2 lbs.
Japan clover	5 lbs.
Orchard grass	5 lbs.
Red top	3 lbs.
Timothy	3 lbs.
	18 lbs.

c. Wet lands:

Japan clover	10 lbs.
Red top	5 lbs.
Timothy	3 lbs.
	18 lbs.

A satisfactory way to sow the mixtures is to sow redtop, timothy and bluegrass in the fall with small grain and to sow orchard grass and clovers in the late winter or early spring.

They may all, except Japan clover, be seeded on a well prepared seedbed in August. For such seeding the ground should be broken as early as possible so as to allow the soil to settle before seeding. Weeds should be kept down by harrowing or disking. The soil should be firm at seeding time, only enough loose soil being needed to cover the seed.

Either of the above methods is preferable to seeding with oats in the spring, unless the seeding can be done early with a light seeding of oats.

THE CARE OF PASTURES.

Stock should be kept off of pastures when the ground is wet enough that tramping will injure the grass. Pastures are often seriously damaged in this way.

Pastures may be grazed some the first year. A certain amount of tramping when the ground is not wet seems to be favorable to young grass and clover. Especially should red clover be pastured or clipped the first year to prevent blooming which often weakens it to such an extent that it dies before the second year. Close pasturing of clovers late in the season causes them to "lift" out by freezes. Stock should not be turned upon pastures until the grass has made a good start and in no case should they be kept grazed closely.

The ideal would probably be to allow the grass to get 4 to 6 inches high and then graze it down rapidly in small sections fairly closely. By the time the last section was grazed, the first section would be ready to start on again. This would involve temporary fences which would be expensive. Where the whole field must be pastured it is best not to keep it grazed too closely, because it will not renew itself rapidly enough. Close grazing encourages the growth of weeds. Not enough grazing weakens sods.

In case weeds appear they should be mowed down. Sprouts should be grubbed out if clipping does not control them.

If fertilizers were not used liberally when the grass was seeded, a top dressing of 200 pounds of acid phosphate per acre in the spring will be helpful in most places except on the better bluegrass soils.

A STATE-WIDE PROBLEM.

The objection may be made to the statement of the low average condition on farms that if the mountains were eliminated from the average the case would be different. It is true; but we have the mountain farms with us and they are an important factor in our economic situation. An average contains farms above the average, farms below the average and farms of the average. It must not be forgotten that many of our strictly agricultural counties are of the average.

For example, one of the strictly agricultural counties of the Purchase region has an average of 43 acres of improved land per farm, with a total average value of all crops, live stock and poultry of only $1,200.00 per farm.

A purely agricultural county in the St. Louis Limestone region has an average of 73 acres of improved land per farm with an average value of all crops and live stock of $1,100.00 per farm.

One of the best agricultural counties in the southwestern limestone region has an average of 62 acres of improved land per farm and an average value of all crops and live stock of $1,450.00 per farm.

A need for agriculture is industries in the state that will take a considerable part of our 54 per cent of farm population away from the farm so that we may have larger farms and more economical production. Farms of the average size in Kentucky cannot be operated upon the most economical basis. The thing that should concern us is keeping the right kind of people on the farms.

To do this there must be profits on the farm and social conditions that will hold people of ability. This means good roads, good schools, good churches and well equipped homes. These in turn require money. It is certain that we will never pay for good roads, good schools and other community welfare requirements with the present earning capacity of farmers. On the other hand, their earning capacity cannot be greatly increased thru the improvement of their farms without roads and schools.

It would seem that the development of roads, schools and farms will have to go hand in hand, since they are so interdependent.

This is a state-wide problem. The conditions of the poorest farming regions are the concern of the best farming regions.

A large part of the expenses of the state school system and all other state expenses must come out of state taxes. There is only one way to equalize the burden and that is by the poorer regions becoming more able to bear their per capita share of taxation. In order to do this their earning power must be increased thru the improvement of their farms.