Sound Horses Are Bred on Fertile Soils

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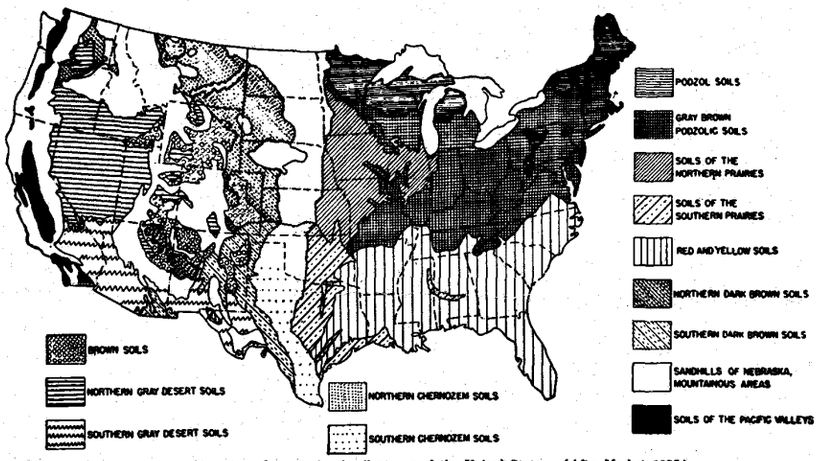
SOUND bones are the basis of good horses. Such bones can best be made by healthy bodies that get the necessary lime and phosphates—bone ingredients—from the soil by way of nourishing feeds. When limestone and phosphate are soil treatments to improve crops, the question often arises whether horses need dosages of these minerals directly. Our soils have much to do with the delivery of these in forages for efficiency in livestock production, more particularly for those longer-lived animals, the horses.

much of the rain water where it falls by making more of it go into the soil. This infiltered water is growing more crops as cover, more of them on the contour and otherwise, all to keep more soil at home.

The realization is about to come that it isn't so easy to grow perpetual cover crops successfully. Even before the soil started going, much of the soil fertility—the soil substance that it takes to make plants—had already gone. Not only erosion and difficulties in growing some crops are bearing testimony of this fact, but even



Climatic and vegetational soil groups of the United States. (*After Marbut*, 1935.)

The different soils of the United States bring differences in horse production just as they do in the Old World. Better horses can be had on the better soils.

The fertility of the soil, which includes those plant nutrients that make up mainly the plant ash, is now coming in for wider general appreciation. Nitrogen as the nutrient hidden in the soil organic matter, or humus, has long been appreciated because of its scarcity and of the difficulty in replacing it. As erosion dug deeper ditches that hurried the water off in record-breaking floods and most disastrous droughts, we recently became engaged in one of the largest national action programs outside of war. We have undertaken to keep the body of the soil at home. Even there we are no longer thinking of only dams in the gully to control floods. We have gone out of the ditch and on to the upland to stop the farm animals are reporting their troubles in deficiencies of growth and in reproduction because of our past neglect of soil fertility. These are some of the signals flashing caution and reminding us to *look to the maintenance of the soil for the future health and profit of our livestock.*

Grass for the grazing horse serves two body functions. One of these consists in supplying the materials by means of which the body is constructed. The other is that of providing energy to run the body machinery and move the animal and its load about. Growth demands protein to build muscle. It demands lime and phosphate to build the bones. Only a proteinaceous substance already fabricated by the plant can meet the protein requirement for horses. They cannot use the simpler elements for making their protein as in the case of plants. The lime and the phosphate also come by way of the plants from the soil. The minerals and the proteins are required in larger amounts by young horses, by mares during gestation, and by stallions for most successful service, because these are the "grow" foods and come from the soil

Energy foods are supplied in the form of the carbohydrates and fats. It is the carbohydrates that make up the larger part in the bulk of the plants. These compounds are the main product of the plant factory as it takes carbon from the air, water from the rain source, to be combined into carbohydrates by means of the green chlorophyl in the leaves as it catches the sun's energy to do this chemical work.

"Go" Foods and "Grow" Foods

Starchy grains, saccharine plant compounds, and much of the plant's fibrous structure are the horse's energy or power sources that do not come directly from the soil. They are the "go" foods that plants seemingly make from the weather, or those materials amply present without the soil. Plants won't render this energy-snatching service, however, except through the help of the five or ten per cent of their own "grow" foods that are taken by their roots from within the soil and represent the plant's mineral part, or ash.

Horses are power plants to release for our service the sun's energy stored by the plants. Horses haul their own coal when they come from the pasture. They must first be built, though, by means of the body-constructing proteins and minerals that come from the soil. Horses must "grow" first and "go" later. The soil is the foundation of our farm power plants when these are horses.

It is easy to become excessively op-

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timistic as to what can be accomplished by the breeding of horses, now that breeding of plants has given us hybrid vigor, crosses of poultry have served for sex distinction in chicks, and certain hog crosses have given unusual growth capacities. Breeding has its possibilities, but feeding by way of soil fertility treatments needs wider consideration as to what it has done and can do for horses.

One needs only to survey the different sizes and kinds of horses in different countries and relate these to the soil to appreciate how much the soil may be in control. It is now known that soils in a region limited enough to have almost the same climate are different because of different parent rocks of their origin. As we have learned to recognize these soil differences we are likewise appreciating the influence of the soil on the development of horses.

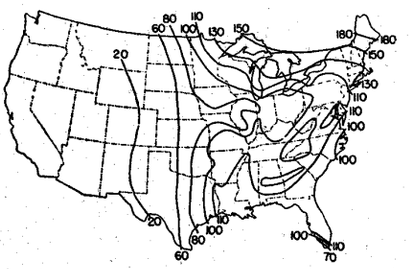
Country, Soil Affect Size

Within small ranges of latitude and longitude reaching no great distances out from the British Isles as the center, and all within the influence of the Gulf Stream, one can go from the smallest to the largest of the horses. The Shetland pony, or the midget horse, is at home on the more rocky, less developed soils of the Islands at 60° north latitude. The Irish pony and the Welsh pony, larger but still in the pony class, are on the granitic and slaty soils respectively, at 55° north. Of about corresponding size are the Russian horses on the gravelly, glacier-deposited soils of North Russia, and the Norwegian horses in the rock-bound fjords at not much different latitudes.

One needs only to go into Scotland with the greater clay content of its soils to find such active and stylish hulks of horseflesh as the Clydesdales, or east from Wales and its slates into England with its clay soils to go from ponies to the massive Shires and Suffolks. South, a bit farther, there are the heavy, closely-coupled Belgians. Nearby in Normandy of France on soils similar to those of England where heavy clays, heavy plows and heavy horses all go together, we find the original Normans or the Percherons of tremendous body, surplus power, and excellent disposition.

Through this small area—all within the region where woolens are the common wear—the climate is not so widely different. Yet the soils include a great variety because the different rocks in similar climate mean different minerals. Therefore the soils made from them are different. Different soils make different feeds. Different feeds mean horses differing in size, speed, conformation and disposition.

Horses differ by countries with different soils, not because horses eat the soil directly, but because even the same crop differs in its chemical composition and its service as feed for horses according as the soils are different. What, from general appearances, may look like the same soil may be decidedly different in feeding function by way of its forages. In fact, the same soil in the same place may change with time, or through neglect, enough to make its crops of greatly lowered feed value.



The rainfall in contrast to evaporation in terms of ratio figures tells us that if the "prairie soils" of the West made sound wild horses we are fortunate that the West extends into the Cornbelt to give us sound horses there.

Soil treatments, including manures, limestone, and fertilizers, are but small additions to the soil. Yet they may alter most decidedly the nutritive value of grasses thereon. We are just beginning to appreciate different soils as they represent larger or smaller stores of reserve nutrients, and a more or less active factory with an annual output of plant nourishment available according to the crop needs through the course of the season.

Recent soil studies have reported that it is in the clay and humus, or what is spoken of as the colloidal part of the soil, that the plant nutrients are held in the adsorbed condition. This adsorbed condition means in forms available to the plant by exchange. Sandy soils in the humid region, or those with little clay, when broken out of virgin condition, are soon in crop troubles. These bring animal troubles too. Heavy soils have always been known to hold up longer. The clay is the custodian of the mobile nutrients, while the mineral particles of silt size are usually the reserve of them.

Good Horses from Good Soil

It has also been discovered that the plant gets its nourishing elements from the clay by trading hydrogen, or acidity, for them. The clay in turn, as a kind of jobber, trades the acidity to the silt particles, or the sand, for their minerals of original rock nature—if they have any trading stock left. Thus, calcium, magnesium, potassium and other constituents of the plant ash are moved from the original rock form in the silt via the clay or the humus colloid to the plant roots. In the opposite direction there goes the acidity, or hydrogen, from the plant to be taken first by the clay. It is then passed on to the silt to be neutralized by its rock fragments breaking down slowly in consequence. As soils differ in clay content, in humus content, or in mineral reserves of the silt and sand, necessarily the crop growth will be different. As the reserves are exhausted, naturally the kind and the quality of the vegetation will differ.

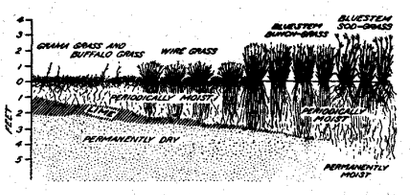
The feed quality of vegetation is largely a matter of whether it is mainly woodiness or whether it is rich in minerals, proteins and all the accessories, both known and unknown, that the better forage feeds have. Forages like the legume crops are rich in these latter respects. Can it be mere coincidence that when veterinarians so commonly recommend alfalfa hay as a remedy for vitamin deficiency they are calling on a crop that is at the top of the list for its concentration of minerals, and its heavy demands on the soil? Legumes are universally accepted as effective feed for colts and other growing animals. White clovers in the bluegrass pastures are evidence of lime delivery to the crop by the soil. Can there be any connection between the fact that clovers grow only on soils rich in lime and phosphorus, and the fact that clovers are "growth" foods? This is a question that more horsemen might raise when at last they realize that the Dutch clovers have not been seen in their pastures for so many years.

The lime and phosphate soils of Tennessee and the bluegrass region of Kentucky don't mean fine horses merely because of idiosyncrasies of the people of that area. Can it be a coincidence that the winners at Churchill Downs are seldom imports into that region? Such things suggest that we can connect good soils and good horses with a good likelihood that the former is the cause of the latter. Success in growing colts can not be divorced from lime, phosphate and generally good fertility in the soil. Quality of forage is more than a trade mark stamped on the package. It must be grown into the goods by way of the soil.

Nature Posts Warnings

As soils are more weathered in consequence of their location in heavier rainfalls or higher temperatures, or have been more heavily cropped, they are correspondingly more depleted of their phosphorus, lime and other minerals. As this depletion occurs, the crops on them shift to those of less growth value and mainly of a woody nature or of fuel value.

Nature has demonstrated this fact with the forests located on soils low in mineral store. Woods or timber are the last stand by vegetation against the flow of fertility to the sea. Wildlife in the forests is scant, because the minerals in the forage are scant. The pregnant timber squirrel carrying bones is no unusual observation. Well-gnawed or teeth-marked fragments of bones in the squirrels' nests would scarcely be considered as dental artifices for keeping the teeth and jaw muscles up to their maximum. Antlers in the woods disappear because of the struggle by animals to get their necessary lime and phosphorus from past animal life when they can't get these from the plant life.



On the lime-laden prairie soils proteinaceous, mineral-rich, grass crops flourish. On soils leached of lime timber dominates. Crops on cleared timber lands are often low in protein and minerals.

Soils that are depleted, whether by nature or man, mean crops mainly of fuel value and of less help in animal growth. Not only horses, but other animals reflect these conditions in their bone troubles, teeth troubles, reproductive irregularities and alternate breeding when the more exhausted soils provide them with crops of lowered mineral contents. This principle may well be more widely applied.

Better Soil, Better Bone

Unfortunately, we are a bit late in realizing that the depletion of our soils is the reason for failure to grow white clover and good bluegrass that once were the delight of horsemen. Mechanical genius may have brought in the tractor, but it is going to take more than the diversion of steel to war needs and rationing of tractors to the extent of their elimination to bring good horses back again. Bone blemishes on horses were all too numerous in the corn-belt even before the tractor. Branded bronchos from the lime-laden soils of the West were excellent examples of soundness in bone.

We didn't associate the declining store of fertility in our own soils with increasing curbs, spavins, splints and sidebones. But now that intensive cultivation by tractor, and diminishing amounts of manure and fertility going back to our soils have depleted them to the point where they won't grow cover fast enough to stop erosion, *we can't bring horses back merely by economic necessity*. If they are to come back economically (for back they must come under present indications) they must do so by way of better soils and fertility restoration in them.

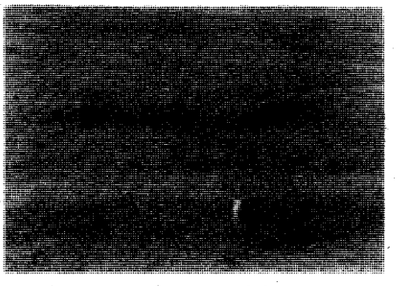
Pasture research is going forward to give us better pastures. Much effort is being put into the search for substitute grazing crops. To date, as most horsemen will agree, there has been none found to take the place of the combination of bluegrass and Dutch clover. The clover goes out with the mineral depletion of the soil. Departure of the clover means that the bluegrass becomes less nutritious. Might it not be possible that depleted soil fertility is the reason why bluegrass quits so much earlier in the summer and doesn't begin until so much later in the fall? Can't we see the increasing need for so much supplementary summer pasture possibly connected with our neglect of putting some fertility in the form of minerals and organic matter back into the soil?

Substitute crops have come because of neglect of the soil. Now that there are more refined means of controlling the soil as it delivers nutrients to the plant, more careful study of plant composition points out that the soybean, for example, recently introduced, has a remarkable "staying power" on soils where other crops passed out.

One needs to be reminded that if soybeans are making two tons of forage where alfalfa made but a half ton, then the soil-given minerals must be diluted by four times as much woody matter in the soybean forage as in the alfalfa. Soybeans have demonstrated experimentally that they may be growing to good height and yet may contain less protein and less phosphorus in the crop than was in the planted seed. They have also been shown to behave in true legume-like fashion when on soils with ample lime and phosphorus, but behaved like woody vegetation when these two were not so amply provided. Here is the explanation of why one might believe them an "acid-tolerant" crop, when in reality they shifted from a legume crop over into a timber crop.

Substitute crops are bringing on increasing numbers of disappointments for animals. Juggling of crops to maintain tonnage per acre is dropping the animals into nutritional troubles. Wide use of calcium gluconate as a remedy points toward needed attention to lime and phosphate, particularly when pregnant animals can't make it through the winter, as acetonemia and other reproductive troubles indicate. We may be trying to "rough them through the winter" but roughages from the less fertile soils are proving too rough. Substitute crops will continue to emphasize the fact that their production of mere mass is hiding the deficiency in soil fertility, which is the real need in the situation.

When the daily mineral requirements of horses are measured in fractions of an ounce while minerals as soil treatments are measured out in pounds, we readily think of mineral mixtures on the drugstore shelf as feed supplements. Even if such mixtures are helpful, this is no proof that they are a complete substitute for these applied as treatments on the soil and all that they bring with them in travelling to the horse's stomach via green or dry forage.



Animals draw a fine line of discrimination when two hundred pounds of fertilizer on the left make them graze closely, and one hundred pounds on the right make them disregard the forage.

Recent experiments using sheep demonstrate the fact that putting the lime on the soil makes lespedeza hay, for example, a much more efficient growth producer. Liming increased the yield of the lespedeza crop by about 25 per cent. Each pound of limed hay, however, was about 50 per cent more efficient in terms of lamb growth resulting from consuming it. With the animals eating all the hay they could, those eating the hay given proper soil treatment made 50 per cent more gain. Because of better crop yield, and greater growth-producing efficiency of the hay the limed acre was then about 75 per cent more efficient in terms of increase in sheep weight.

That the lime was effective, not wholly because of the nutrient element calcium, and the phosphate not wholly because of the element phosphorus, delivered by these soil treatments is shown by these hays in digestion trials with rabbits. Contrary to expectation, the hay giving the poorer growth rate was the more completely digested. Therefore, the animal machine was handling the vegetable matter to the best of its ability.

Unfortunately, however, the unlimed hay was deficient in something to help the animal build the calcium and phosphorus into its body. These two bone-building essentials in the animals on the poorer hay were being eliminated by way of the urine just twice as fast as from the animals on the more efficient hay. These minerals were digested, but apparently the plants had not worked them into proper combination, or provided the manufactured supplement for their effective service within the body.

Store Minerals Not Enough

The mere delivery of calcium and phosphorus to the digestive tract, and a high degree of digestibility of them are apparently not enough. These essential minerals must enter into nutritional service for the plant first if they are to be of nutritional service to the animal. If these are the facts, then drugstore minerals shovelled into the feedbox are not the equal in value to those put on the land as soil treatment and as help in the better output of the many complexes from the plant factory.

As the soils become poorer for certain crops and as substitutes are used, these substitute crops tend to become mere mineral haulers. Unfortunately, the minerals they deliver consist more of silica with no feed value, in place of calcium, phosphorus, and all else of nutritive value that comes with them. An unbalanced plant diet offered by the soil cannot be offset by minerals added to the vegetative bulk used as feed, any more than wheat straw would be good feed when supplemented by saltpeter, limestone and bonemeal. Synthetic diets at best leave much to be desired before they will be equal to the spring growth of the forage in bluegrass-white clover pastures on fertile soils.

Body processes of horses are not such simple performances. Neither are the processes of plant growth. When calcium in animal ash is forty times as concentrated as is the mobile calcium in the soil, and phosphorus similarly more than a hundred times, we may expect the animal to be in trouble when compelled to eat herbage getting little of these essentials from the soil. Animals know their forages so well that even a blind horse, according to Doctor Dodds of Ohio State University, will graze to the line of the soil treatments represented by only a few hundred pounds of fertilizer.

We might then expect that the thousands of pounds of fertility hauled off through years of farming are a decided disturbance in animal behaviors. In place of going to the drugstore for mineral supplements, it would seem better to let the animals make their selection via plants from a liberal variety of them in the form of fertilizers put back on the soil. Animal production is not wholly a matter of short cuts and economics, but a most discerning cooperative

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effort on our part in the complex performances of nature.

Fortunately, the cornbelt and much more of the United States were blessed with good soils, particularly good for horses as pretractor days demonstrated. They will be good soils for horses again if we treat our pastures with the proper mineral fertilizers to restore white clover, the bluegrass fertilizing legume. Fertility depletion during the youth period of Americanism toward our soil need not prohibit our handling it from this day forth with the maturer judgment of American adulthood apparently about to arrive. We can hold our soils at the present level, and even build back.

Horses can help us in this program and guide it by their help in their more refined assay of the mineral nutrient levels. Short-lived animals suffering early nutritional irregularities reveal soil troubles quickly. Meat producers like sheep are more responsive than hogs, of which the fat constitutes most of their bulk and hides the trouble more readily. When it comes to the long-lived horses their troubles more slowly accumulate and longer remain hidden as minor defects. For these hidden faults, prevention is better than antidotes or cures. For prevention there is no better means than good feed of animal choice and collection from fertile soils. *For horses, as for humans, the way to be healthy is to be well-fed.*

Just as good horses are supported by fertile soils, likewise good horses in turn support the fertility of the soil. Horse power is merely the sun's energy released on the farm right where it was collected by means of the soil minerals or soil fertility. None of this needs to be exported from the farm to pay for horse power as is done for liquid fuel and lubrication. In using horse power, the soil fertility is merely in rotation from the field to the barn and back to the soil. As the amount in this cycle of rotation becomes larger, the yields of crops on the farm go up.

Horses as additions to other livestock can be significant additions to our efforts in soil conservation in a larger way. As more of the minerals mobilized out of the soil into organic matter combination go back to the soil, these are more nearly good growth food for the soil bacteria. This puts "life" into the soil, which with more grass pastures will win its way back toward virgin condition. It was—and will be—on such mineral-rich and humus-rich soils that our lands will do much to conserve themselves. It will be because they can take the rain water and because they have the fertility to grow their own cover to prevent erosion. It was—and will be—on such soils that the production of sound horses need not alarm us much about the necessity of supplying them extra minerals.