# Proteins Are Becoming Scarcer

## As Soil Fertility Goes Lower

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*EDITOR'S NOTE: I think this article conveys a wealth of sound information and that those who read and absorb what the author has stated will have gained ideas and facts that are more than worthwhile. The author, Bill Albrecht and I, were, in a way, classmates at the University of Illinois back about the beginning of World War I. To be more specific in this respect, Bill was a graduate student at the time I was a senior undergraduate. However, there were at least three courses of study in which we were classmates: Soil Fertility under Dr. Hopkins, Soil Physics under Dr. Moser and Animal Nutrition under Dr. Grindley, all leading authorities on their subject. It seemed to me that Bill knew more about these subjects at the beginning of the courses than I knew at the end. I was always jealous of him because of the knowing way he answered the questions the instructors asked. Today I know that he is a top-ranking authority in his field. This article is recommended to the attention of cattlemen and especially to those of the younger generation.*

Eventually, we shall learn that meat prices are going higher because proteins are becoming scarcer. All this is happening because the soil fertility supplies are going lower. Only the renewal of the fertility and the restoration of the creative capacity of the soil can maintain the production of proteins, feed us along with our animals, and keep the stream of life flowing.

Cattle don't create our beef proteins from the elements. They only collect them via the components of the proteins which the consumed plants and the microbes created from these simpler sources. As a consequence, our more complete food proteins in red meat, for example, depend on the higher fertility in the soil by which the forages and the other feed plants are grown. Only very slowly are we coming to see that protein production—which is the very continuation of life itself—depends on the synthesis of these compounds by the plants. Still more slowly are we realizing that the plant's processes for creating proteins are, in turn, premised on the regular and generous fertility delivery by the chemical and biochemical activities within the soil.

### Proteins Troubled Early Man

Primitive man was highly dependent on his herds and flocks for protein. This scarce item constituted a problem in his, as well as of our, food supply. He was more dependent on them as he migrated farther inland or away from the sea and its fish proteins. Foods from that marine source represent the maximum of fertility in terms of the many essential chemical elements. Man's late entrance into the drama, enacted by all the hungry life forms, suggests that the sea was then already well stocked with all the different creative elements that could be washed there. It contained those elements washed in from the rocks in the course of the development of the soil and under the climatic forces.

With his evolution linked closely to the sea water, we may well expect the physiology of man's body to be highly complex. We may expect his body processes to demand complex combinations, not only of the major fertility elements, but of the "trace" elements as well.

*Primitive man on the move, like cattle on the range, covered extensive fertile soil areas for more protein security.*

When man lived largely by means of his herds and flocks, it was they, more than he, that looked after the soil fertility for both of them. Already at this early age, he might have been looking after the kinds of crops grown. Man has commonly observed the different kinds of plants he can use. But, he has much less commonly observed the fertility of the soils under them. Little of his concern went to the soil's creative power through which the weather can produce them. Consequently, man and his herds moved from crop to crop. Fortunately for him, however, in that shift, the herds led the way. After the animals had grazed out an area, he moved his tents in the direction which the animals determined. They had gone ahead to assay the nutritional quality of the forage according to its value for body growth and repair more than for fattening values.

In the Old World, then, with man on his slow move Westward along the Northern Mediterranean shore under his limited technologies, it was this fortunate assay of the soils by the herds and flocks which guided agriculture into the more fertile European valleys. It is in these same valleys today where the lucerne (alfalfa) still grows. It is this and other legumes, fixing the atmospher-

ic nitrogen to build up the soil in respect to this element, that determines the size of the manure pile (usually seen in the front yard) and thereby the size of the farming business and the degree


**"Some of this stuff tastes so bad I only chew it once."**

**With a vote of thanks to the artist, Marvin Townsend.**

of prosperity of the family. Under the legumes and under the surface soils, however, there are also the weathering phosphatic limestones interbedded with potassium-bearing shales. While the soils are but slowly developed from these rocks under the Mediterranean climate, one can understand why the older soil is not worn out or is only slowly eroded at the surface, while the newer soil to replace it is developed by the weathering forces pushing their effects deeper into the fertility-rich subsoil and parent materials. It was this soil depth that has been the fount from which the protein potential has been flowing these many years.

In the New World, man's early agriculture and westward moves were helped much, like his travels across the sea and land, by many technologies. The plow, as one of those, went ahead of the cow over here, even for her misfortune in some cases in relation to protein-rich forage grown by ample soil fertility. Often she had no choice. She was expected to support herself even where the low-protein crop of corn demanded fish protein under each hill for it to make the protein it required to guarantee its own survival.

Cleared pine forests were not the cow's choice of territory. When the Creator Himself could make no more than wood on those highly weathered soils—and then only by returning to the soil all of the vegetation He created there—the cow would naturally be expected to put up a cry for imported protein supplements as in the case of the corn plant. She was compelled to call for feeds more concentrated in this nutritional component, as well as all the extra elements required when utilizing crops that give proteins in the supplementary amounts required for fodder and even corn grain. The cow requires more proteins if she is growing, reproducing her kind, protecting her body by herself against invading microbes or foreign proteins, than if she is merely making fat.

Our westward move was in rather rapid order. Our increasing technologies helped to extend the life lines from less fertile, back to more fertile soils, and to bring protein-rich by-products from the milling, brewing, packing and other industries. All these served to reduce and to keep hidden many of the fertility deficiencies for protein production in the highly weathered soils we crossed in going west. On such soils, which originally produced wood and now under the plow, there is the belief that by crop selection, according to certain plant pedigrees, their products would necessarily be high quality feeds for growing animals. The protein problem finally showed up and all the more serious.

While we were marching westward, the economic situations did much to keep protein feed concentrates moving in the opposite direction. We were thus unwittingly solving the problem of protein deficiencies in the East. The plow went much in advance with expanding crop acreages. It was keeping far ahead of the herds which followed slowly. But before long, the herds had come West, too. They moved to the deeper soils with lime-laden exchange capacities, and with unweathered mineral reserves that were windblown from flood deposits hauled in by rivers from the mountainous West. Moved as they were to soils which represent fertility mixtures as complete as possible, these animals found their bonanza in the Mid-continent and on the Plains. When they came West to rustle for themselves and to copy the soil area which the American Bison had mapped out for himself, the cow herds reached their zenith as reproducers of their own kind and climaxed man's claim for making them.

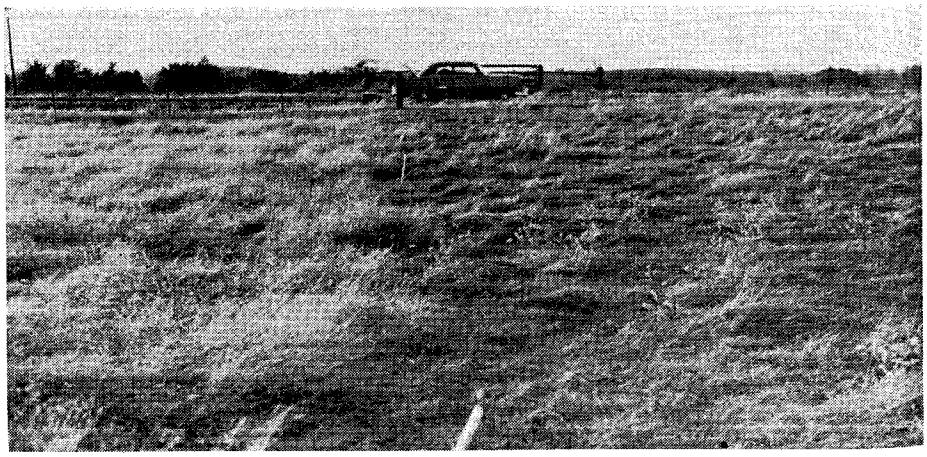
While the cattlemen deserve much credit for what they have done for the success of that phase of agriculture that gives us one of our finest food proteins, namely, beef, let us not forget that the cow deserves credit too. Viewing the cattle business carefully, even the cattlemen confess that credit must go to the cow in combination with the soil fertility which she has chosen wisely more often than have her owners. It was an experienced cattleman of the Plains Country who said, "We really don't raise them. We only count them." Since that remark was made during the depression days, it was appropriate repartee to reply, "If you don't, the banker will."

Now that our westward livestock expansion has about expended itself and we are settling down to feed our animals on what grows right where we and they are, we are more conscious of the fact that proteins are becoming relatively scarcer and their costs are therefore going higher. Tempted, as some may be, to hope for economic adjustments suggesting manipulations, or for legislative enactments for price control, those of longer experience in any kind of agricultural production are turning to consideration of the possibility of creating better feeds through more and better plant proteins. They agree, that if we are to feed rather than only fatten our livestock, we must treat the soils with extra fertility.

Soil Conservation is becoming less and less a matter of fighting running water which has always been running down hill. Conservation of the soil has now been recognized as a matter of rebuilding the fertility strength of a weak and broken soil body. It has become a matter of growing more proteins in more crops to keep the soil covered, and also, for that soil cover to serve as animal nourishment. These crop proteins are more scarce than we realize because the fertility of the soil, which is required to produce them, was going without our notice of its departure until much of the soil itself was going, too.

### More Quality—Not Quantity

When our pioneer leaders were talking about the benefactor to agriculture being one who could make two blades of grass grow where but one grew before, they were not expecting him to bring in substitute grass crops of which each blade had less than half the nutritive value of the one blade that was displaced. They were asking not merely for two blades, but for doubled feed value from the same soil area. Doubled feed value called for doubled proteins along with doubled carbohydrates; this called for doubling the soil fertility per plant. Can we call him a benefactor who

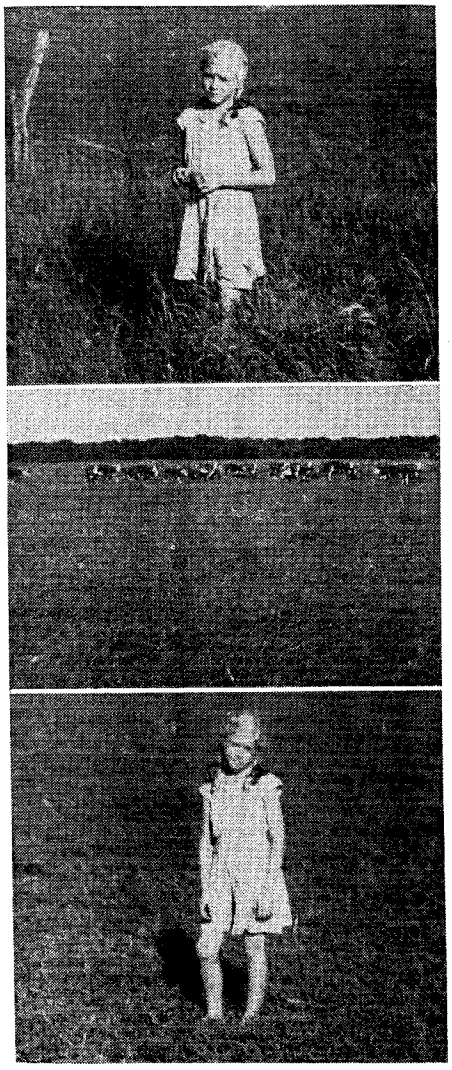


**The cattle's choice of the treated bluegrass pasture (on the right) to graze it while disregarding the untreated portion on the left, tells us that Missouri's bluegrass is good feed because of the soil fertility and not because of this species of grass.**

is giving us two blades of grass by doubling the carbohydrates but gives us no increase in proteins, vitamins, inorganics, etc., beyond those in the original one blade? Shall we call him a benefactor who will fool us with fillers and fatteners when we need body growers and body protectors like the proteins?

*The past decline in soil fertility was kept hidden from us (but not from our livestock) by bigger crop quantity of lowered nutritional quality.*

It is true that we have found substitute legume crops. For example, let's take the Red Clover, once common in the Mid-continent. Red Clover failed because it was starving for nutritional help from the soil. Once plentiful, these nutritional elements were soon mined out after many Red Clover and other high-protein crops were taken off. The substitutes spread rapidly because we were satisfied with their yields as bulk. We forgot to call in the cow and submit the crop for her approval under her criterion demanding, not one that merely fattens a castrated, mature male, but one that makes calves become cows and cows come with calves. Her criterion does not approve "new" crops making merely more carbohydrates to dilute their proteins. The cow brute approves, as "grow" feeds, only those feeds with a nutritive ratio narrower than most of our highly-heralded forage substitutes. She disapproves substitute crops delivering more bulk without extra fertility to hold up the nutritional values of those crops. She turns thumbs down on what is only a substitute, making bulk where the predecessor failed because the declining feritility prohibited it from making of itself the higher nutritive values in that same bulk.



**Bluegrass and white clover "knee-deep" in this untreated permanent pasture (upper photo, foreground) did not entice the Herefords going through it daily from water to the once-treated corn field (upper photo, background, and center photo), abandoned through labor shortage, but grazed closely of its weed crop (lower photo). The taller growths caused by droppings (center photo) suggested that the soil needed nitrogen along with the dolomitic limestone and superphosphate given it. These elements were inviting to the cattle via the weed crop.**

In spite of our many "new" legumes, we doubt whether the pioneer farmer, who used Red Clover as supplement to corn, would grant that we have yet produced another legume forage to supplement corn grain equally as well as Red Clover supplemented the corn when both were grown about a half century ago.

Considering limited acreage, scarcity and high price of seed, plus our campaigns to "Lime the Soil for Clover and Prosperity" few of us would grant that we have done much for medium Red Clover. We are compelled to believe that all our delicate measurements of pH of the soil, our fight on soil acidity on a national scale, and the millions of tons of carbonates put on the land by financial helps suggesting political pork-barrel procedures have been in vain for keeping this good protein-producing legume from going out when corn, the carbohydrate producer, remained.

Are we not ready to look to the nutritional demands which red clover (or any other nutritious forage) makes on the soil that grows it? Can we as crop men not treat the soil to feed the plants properly, just as the livestock man knows the feed demands his animals make in order to satisfy them? Is the certification of the seed and of the variety name any guarantee that it can create a crop from any soil merely because we scatter that seed of noble pedigree anywhere under blue sky, ample rain, and generous sunshine? May we not need more than lime and reduced acidity there? May we not need lime to feed this forage some magnesium and some calcium? Is the introduction of phosphate rock enough? The increasing use of potassium is helping to hold Red Clover on some soils, but on others, this soil treatment has not sufficed. Quite contrary to the opinion of many, a little nitrogen fertilizer along with the clover seeding has done much to establish this crop on some soils. Didn't the pioneer use it on the black soils of the prairies showing by chemical analysis from four to six thousand pounds of nitrogen per acre plowed layer?

When the sulfur-containing part of our required proteins, namely the amino acid, methionine, has now become almost the major deficiency in our feed crops, and to the degree, that invites its commercial chemical synthesis on a large scale, it is significant to note that Red Clover has lasted longer on the experimental plot where both rock phosphate and the sulfur containing superphosphate were used than where rock phosphate was applied alone. Then, too, when Red Clover is still growing nicely on the old, very acid, Jordon plots at Penn State College where only manure has been used these many years, there comes the suggestion that possibly not only the elements: Sulfur, magnesium, potassium, the trace elements and others, but also some organic compounds in cycle from the plant back to the soil and into the plant again, may be the soil deficiencies bringing failures in our protein-producing legumes of such high feed values as Red Clover. In spite of all our faith in legume seed pedigrees, the plant's life-time nourishment is not provided in that way. We cannot expect a clover crop (or any other protein-producing crop) merely because we turn the seed out to rustle for itself. The soil must be fertile in all the requirements for feeding the plant so it can create its proteins. Raising protein-rich crops is no different than raising cattle on the range where they rustle for themselves. In both cases, the soil is the source of what they make. Protein-production by the plants and in turn by the animals is therefore determined by the soil fertility.

We are slowly realizing that failures of our choice protein-producing crops register the failing soil fertility, and, already hidden too long to connect with soil failure as the cause, the mounting animal failures.

### Give the Cow a Chance

Making a calf crop doesn't give much credit to the herdsman. That accomplishment must be credited mainly to the cow. The herdsman is largely an observer. With the fact cows once made calves entirely without our help, it raises the question whether our management of the cow is really a help or a hindrance in her calf-making performance. One must suspect the latter on noting the high percentage of sterile cows, or so called "shy-breeders," continually hampering the profit aspect of the cattle business.

*Cow failures are following in the wake of soil fertility neglect.*

Under artificial procedures, the numerous matings required for conception, which usually succeed eventually in case of natural insemination, cause us to give up and turn the shy-breeder over for slaughter; this should provoke some serious thinking. Such observations ought to raise the question whether the larger dose of semen repeatedly served by the male, in the former practice, is not a kind of successive hormone administration to bring about better ovulation and eventual conception. This may not be the case under the limited semen supply used in the latter practice.

The physiological load of reproduction carried by the female is larger than that of the male. Also this fact is not commonly appreciated when we contend that "The bull is half of the herd." Neglect of the nutrition of the cow, especially the generous use of proteins and all that comes along with their production by crops on fertile soil, suggests itself as the major cause of the trouble when we want to carry our cows through

the winter cheaply. In that saving of feed, we are "penny wise and pound foolish" when we suffer the loss of the cow's breeding service for at least a year and consequently have a low percentage calf crop. The feeds of low protein content may keep the cows in enough fat to resemble a "good condition," but that is not "breeding condition" or reproducing ability. When considering that the protein of corn grain has fallen from 10.3 per cent to an average of 8.3 per cent in some thirty years, to say nothing about what may have happened to the quality or nutritional completeness of that protein from mining rather than managing our soil fertility, this fact seems too far removed from shy-breeding cows to make us see any possible causal connection between the former and the latter. Cow failures are the sequel to soil fertility failures.

Under declining soil fertility and corresponding decline in feed values, the load of reproduction is becoming too heavy to be carried successfully during the period of gestation. If the increasing abortions and the mounting percentages of so-called "midget" calves are not studied more critically in terms of nutrition, rather than dodged by putting the blame on some aspect offering more mental escape, these losses may occur astoundingly often. Only recently, a herd was reported as having 25 per cent of calf crop defective as "midgets." For last year, the figure was 18 per cent of the crop.

Abortions in some parts of Missouri bring about figures equally as appalling. In this latter case, the fight on some microbes—which may be only a symptom and not the cause—stimulates the search for serums from similar microbes under laboratory culture which gives an escape via what suggests a kind of blind alley. This so-called "disease" is now having the cows killed to eliminate the "disease" while it is eliminating our cows too. It is following a line of reasoning like burning down the house to get rid of bed bugs. But in the case of the "midgets," even the belief that it is a breeding problem is of no consolation. It is not limited to either beef or dairy types. Nor is it limited to any one breed in either of these groups.

Any struggle to escape via some hopeful aspect of genetics suggests itself as only a delay of the day when the cause will be located. Reduced body size may well suggest reduced nutrition to the geneticist when the genes, the chromosomes, and the nuclei, as the very centers of genetic performances, are the most specific in their types of proteins for life-carrying activities. Whenever a chromosome is divided, each half must grow back to size again if it is to permit the next regular division of each of the two new cells. If the dividing process is not to play itself out of that very possibility, it must do that growing of protein by protein nutrition. Of all the growth behaviors, those under genetics must certainly find their physiological foundation in the proteins. That foundation certainly is not to be found in the fats and the carbohydrates. If our failing soil fertility is still supporting the plants as producers of carbohydrates, but is letting them down as producers of

**Top, a manure strip in a virgin prairie which was taken by more weeds, as well as attracting more attention from the cows. The manured area was closely grazed which tends to give the grass less resistance to weeds. When grass fails at giving cover to the earth, nature provides another crop that can exist and grow in the area inhabited by the grass. What we call "weeds" and "briars" were preferred on this strip, but disregarded in the untreated area.**

**Center, close up of the foreground in the top picture giving a better view of weed growth.**

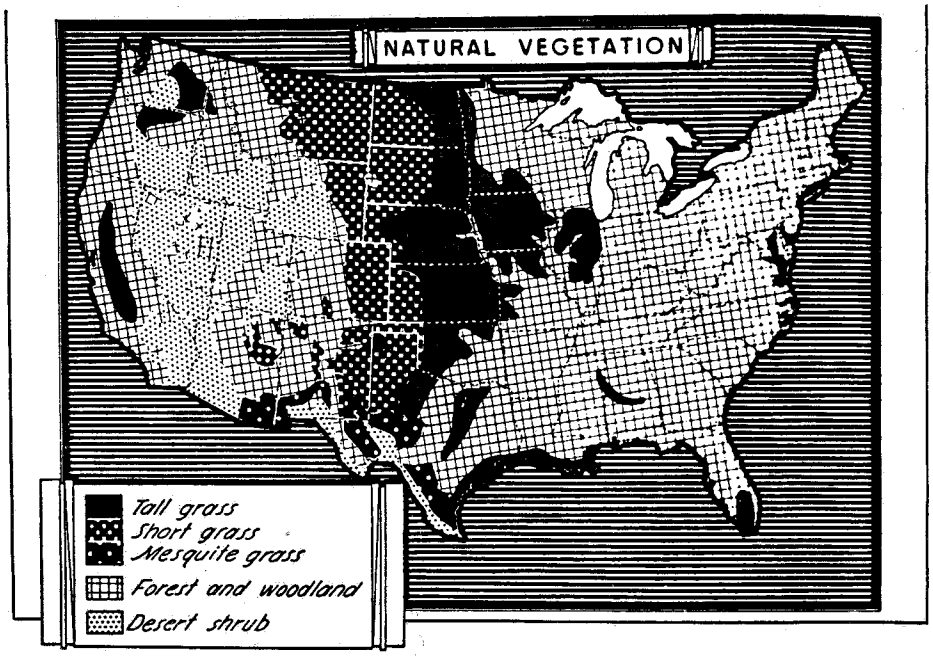
**Lower, some weed specimens laid out on a white background to give some idea of the various kinds which had infested the pasture. One can count several varieties and recognize familiar leaves that may be present in our pasture or pastures.**

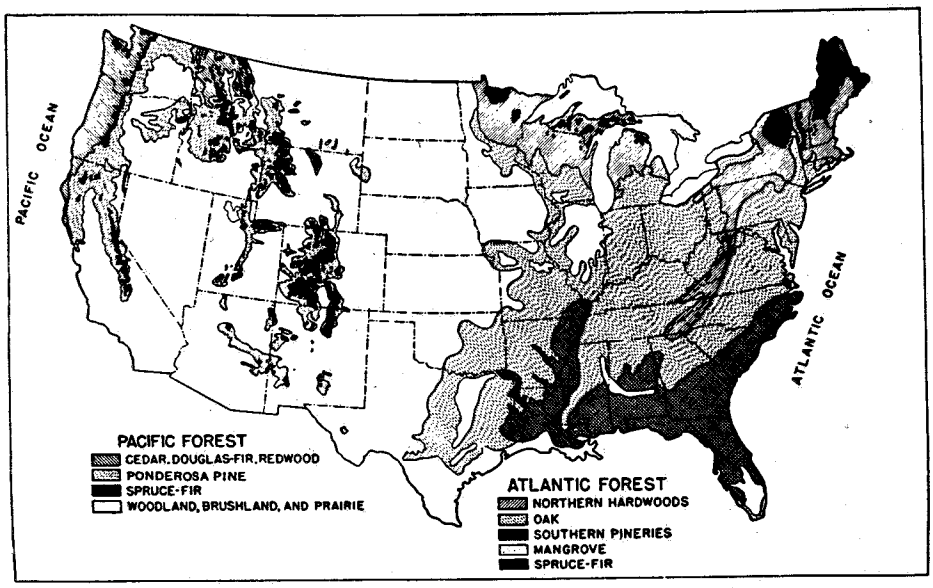
proteins, is it too much of a stretch of the imagination to see the cow being let down in calf production to the "midget" level during gestation by that low level of feeds pulled down by the deficiencies in the soil?

When the means by which body characters are transmitted from generation to generation seem so mystical to many folks, genetics as a new science is seized in hope of an explanation, especially when so much is still unknown and yet Nature has done so much. The plant breeder has been hoping to breed legume forages which will "tolerate" soil acidity. He has had hopes of breeding cereals that will "tolerate" low winter temperatures, the smuts, the rusts, and hosts of other troubles suggesting themselves as manifestations of the plants' physiological inequality to the soil's limited offerings. Other aspects of the setting which involves the plant is the struggle to create the proteins by which it grows and protects itself from invasions by foreign proteins.

If the hopes for this procedure of breeding unusual "tolerations" into the species were to be successful, should it be beyond the breeder's hopes—if we followed that line of reasoning to its limit —to breed animals to tolerate starvation and save all the feed? An experiment set up with that hope would go forward for only one generation, in fact, no farther than one hoping to breed a race of bachelors. Shall we look to the breeder to uncover the changed genetics responsible for the "midgets" or shall we search out the changed, disturbed or destroyed physiology in the calf because of malnutrition of the mother and of the calf in the foetal stage?

A few studies of the blood chemistry of the "midgets" have found such low levels, and near absences, of some of the soil-borne essential elements to suggest the source of the trouble in some nutritional deficiencies in the cow's feed, or troubles going back to the soil for their origin. Even then, the soil-borne essential elements must do more than hitchhike from the soil through the crop, through the cow to the foetal calf. The creation of the "midget" calf suggests its irregularities traceable to irregularities in the fertility of the soil and the feed grown on it. It is leaning toward a waning faith in breeding but a waxing hope in feeding.




—The two forest belts of the United States, the Atlantic forest and the Pacific forest, and their major subdivisions.

**Grasses are not killed by drought but live by intermittent growth during the season, hence are dominant in regions of moderate to low rainfalls from which forest trees are excluded. Such climatic conditions give less-weathered soils growing protein-rich forages by which cows have been raising themselves.**

**Forest soils under higher rainfalls growing mainly woody crops, suggest their services mainly in fattening animals, except where soils are given proper additional fertility.**

### Man and Cow's Need Much Alike

The cow is one of the higher forms of life and just below man in the biotic pyramid. Consequently, like him, she lives under greater hazards of threatening nutritional deficiencies because of her lofty position giving higher chemical complexity. Unfortunately, her nutrition is too completely controlled by man prohibiting her to care for herself in that activity by her own instincts, however she struggles to demonstrate those for her own good. Man, who follows no instincts of his own for his better nourishment, prohibits the cow from following hers. Instead, he labors under the delusion of sufficiency of his wisdom for wise guidance of the nutrition of both himself and her.

*Lessons may well be taken from Nature.*

Careful observation of the ecological pattern of wildlife, and of its struggle to get its proteins, has much that is significant help in our efforts to feed our livestock. It will point to the proteins as the problem, not in terms of business transaction trading them from one place or person to another, but in terms of the fertility of the soil to create them. Agriculture is first and always a matter of creation and then, later, one of speculation. One doesn't do any horse trading without a horse. Neither does one do any creation of life without some soil as the basis of it.

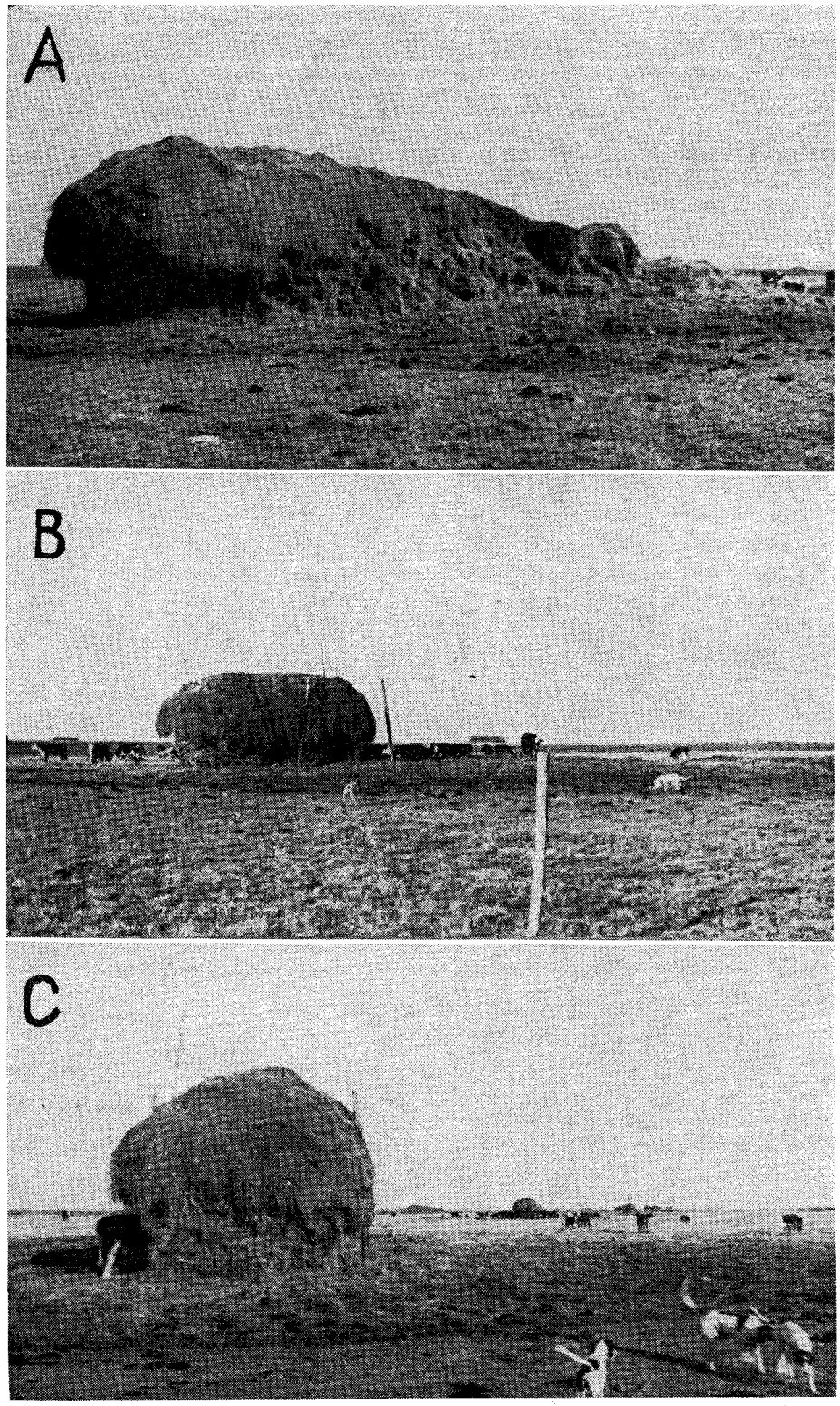
Now that we have connected the essential element, nitrogen, in the soil with more protein in the crop and with more crop, a major lesson from Nature has developed. Cells multiply to increase the total yield when they get more nitrogen and other elements from the soil to make more protein. More protein means more cell multiplication. Since we have been building up the soil in calcium, phosphorus and potassium beyond what legumes were using in getting nitrogen from the air, the increased chemical nitrogen now used as fertilizer is demonstrating some miraculous effects in the way of bigger crops. Nature responds quickly when we strengthen the weakest link as we do in providing fertilizer

nitrogen, which is the weakest fertility link in the soil for protein production.

High protein crops, however, make such good feed for growing young animals. This is true not just because these feeds contain much nitrogen as proven by burning the crop in sulfuric acid, but they are good feeds as growth promoters and health promoters because in making proteins they are also making a host of other food constituents, stimulators, tools, etc. If these protein crops are making such complete life-carrying substances, they must be taking a long list of many things from the soil. Along on that list, they have been taking the trace elements. Also they are taking compounds as well as elements. Because the high-protein crops do so much in their creative ways, experiments have shown their roots must be equipped to exhaust the fertility supplies of the soil to a lower level. Crops making more protein for good nutrition for us are making it first for nutrition for themselves; therefore they must also take more from the soil for these special accomplishments. Now that chemical nitrogen suddenly comes in to do so much, we dare not forget that all the other elements in our soils are being exhausted all the more rapidly. Our legume crops were and are bringing about the same situation. On test plots where legumes were used in crop rotations for 60 years on Sanborn Field of the Missouri Experiment Station, the soil fertility, outside of nitrogen, is lowest. More and better protein can be had only as we learn to put into the soil all the fertility elements and compounds required to create it, first, in the microbes and the plants, and then in our animals.

The natural seasonal birth pattern of our grazing animals brings the parturition in the spring of the year. One might believe that this is due to the shift from lower to higher temperature giving a favorable matter in terms of comfort relative to cold and heat rather than the nutritional comfort, or the "inner" comfort. It is the warming soil that starts plants growing. The result of the higher soil temperature speeds up the fertility delivery to feed the plant roots. The growing spring plants are high in protein since the shorter days have not pushed up the plant's photosynthesis to the point of making carbohydrate production and cellulose bulk delivery their main activity. Protein production, and a high concentration of it with the accompanying compounds to carry on this process within the early spring growth of grass, is the reason young grass is good grazing for the mother which has suddenly taken on the increased physiological load of giving milk for the young. Nature has synchronized the biochemical performances of the animals and the plants to fit into those chemicals and biochemicals of the soil.

The grazing wild sheep move upward higher into the mountains with the advance of the spring season. The later advent of the first grass growth at higher altitudes is the reason, but it is also the means of giving these wild animals their supply of protein concentrates in the herbage. They don't purchase protein supplements on the market. The Swiss dairyman, who also cannot import protein supplements, follows the same



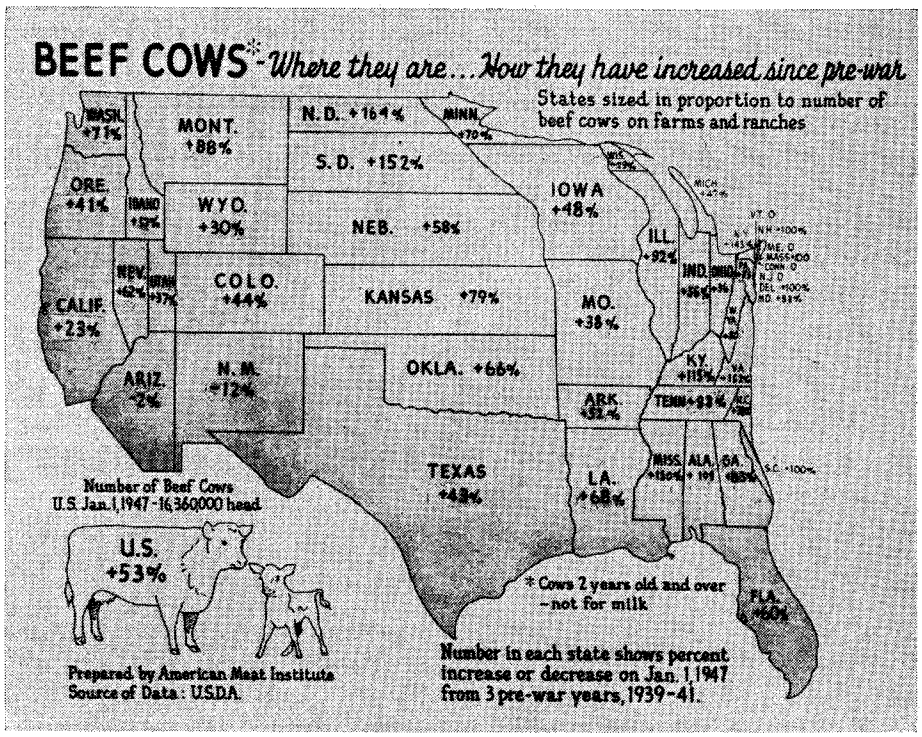

**Hay from five acres fertilized once eight years earlier had been swept into this stack along with that from 15 acres unfertilized (A—right section). When the stacker would build no higher in making this hay stack, an extra section was added as the left end (A) to include all the hay from 25 acres. Three other stacks of 25 acres each from untreated soil made up the hay crop. Cattle turned in for this winter feed consumed first the part of the stack with hay from soil treated seven years before (A). They cut that stack in two along the dividing line between fertilized and unfertilized (B), and then showed no more preference for the remnant of the one chosen first (C foreground) than for the other stacks (C background). E. M. Poirot Farms, Golden City, Mo.**

**The fact that cattle choose what they eat, when they have a choice, is substantiated in these three pictures prepared by Dr. Albrecht for this instructive article.**

**The pictures (A), (B) and (C) show the progressive manner in which the cattle chose and consumed the hay to their liking from one stack where the contents were from fertilized and unfertilized fields. The location of these fields are on a farm in southwestern Missouri, and a limited amount of fertilizer had been applied. After reading what Dr. Albrecht has written about these stacks, one might have a greater respect for the lasting value of fertilizer.**

principle by moving his cows to higher altitudes for grasses. These grasses in their early protein-rich stages of growth, are dependent on freshly weathered rocks for their fertility supply. Nature's lesity by which they in their more complete array of amino acids are created in agricultural production.

In dealing with living things, the many factors involved make the picture in its entirety a rather large and complex one. We cannot comprehend the whole. We do well to see only the parts. We have not yet learned what good health of our animals, or of ourselves, really is. We do not study animal good health. We study mainly animal "bad" or "failing" health. Working backward from the carcass and the cadaver by post-mortems, we call in the pathologist to explain, and to put on a label, if not even a quarantine. But this usually lets physiology—an explanation and understanding of the real cause—remain unknown. We have been using the label "X—disease," for example, which means that the "X" is unknown. Too long has "disease" been an unknown, too. But slowly we see body degenerations compelling us to believe that much that we call "disease" should be considered malnutrition, and should send us to growing better feeds of more total and more complete proteins.




**Cattle create themselves, and thereby our choice food proteins, where the moderate rainfalls have not weathered the soils severely enough to make them acid and deficient in the fertility for growing protein-rich forages.**

*"To be well-fed is to be healthy," but that calls for plenty of complete proteins possible only on fertile soils.*

Our failure to feed completely is not the only contributor to troubles in growing our livestock. We must also look to the possibility that we are subjecting our animals to slowly reacting poisons. The "X-disease" may be only one case of our poisoning our animals—and ourselves —now that we are using such deadly poisons that serve as insecticides, and herbicides. They may be hom(o) (i) cides too. These are all chemically complex compounds, built out of the so-called chemical ring carbon structures. The human body cannot break these down. It may only rework them and possibly with disastrous effects. The ring compounds the body uses are most powerful in the smallest amounts. The "X-disease" is now connected with chlorinated naphthalene or a double ring compound. This fact points to the many other ring compounds taken out of the soil by plants and appearing, for example, in the bean seeds, the potatoes and in the fruits. We may thus be delivering poisons for one form of life, and for one supposedly beneficial effect, while unwittingly dealing a slow death to our livestock if not to ourselves. We must protect our animals

sons through wild life and the habits of even our livestock tell us that proteins are the problems for our plants. Consequently they are then the problems for our animals and ourselves, too, since we only collect them.

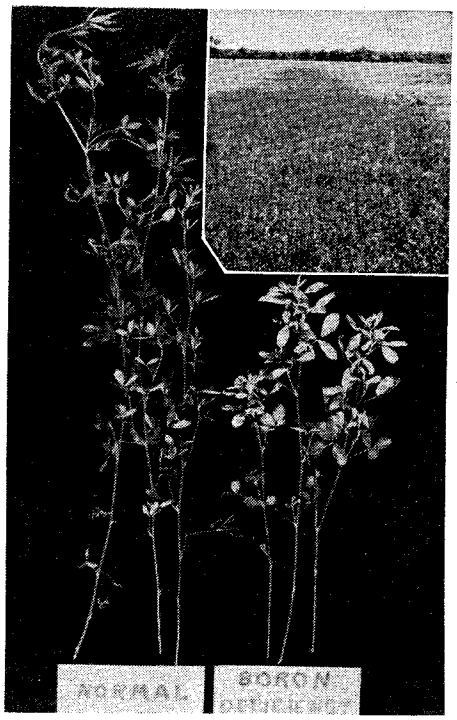
The struggle to live through the winter presents a problem for plants, too. This problem is solved by Nature because the shortening days of the autumn reduce the plant's rate of piling up carbohydrates, and allow the plant's conversion of those into proteins by means of soil fertility to dominate. This process may well be called "hardening off" the plants to prevent, what some would call, "winter killing." Winter wheat and barley are often said to have "winter killed." It would be more logical in most of those cases to forget "winter killing" and consider it "winter starvation" for proteins. High protein contents in the autumn help plants to go through the winter. All of this tells us that increased winter killing is due to declining soil fertility, and that it is capable of prevention by more nitrogen and all else that goes with it to make the complete proteins the plant needs by which to live.

Critical studies of nutrition, whether of microbes, plants, animals or man, point to the proteins in quantity and in quality as the problem. Natural phenomena all about us suggest the growing scarcity of these compounds, and grown to the present degree of shortage in no small measure because we have not refined our concepts of the proteins, their functions in physiology, and the soil fertil-

**Soybeans as a protein supplement in cattle feed have their troubles in making the proteins they require for their own growth. Many other "imported" crops soon tell us their troubles because of shortages in soil fertility. (Row in left of photo suggests the soil's magnesium deficiency, which is enlarged in the inset.)**

from excessive drugs and slow poisons as well as prevent malnutrition by means of good feeding.

Only as we see feed proteins in their complete array of the quantities of amino acids balanced for body growth, for reproduction, and for protection against the invasion of foreign proteins like viruses and microbes; only as we learn more about how the cow would feed herself for offspring production rather than how we would carry her cheaply through the winter or fatten her; only as we discover the details of plant physiology by which we can know the crops which in combination will give us the complete proteins as feed; and finally, only as we know more about the soil fertility management that will undergird the plants' struggle in making proteins from the required chemical elements, can we expect to start the assembly line of the creation of livestock so that it will run in high order and without mishaps at all stages along that line. Only as we build up the soil can we escape the fact that our proteins that minister to better health to man and his animals are becoming scarcer because the soil fertility for the soil's power of creation is going lower.




**Left:**
**Boron is one of the "trace" elements essential for plants but is not yet so listed for animals.**
**Experiments with Boron as a soil treatment for alfalfa demonstrated the effect by the Boron for increasing the concentration of the commonly deficient amino acid, tryptophane, in this excellent legume hay.**