Weed Killers and Soil Fertility

By Wm. A. Albrecht

WEEDS are commonly considered as a detriment because they are plants that use soil space but do not provide nutrients either to us or to our animals. In pastures weeds are plants that a cow has sense enough to refuse if she can help herself to other more suitable plant growth. The vegetation she eats is not chosen according to its particular species, but rather according to its palatability and the balanced fertility of the spot or area of soil where it grows. Unlike the cow, however, we have not seen the imbalance, or the deficiency, of the soil fertility which still lets some kind of vegetation grow even if failing to make food for us. We have defined a weed as "any plant out of place." It would be more accurate to say: "Weeds are plants making scarcely more than vegetative bulk growth on soils too low in fertility for other kinds of plant growth."

Because of this confusion in definition, we have recently taken it upon ourselves to put those plants, i. e., the weeds, back into place—or out of the wrong place—by calling in either the chemical, or the hormone, sprays. By means of these treatments, the weeds (and non-weeds too) can be killed easily and speedily. Emphasis on the plant species out of place, and our readiness to engage in a fight on some unsuspecting plants, have made us lose sight of the decline in soil fertility that had starved out the food-producing plants but let the non-producer of food, the weeds, still survive. As the weed plants produce less, they can survive on less, at least on less coming from the soil as nutrition for them, for animals, and for ourselves.

Weeds and Low Soil Fertility

Lowered fertility may bring in weeds; lowered more, it may prohibit even weeds. That such reasoning rests on a logical basis of the soil facts is the testimony of the two classic plots on Sanborn Field at the Missouri Experiment Station. Corn has been grown continuously now for 62 years on these plots. The entire crop, both grain and stalks, has always been removed. One plot was given six tons of barnyard manure annually. The other was given nothing but corn seed, cultivation, and the opportunity of producing a corn crop, if it could, by the help of the same weather that has been giving almost twice as large a corn yield on the adjoining manured plot.

If these two soils are observed in the Spring, ahead of plowing them for another crop in this continuous corn series, one would be apt to conclude prosaically that the use of manure brings in weeds. The "no manure" plot has no weed crop, but it has almost no corn crop either. There is no need to cultivate it to get rid of any weeds. There are seldom any weeds on it now after 62 years of continuous corn. This is true since there is not enough fertility in the soil to keep growing any sprouting weed seed that might have gotten there from being blown in, or brought from somewhere else by other means. Here is a nice clean, weed-free plot. It might win our admiration for the absence of weeds if one were to think no deeper about good soil management and wise farming than just the need to keep the land free of weeds.

On the plot given the six tons of manure each year, there is a heavy growth of weeds to be plowed under every Spring. These start coming in soon after the third cultivation of the corn in the Summer. They are already a good cover crop against erosion by the time of the autumn rains. They carry over through the Winter. They take up the soluble nitrogen from the surface soil in the late Summer. This is no harm to the corn crop after cultivation has killed all the shallow corn roots anyway, and when the corn is feeding by means of roots at much greater depth, and in more regular moisture content, than this upper section of the soil profile represents.

These weeds are Nature's way of giving us a self-seeded cover crop to prevent the loss of soluble nitrogen and the damages by sheet erosion. In the face of these extra and beneficial services to the soil given by the weeds, when we neglect to supply the equivalent fertility support to the soil of the unmanured plot, shall we engage in a fight by means of chemical poison sprays on such a service-providing weed crop? Shall we think of weeds as coming into competition with our crops, or shall we think of them as Nature's attempt to help improve the soil conditions?

New Practices Should Provoke Caution

The spraying of chemicals on weeds may well call for some thinking about the nature of the chemical compounds that render this violent death blow to vegetation. It is important to note that the core of the sprays' chemical composition is the benzene, or the ring, structure. It is the compound originating in the coal-tar by-products from distilling coal for making coke. Apparently these ring compounds were not destroyed by the microbes active in the anaerobic decay of the woody materials that originally went into the formation of the coal. Such is readily true since bacteria commonly tested in the laboratory do not break down the compounds of benzene or ring structure. In fact, such chemicals usually arrest the microbial processes. They kill the microbes as we know for carbolic acid, or phenol, one of the early ring compounds once widely used as an antiseptic.

The wood-producing plants are the natural agents creating the compounds with the ring arrangement of the carbon and hydrogen composing them. Lignin of wood, that is, the compound enshrouding the cellulose to make wood of it, is not readily decayed or destroyed in the soil. It accumulates there as humus. Lignin consists almost exclusively of ring structures combined or linked together as many combinations. It is a synthetic output by the vegetation on the soils more highly developed by the climatic forces and on the lowered fertility where wood production is the major crop possibility.

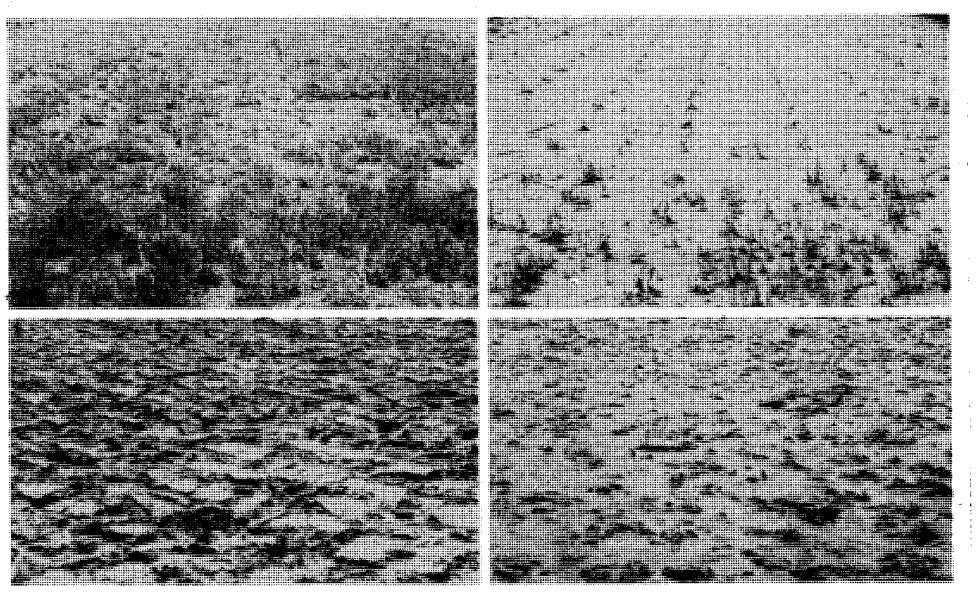
Legume crops, for which a less highly developed and more fertile soil is required, do not produce humus in the soil in such amounts as is the case for woody and non-legume plants. While leguminous crops make cellulose, they do not cover it with much lignin or phenolic compounds to convert it into wood. Lignified cellulose is not so digestible. Not only do bacteria fail to digest the lignin, or ring compounds, but such structures are not broken down during digestion by higher animals either, so far as we know. These synthetic chemical creations by woody plants, growing on the less fertile soils, are in the chemical groups representing little or no food values to microbes or to animals in ways we commonly visualize that foods serve us. Rather they are in the drug group. They are more nearly in the class of poisonous compounds. This can be said of them when they are ingested in significant dosages or amounts equivalent to common foods. Taken in smaller dosages, as we do with many commonly considered poisons, they are stimulants.

It is in this category of stimulants that one of the more commonly used weed killers, namely 2-4 D, is classified. It acts as a growth hormone for plants. It is a substance of which very small amounts serve to increase the speed of the chemical reactions of life, if not to initiate new ones counteracting this drug. It literally makes the plant respire itself to death or burn itself out.

While considering these chemical ring structures in the form of weed killers, acting like terrific stimulants for the plants' body processes, it may not be too far-fetched to remind ourselves that the sex hormones (powerful stimulants) of man and animals are also complex ring compounds. Some of the amino acids, too, have similar chemical arrangements as component parts of their atomic structure. In fact, a small, but required, part of the protein molecule contains this particular arrangement of some of its carbon and hydrogen atoms.

In the light of these facts and of such reasoning, it seems that our own body requires and uses some compounds of the benzene ring structures in its functions. But by what chemical methods it links together the plant-given ring compounds, or transforms them to construct those serving it so specifically in such small amounts, is still unknown. According to present knowledge, the ring structure is not broken while in the body. Compounds of its kind ingested are eliminated as such without chemical destruction of the ring itself. They come in as very small amounts naturally to render their services. In larger amounts they quickly give disastrous effects, as do other poisons.

It is still more significant to recall, in this connection, the fact that experimental skin cancers in mice are produced by repeated applications of coal-tar. Cancer was originally named as "chimney sweeps disease." Cancer of the lips of pipe smokers raises the question of possible causal connections in this case with coal-tar distillates from burning tobacco. With ring compounds so disturbing in human and animal physiology and through biochemical ways still unknown but disastrous, it raises some question as to the hazards that might possibly be brought along when they are scattered about so promiscuously as weed-killing chemicals.



Weeds are nature's winter cover crop on soil that receives manure annually (upper left photo) and is fertile enough to grow them along with a crop of continuous corn. Weeds are now absent (upper right photo) where corn, also grown continuously for 62 years but with no treatment, has depleted the soil to the point of prohibiting weeds. The soil body is also correspondingly strong (lower left photo), or weak (lower right photo), against the beating effects of rain and erosion. (Photos taken last Spring of test plots at Sanborn Field, Missouri Experiment Station.)

Feed Crops Rather Than Fight Weeds

If weeds are competitors with our food-producing plants, natur-

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ally it makes us think first of getting rid of them. Only after some careful thinking will we take to the idea of tolerating them, within the proper limits. On more careful consideration of the details of soil fertility and plant nutrition, however, it would be far better soil management to consider using not so much and so many chemicals to kill the weeds, as competitors to a weak crop, but more chemicals as fertilizers to increase the soil fertility. By nourishing the desired field crop well, with the proper fertilizers applied deeply, and by cultivating it to keep down the weeds until the crop is deeply rooted, then the later growth of weeds would not be serious competition for the fertility. In fact, at that later time, weeds would be conservators of the fertility in the upper soil layer which would not be of use to the corn or other crop plants anyway during that part of the season. The use of more chemicals of fertilizer values, plowed down deeply to nourish our crops well enough and still grow a succeeding weed crop as natural cover, plus soil organic matter, is a sounder practice than the use of more chemicals of the poison class scattered about profusely in a fight on what we call weeds. Instead of trying to cure a failing crop by killing the weeds when deficient fertility is the principal fault, it seems much more logical to practice prevention by strengthening the crop through proper fertilization of the soil. This positive approach tells us that we must pay more attention to the soil and its fertility, for nutrition of the crop, and not depend wholly on drugs for poisoning weeds. Sanborn Field at the Missouri Station is the sage giving this advice after its 62 years of carefully recorded and well-considered experience.

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