Letters

Alcohol or Humus?

Philip H. Abelson (Editorial, 20 June, p. 1325) comments on the rosy outlook that is sweeping the nation about converting biomass to alcohol and gasohol.

Production of biomass demands suitable combinations of climates and soils. For a soil to function effectively in plant production it must possess substantial water-holding and ion-exchange capacities, good physical structure, and thriving populations of bacteria, fungi, and invertebrates. These attributes are highly correlated with humus substances, which are dark-brown organic macromolecules rich in phenolic compounds and are derived from plant remains and microbial synthesis. Humus has high sorptive capacity for toxic metals, and its buffering power mitigates the impact of acid rain. Humus maintenance requires a steady influx of plant biomass from root decay and aboveground organic residues. Good soil structure depends on aggregation of colloidal clay platelets held in position by organic thread molecules. These are being consumed continually by invertebrates and have to be replenished by photosynthates and microbial products.

At the turn of the century, farsighted agricultural experiment stations set up permanent cultivation plots and monitored for decades the nitrogen and carbon balances. Stirring soil and removing crops initiated profound declines in nitrogen, carbon, and humus substances and caused deterioration of soil structure. Under these circumstances water infiltration is reduced and runoff and sheet erosion are encouraged. Crop yields suffer. While applications of nitrogen fertilizers boost yields, they have not restored the soil body. In central Europe, farmers used to remove forest litter and put it on their fields for manuring. Tree production declined markedly, documented by Aaltonen (*1*). Mulches of leaf litter and stubbles of grain crops keep wind erosion under control.

We are promised construction of ingenious machines that will pick up all crop residues in the fields and leaf litter and humus in the forests. The carbon and nitrogen cycles of ecosystems will be curtailed and soil stability endangered. Because of a possible climatic warm-up, we do not wish to accelerate humus oxidation and the concomitant flux of carbon dioxide from soil into the atmosphere.

I am arguing against indiscriminate conversion of biomass and organic wastes to fuels. The humus capital, which is substantial, deserves being maintained because good soils are a national asset. The question will be raised, How much organic matter should be assigned to the soil? No general formula can be given. Soils vary widely in character and quality. Some can endure a measure of organic deprivation, as in overgrazing; others cannot. On slopes, strongly erodible soils, or soils that have been eroded already, require more input than soils on level lands. The Agricultural Experiment Stations, Extension Services, and the Soil Conservation Service possess a pertinent store of knowledge that should be put to use in energy conversions.

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Reference

1. V. T. Aaltonen, *Boden und Wald* (Parey, Berlin, 1948).

Mathematical "Invasion"

In our recent letter (6 June, p. 1088) about the "monster" finite group, we intended to report that R. L. Griess, Jr., had presented his method in the group theory seminar at Chicago. As printed, this came out "group therapy." We apologize to our psychiatric colleagues for this unintended invasion of their domain.

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Keeler's Gap

In the otherwise excellent report "Imaging photopolarimeter on Pioneer Saturn" by T. Gehrels *et al.* (25 Jan., p. 434), the sharp feature in Saturn's rings marked "Encke Gap" in figure 3 and described as "Narrow" in table 2 is mislabeled. Encke's gap, or division as it is more usually called, was discovered more than a century ago with a small telescope and has been observed by thousands of astronomers since. Although narrower than the prominent Cassini's division, it has always been described by observers with adequate instruments as a broad, low-contrast feature (*1*). Careful observations with large telescopes during rare conditions of excellent seeing and transparency reveal that Encke's division is actually a complex of several broad, shallow maxima and minima, with one narrow, deep minimum at its outer edge (*2*). This fine, very dark division or gap was, as far as I know, first reported by James E. Keeler, who discovered it and observed it several times with the then very new Lick Observatory 36-inch refractor (*3*). The gap's width, as measured by Gehrels *et al.*, projects to only about 0.1 second of arc at the earth's distance from Saturn, and it could not possibly have been seen by Encke with his 9-inch telescope in Berlin. Later planetary observers were apparently unaware of Keeler's work, and one other recent observer has referred to the narrow, deep feature as Encke's division (*4*); but this name should be reserved for the broad complex feature, and the narrow division should be called Keeler's gap (in the nomenclature of Gehrels *et al.*).

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References

1. P. Moore, *A Guide to the Planets* (W. W. Norton, New York, 1954), p. 162; A. F. O. Alexander, *The Planet Saturn* (Macmillan, New York, 1962), pp. 170, 206; P. Moore, *The Planets* (Norton, New York, 1962), p. 134.
2. A. Dollfus, in *Planets and Satellites*, G. P. Kuiper and B. M. Middlehurst, Eds. (Univ. of Chicago Press, Chicago, 1961), p. 568; *Surfaces and Interiors of Planets and Satellites* (Academic Press, New York, 1970), p. 270.
3. J. E. Keeler, *Sidereal Messenger* **7**, 79 (1888); J. E. Keeler, *Astron. J.* **8**, 175 (1889).
4. H. J. Reitsema, *Nature (London)* **272**, 601 (1978).

Erratum: In the letter by R. L. Brownell, Jr., and H. Omura (30 May, p. 976), an additional reference [M. Tomita and M. Nishimura, *Jpn. J. Hyg.* **28**, 59 (1973), p. 44] should have been cited at the end of the first sentence of the last paragraph. Two sentences should have followed: "Tomita and Nishimura (1973) reported that the total mercury content of sperm whale meat ranged from 0.54 to 3.69 parts per million (ppm). However, mercury levels in meat from two species of baleen whales examined, sei and minke, were much lower, ranging from 0.04 to 0.12 and 0.15 ppm, respectively."