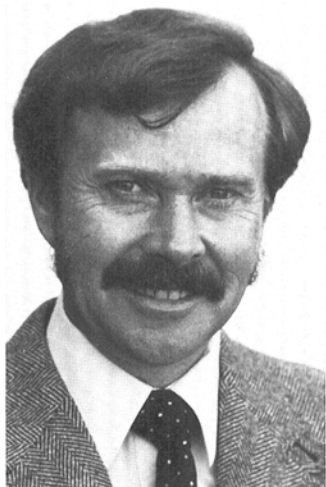


Use of the Term "Crop Loss"

R. JAMES COOK

Agricultural Research Service, U.S. Department of Agriculture, Pullman, WA



Those of us in the plant protection disciplines are constantly asked to document the importance of diseases, insect pests, plant-parasitic nematodes, and weeds on the basis of the "losses" they cause to crops. I have not determined the origin of the term "crop loss" nor have I determined how long it has been used in the plant protection literature. It goes back a long way and may well be the invention of our own science. Regardless of its origin, in my opinion its usage in most cases is incorrect. I will limit my

argument against this term to its usage in describing the effects of plant diseases on crop yields, but many, if not most, of my arguments can and do apply to describing the effects of insects, nematodes, and weeds as well.

With few exceptions, diseases that affect the growing plant and thereby limit ability of the plant to yield do not cause "crop loss," nor can they "reduce yields." A grower can lose trees because of nematodes or diseases or a commodity during storage, but cannot lose what was never produced in the first place, nor can a yield be reduced below some yield that was never achieved. It is more appropriate to say that the diseases of the growing plant prevent the crop from yielding at its potential as determined by the soil, climate, and agronomic inputs. Using an analogy, if I sell shares of a stock at \$100 per share and then the stock goes to \$110 per share, I cannot, on this basis, claim to have lost \$10 a share. I could have had \$10 more per share, but I have not lost \$10, the IRS will not allow for a \$10-per-share tax deduction, and certainly the \$100 price received per share cannot be claimed to have been reduced by \$10 on the basis that later the price went up to \$110 per share.

A wheat field in eastern Washington yielded about 90 bu/acre (6.3 t/ha) in 1984, but replicate plots within this same field, in which the soil was fumigated before sowing using Telone C to eliminate *Pythium* spp. and plant-parasitic nematodes, and with foliage sprayed with Benlate in April to control *Pseudocercospora* foot rot and with Bayleton in June to control rusts, the yields averaged 128 bu/acre (9 t/ha). Although the owner could have harvested an additional 30–40 bu/acre (2.1–2.8 t/ha), he did not lose 30–40 bu/acre, nor will the IRS allow this as a loss. To borrow from the terminology of government when tax revenues collected are less than projected, there was a "shortfall" of 30–40 bu/acre in this field from the potential yield.

Some "crop loss" estimates are attempted by calculating the difference between the actual and the potential yield, but this also is incorrect by my argument that legitimately one cannot lose that which never existed. There is also the problem of how to determine the full production potential. Who would have suspected that 90 bu/acre on dryland wheat—about three times the U.S. average—was 30–40 bu/acre below the potential yield in the same field with the same cultivar, fertilizer, and water supply? What is yield potential of a perfectly healthy and pest-free crop? Only the ornamentals industry has the technology to produce pathogen-free plants in pathogen-free soil, and this technology has virtually revolutionized that industry.

By ceasing to refer to lower yields caused by pathogens as a loss, we would not hear such comments as "If you add up the losses claimed for weeds, insects, pathogens, and nematodes, you come up with a negative yield." Everyone knows that the yield in any given field develops under the influence of pests and diseases. Except for these pests and diseases, the yield would likely be greater, which is how the effects of pests and diseases on a growing crop should be expressed—by the greater yield possible when they are controlled rather than in terms of a yield "decrease" if they are not controlled. It makes no sense to express the combined effects of all pests and diseases on a crop by subtracting from the yield actually harvested. Also, it is better to express the benefits of pathogen control in positive terms—greater yields with pathogen control—than in the double negative—to reduce losses by controlling plant diseases. Expressing the benefits of pathogen control in the positive also makes it easier to emphasize benefits in addition to increased yields. For example, one benefit of disease control is better weed control. Weed control begins with healthy competitive plants. Disease control may, therefore, save on herbicide use. Control of soilborne pathogens saves fertilizer because healthy roots are more efficient in the uptake of mineral nutrients. Our mission is to increase the efficiency and sustainability as well as the total production of agriculture through improving plant health.

Finally, and most important, expressing disease as a yield-limiting factor or constraint to yield rather than as a cause of crop loss is more than a better way to communicate, it's a better way of thinking. A yield of 90 bu/acre in a field where water or fertilizer was sufficient to produce 130 bu/acre reveals very clearly that the yield-limiting factor was a combination of biological stresses and not the lack of plant nutrients or water. The yield of 90 bu/acre was at best only 70% of the potential in this instance, which is another way to quantify the effects of the diseases on that crop. These results and others that could be cited lead me to suggest that many estimates of the effects of disease on crop yield have been too conservative. Only with a change in thinking on how to document the effects of plant diseases on yield will we be better able to make our case for the importance of these diseases.