Ozone debate far from resolution

by Hugh Maynard

This summer of '92 will not go down in the history books as the best for suntanning weather. A dearth of cloud cover, cool temperatures and wet periods has also created confusion about the immediate effects of global warming and the ozone layer. A few hot days in May spawned a flurry of media reporting on the state of the ozone layer and the institutionalization of the daily ozone reading. There is no doubt about the essential role ozone plays in maintaining life under the sun's glare, but just how severe the depletion has become and what that means for life on earth is still the subject of debate.

The ozone layer is found in the stratosphere, 15 to 50 km above the earth's surface, where it acts as a filter against the different types of ultraviolet light (UV-A, B & C). The less ozone in the stratosphere, the stronger UV radiation becomes at ground level, the more the health of many living forms - from humans to algae - are at risk.

Of particular concern to humans is the UV-B type of radiation, which reaches earth in greater quantities than the other forms and can "cause a wide variety of damage to living organisms if they are excessively exposed," according to a study cited by the federal Ministry of the Environment in its recently released publication, "The State of Canada's Environment."

There appears to be general agreement amongst scientists that the ozone layer has diminished over the last decade, but estimates of the severity vary from 4-10%. There is also agreement that human activity on earth, principally pollution of the atmosphere with chlorofluorocarbons (CFCs), has been a major contributor to ozone depletion.

CFCs are non-toxic, synthetic chemicals used as refrigerants, aerosol propellants and industrial solvents. They "attack" and destroy ozone molecules and most scientific evidence suggests that their continued use will most certainly reduce, to critical levels, the protection provided by the ozone layer.

Fact or fiction

All that having been said, is a depleted ozone layer responsible for the increasing rate of skin cancers and other health problems that appear to be so prevalent to-day, as well as the potential for a

disaster in crop production? Not necessarily, says David Hume of the University of Guelph, who has just completed a major review of literature related to the tolerance of plants to increased levels of UV radiation.

"It's difficult to separate hype from reality. There has been a 7% increase in UV radiation over the last decade, of the type that would effect crops, which probably doesn't mean very much by itself," Hume says. There are natural variations in the ozone layer, he notes, which present measuring methods are not sophisticated enough to record until sometime after; in essence, we won't know where we stand to-day until perhaps as much as a decade away.

Hume cites the recent trend towards publication of UV radiation levels in newspapers as an example of unwarranted hype. The reports suggested that levels in early May were equivalent to a hot day in July, playing to fears that ozone depletion was already reaching dangerous proportions.

Hume explains that UV levels are normally higher in spring time because this is when the ozone layer is thinnest. The so-called "holes" in the ozone layer usually occur during the cold of winter, with ozone diffusing to fill in the void as the seasons warm up. The angle of a mid-summer sun makes it feel hotter in July, but UV-B radiation levels should be higher in May, gradually declining after the summer solstice. "This year is so far not radically different from any other," he says.

Uncertain

Hume's opinion is backed up by the report from Environment Canada, which states: "Because no significant increase in human exposure to UV-B has been detected, there are consequently no credible grounds for believing that ozone depletion has yet affected human health . . . The causes of the apparent increase in the incidence of skin cancer cannot, therefore, be attributed at present to ozone depletion."

A similar conclusion with regards to plant life is drawn by J. C. van der Leun and M. Tevini in a United Nations Environment Programme Update on the environmental effects of ozone depletion. The report notes that fluctuating levels of UV-B radiation can "alter the biotic relationships of higher plants as demonstrated by the changes in plant disease susceptibility and the balance of competition between plant species."

But it also states that caution must be exercised in making predictions regarding changes to the ozone layer because of the complexity of the situation and the limited research that has actually been carried out on plants with regard to the effect of UV-B radiation. It is believed that ultraviolet light promotes changes in plant molecules, such as hormones responsible for growth regulation, resulting in shorter plants, as well as delaying or speeding up the onset of flowering, disrupting the pollination cycle.

Legumes (peas, soybeans), squashes and brassicas (cabbages, lettuce) appear to be the most affected by higher radiation levels. Hume says that field crops react differently because, just like humans, some plants have darker pigmentation and hardier cell walls that protect against 'sunburn'; even within the same crop type, such as soybeans, there are varieties which are more susceptible than others.

He notes that two studies on the effects of UV-B radiation on plant growth can reach two opposite conclusions depending on the variety of crops examined and warns against making general conclusions from individual comparisons. He also adds that crop scientists believe they can breed tolerance to UV-B radiation into most plant species if their productivity does become threatened by a thinning ozone layer.

The University of Guelph is currently investigating the effects on crop plants from increased exposure to ultraviolet light. Horticultural scientists Beverley Hale and Doug Ormrod, along with graduate student Xiuming Hao, are conducting tests in an outdoor laboratory based on a forecast five to fifteen percent depletion of the ozone layer. To date, they have found that cellular changes similar to suntan and sunburn in humans occur in plants after just four days of increased UV exposure.

The study is part of overall research into environmental stresses, including ground-level ozone and carbon dioxide.