

COMPATIBILITY OF LIQUID PESTICIDES AND FERTILIZERS

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There has been a tremendous amount of interest the last few years regarding the compatibility of liquid pesticide-fertilizer combinations designed for use on turf. Most of this interest has been generated by the rapidly expanding lawn service industry. The industry recognizes the advantages of liquid programs: Cost of materials, time and labor savings, convenience. As a result, many lawn service companies today utilize liquid programs. Compatibility problems, however, are not unique to liquid programs. Many lawn service companies utilize dry programs with fertilizer-pesticide combinations. A common example is the use of fertilizers which have been sprayed and coated with a preemergent herbicide. In this case, incompatibility problems may arise due to the close association of the pesticide and fertilizer.

There is a void of information on pesticide-fertilizer compatibility. Compatibility charts are available for numerous pesticides, however, they very often are incomplete as far as turf pesticides are concerned. Fertilizer materials seldom are included on these charts. If compatibility information is not available, either from compatibility charts or on pesticide labels, determining compatibility is a difficult problem. However, it is a problem that must be dealt with.

Numerous combinations of turfgrass fertilizers, herbicides, insecticides and fungicides are being used today. We generally consider these combinations compatible if:

- (1) no problems arise when mixing the materials, such as settling or foaming;
- (2) the combination displays no visual toxic effect on the turfgrass; and
- (3) the effect of the various components is the same as if they were applied alone.

Incompatibility is very easy to recognize at times, such as when a precipitate forms at the bottom of the spray tank. However, there are many other cases where incompatibility is extremely difficult to detect. Incompatibility can take on various forms:

(1) Physical Incompatibility - This results when two or more materials form an unstable mixture. The result might be a precipitate, with one or more of the materials salting out within the spray tank. It might also involve the foaming of one or more of the components during mixing, or perhaps a gel may be formed during the mixing process. Layering of immiscible liquids may take place.

(2) Chemical Incompatibility - This is the result of one or more of the materials undergoing a chemical change when placed in a combination. A new product may be formed, or one or more of the materials may become dissociated. As an end result, an individual component of the mixture may lose total or partial efficiency. Chemical incompatibility of this type would be very difficult to recognize.

(3) Placement Incompatibility - This is one very serious disadvantage to liquid programs, and results when two or more materials are used in a combination which must reach different areas within the turfgrass microenvironment. For example, a broadleaf herbicide-fertilizer combination might be considered incompatible since the herbicide must reain on the foliage to be effective, whereas the fertilizer

should be watered in as soon as possible to avoid foliar burn. Another example might be the use of a broadleaf herbicide and insecticide for the control of grubs. The herbicide should remain on the foliage, whereas the insecticide should be watered in to achieve maximum grub control.

(4) Phytotoxicity. Many times materials are used which alone do not have phytotoxic effects. However, when they are placed in combinations with other materials their phytotoxicity is greatly increased. Often when two or more materials are placed in combination their phytotoxic effects are synergistic and the net result is worse than if the two materials were applied separately.

Why do these incompatibilities arise? The active ingredients used in pesticides can take many forms -- solid, liquid or gas. The solids can take many different forms, as can the liquids. A solid may be crystalline in nature, it may be waxy, or it may be soluble or insoluble in water. Liquids can be very thick or thin, or they might be heavy as opposed to light. Turf managers, however, cannot deal with the active ingredients themselves. The manufacturers must first put the active ingredients into a formulation which can be utilized in a spray tank. This is where the problems with incompatibility arise. Because of the different nature of active ingredients, pesticides end up as granulars, solutions, suspensions, or emulsifiable concentrates. In addition, not all active ingredients will dissolve in water and have to be placed in other solvents. As a result, many of our pesticides are dissolved in materials which will not readily mix with water in our spray tanks. Our incompatibility problems, therefore, are largely due to the way in which active ingredients are formulated, and not due to the active ingredients themselves.

Several other factors in addition to formulation may also influence compatibility of various mixtures.

(1) Tank pH. Compatibility problems, both physical and chemical, will arise whenever the solution pH reaches extremes. A well known example is the use of the organophosphate insecticides. Dylox at a pH of 6 has a half life of approximately 89 hours. At a pH of 7, this half life is reduced to 380 minutes, and at pH 8, the half life is again reduced to 63 minutes. A more dramatic example is Sevin. At a pH of 6, the half life is 100 days. As the pH rises to 8, the half life is reduced to 2-3 days, and is reduced to 1 day at a pH of 9. In general, we will have much fewer compatibility problems if our solution pH is neutral or slightly acid.

The water utilized in making tank solutions often has a pH near 8. If ammonium phosphates are being used in preparing the fertilizer-pesticide solution, this material will reduce the pH to a level between 6.5 and 7. If ammonium phosphates are not utilized, there are numerous additives which can be purchased which will reduce the pH to a level near neutral. Whenever a new fertilizer-pesticide combination is used or water sources are changed, solution pH should be measured.

(2) Compatibility problems will often arise from improper mixing procedures. Concentrated materials should never be mixed. The proper procedure involves first adding water to the tank, starting the agitation system, and then adding the various fertilizer and pesticide materials separately. Wettable powders should be added before the emulsifiable concentrates.

(3) Weather conditions are another factor which might affect incompatibility. Many combinations are perfectly safe at relatively cool temperatures, however, they become quite phytotoxic as the temperature rises. An example is the use of moderate levels of water-soluble nitrogen. These materials are relatively safe at cool temperatures, however, they become quite phytotoxic and can cause severe burn during the summer months when daytime temperatures are high.

Where can one start if you are going to be utilizing liquid fertilizer-pesticide combinations for the first time? There is no simple answer. Compatability information most likely will not be available. In addition, compatability of materials may change with time. A combination that initially seems to be compatable, may not be after allowing it to sit for several hours or days. If you are going to be using a combination of materials for the first time, you might want to try the following. First, get what information you can from pesticide labels and compatability charts. Of course, these charts will probably never include all the pesticides which you want to use in combination. Also, be careful on the use of these compatability charts that you will be utilizing the same formulation shown on the chart. Second, mix the various components in a jar at the proper concentration and observe for any settling or layering. This, of course, will provide information on the physical compatability of the materials, however, it will not tell you everything regarding chemical compatability. The ultimate test, of course, is to mix up your various combinations and actually try it on a piece of turf. This should be done in an area where you would not be concerned if phytotoxicity occurred. A few other points include: (3) keep track of the solution pH as you add the various materials, avoiding the use of materials which will drastically alter solution pH (such as lime spray solutions); (4) never mix organic fungicides with a pesticide containing xylene.

Questions often arise regarding the legality of using combinations of pesticides and fertilizers in one tank. The current thinking of the EPA is that use of a mixture is legal if (1) the pesticide label does not say it cannot be mixed with another pesticide or fertilizer and (2) you always conform to the label application rates. The EPA has recently considered labeling of mixtures, and at least, for the time being, they have decided against requiring mixture registration. However, we can all be assured that if the use of fertilizer-pesticide mixtures is abused, stricter legislation will be forthcoming.