

PROFESSIONAL TURF MEN have had many fine herbicides made available to them. These professionals have learned what potential problems to avoid and what advantages to exploit in these materials. But the search goes on for a perfect herbicide, while we fail to put together all existing information on chemicals, practices and equipment for best use of what is available. The opportunity for near perfect weed control is at hand and all but a few have failed to recognize the potential.

The perfect herbicide for turf would control all vegetation except the particular species of grass planted. The more we expect from a single chemical in the way of selectivity, the more difficult it is to visualize what it might be or how it might work. Rather than expect one chemical to do all things, it is much more realistic to use a combination of two or three compatible chemicals working together, properly applied, with the proper wetting agent where needed.

In the late 1950's, the Research & Development Department of the Green Cross Products Div. of Sherwin-Williams Company of Canada, Ltd., began attacking broadleaf weed problems, not by looking for new chemicals but rather by working with existing materials in such a way as to amplify the good features of each product and minimize any detrimental factors. To use this approach, it was necessary to understand the good and the bad of each chemical.

One, 2,4-D, was an effective herbicide, but it did not control chickweed, clover and many weed species which were resistant. The logical approach to the resistant weeds was not to discard the 2,4-D, but rather add a chemical which would control them. For example, Silvex or 2,4,5-T was added to the 2,4-D and control of chickweed and clover was obtained. This gave a product of wider spectrum of control, but occasionally some injury to sensitive grasses occurred and still some weed species were left uncontrolled.

When MCPP became available, it was evaluated for its safety to grasses and control of clovers and chickweed. This material was safe

The PERFECT BROADLEAF WEED CONTROL IS IT POSSIBLE?

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on grasses and also had no human toxicity problems. Green Cross researchers noticed that with certain combinations, unusual things were happening. When they added 1 pound of MCPP to 2 pounds of 2,4-D rather than a herbicide effect equal to 3 pounds of chemical, they were amazed to find a herbicidal effect equal to several times the amount of chemical applied. Other scientists were reporting the same "more than additive" effect. Not only was the second chemical bringing control of weeds susceptible to that chemical, but now a third group of weeds was being controlled which were resistant to both chemicals individually.

When dicamba was introduced to the turf market, it brought control of the polygonous weeds which was not possible before. Researchers found that adding BANVEL D (dicamba) to 2,4-D that again "more than additive" effects were demonstrated. The combining of dicamba and 2,4-D made it possible to reduce the dicamba dosage down from 1 pound per acre to $\frac{1}{4}$ pound or $\frac{1}{2}$ pound per acre. The "more than additive" effect was so great, a patent was issued to the manufacturer covering the mixture of 2,4-D and dicamba.

The Green Cross Products researchers went one step farther. They added dicamba to 2,4-D and MCPP. Confirming research conducted by a Canadian University showed the dramatic effect possible from this three-component mixture. The amount of chemical required to give 90% control of a number of weed species was carefully determined in field tests. The three chemicals were applied individually and then were applied as one treatment containing all three chemicals. The difference in the total amount of chemical required per acre was very great.

The word "synergism" can be applied to this type of relationship between chemicals. Synergism is a much abused word, but a dictionary of biology defines it as follows: "Synergism: Combined activity of (chemicals) . . . such that an effect is produced greater than sum of effects of each (chemical) acting

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alone." The "added effect" from these mixtures does not respond uniformly on all weed species. Some species show very little synergistic effect. Dandelion, readily controlled with 2,4-D, is in this category, where any increase in control over 2,4-D alone can be traced to the dosage of the added MCPP.

The control of broadleaved weeds is greatly expanded from the mixture of 2,4-D, MCPP and dicamba to the point where with the proper adjustment of ratio and dosage only Speedwell (*Veronica*) is still difficult to control. Because of this unexpected improvement in weed control, a U. S. patent was granted to the Green Cross Div. of Sherwin-Williams Company of Canada, Ltd.

These increased herbicidal effects do not carry over into ornamentals and grass species. The three herbicides are probably acting on three different systems within the broadleaved weeds. It is possible that one herbicide while having very little visible effect, could make a weed susceptible to a second chemical.

At the low rates used, MCPP and dicamba have no effect on the grasses and therefore do not apparently influence the effect of 2,4-D on these grass species. Field studies in all areas of the United States with the three-component mixture, conducted by Gordon Corporation of Kansas City, Kansas, who are the exclusive makers of this mixture in the United States, have clearly demonstrated that 2,4-D when used at high ratios, is injurious on Bentgrass and St. Augustine grass. The tests do show that successful weed control can be obtained without injury on these two grasses by reducing the 2,4-D component and increasing the MCPP portion of the three-way mixture.

The product, Banvel D (dicamba) has had adverse publicity regarding injury to ornamentals. It is alleged that the injury occurs when the dicamba is leached into the root zone of the ornamental plant when rain follows dicamba application to turf. While it cannot be argued that injury has not occurred, the amount of dicamba applied may well have been misrepresented. Careful field studies indicated that injury can occur when 1/2 pound per acre of dicamba is applied to the ground at the base of an ornamental and then watered in. At these rates, a few ornamental plants showed injury symptoms and recovered. However,

Table 1: Chemical treatment on pigweed.

CHEMICAL	Amount of Chemical in ounces per acre needed for 90% control of Redroot pigweed.	
	Used alone	Used in combination
2,4-D	10.2	1.37
MCPP*	30.0	0.68
DICAMBA	3.0	0.49
Total Chemical Per Acre	43.2	2.54

*d. isomer only

usage on home lawns at the 1/2 pound per acre rate of dicamba is not necessary when used in combination with 2,4-D, MCPP and dicamba, less than 1 1/2 ounces per acre of dicamba is required for excellent weed control, with complete safety.

The method of application also has a great influence on the safety and performance of a product. When a product is applied as a spray, the droplets of the spray are largely intercepted by the weed and turf foliage and very little chemical actually reaches the surface of the ground. The mechanical barrier effect of the grass thus eliminates dicamba injury from liquid sprays at these low rates.

Seven years of use in Canada and other countries and usage to date throughout the United States has not resulted in a single report of injury to ornamentals. However, the application of a "weed and feed" or granular product goes through a slightly different mechanical filtering process during application. The heavier fertilizer particles fall through the grass and come to rest on the ground. If the chemical is absorbed into these particles, it may be carried to the ground surface to be gradually released as the particle breaks down.

The Dimethylamine salt formulation commonly used to spray on fertilizer to make a dry "weed and feed" product is totally water soluble and moves freely in the soil. The acid form of dicamba, however, is much less soluble in water. It apparently becomes tied up in the soil surface and resists leaching. A dry dust concentrate of controlled particle size can be made and dry mixed with the fertilizer using the acid form of dicamba. Properly prepared, the acid formulations are equal to, or perhaps more effective, as herbicides than the Dimethylamine salt. Made in this manner, the acid herbicides are on the surface of the fertilizer in their own

particle form and not absorbed into these fertilizer particles. In this form, much of the dust adheres to the weeds as the "weed and feed" product is applied. This has a dual safening effect on the dicamba. Not only is less material reaching the ground because the acid dust is collecting on the leaves, but the dicamba acid which does reach the ground, remains on the surface.

The proper usage of mixtures can therefore result in substantial improvement in weed control using minimum amounts of chemical. Greater numbers of weed species can be controlled with increased safety to grasses and ornamentals. In the case of 2,4-D, MCPP and dicamba mixtures, there are clearly demonstrated synergistic effects which give far greater weed control than would be expected considering the spectrum of each herbicide alone. In the case of safety to grasses, it is possible to adjust the amount of each component, reducing those which are damaging to grass and increasing those which are safe. As far as ornamental injury from dicamba is concerned, there is no increased effect from the mixture since only the dicamba is root absorbed.

Also due to greatly reduced dosages the amount of dicamba applied per acre is so low that no injury can result.

Further safening effects can be obtained with "weed and feed" products by utilizing the acid formulations.

Without the benefit of synergism, the indiscriminate use of mixtures can be dangerous. If a full dosage of each ingredient is used, not only would cost be prohibitive, but an unnecessary amount of chemical would be introduced into our recreational environment.

Note:
Mixtures of 2,4-D, MCPP and dicamba under the Green Cross patent are available under the trade names of Trimec, from Gordon Corporation, Kansas City, Kansas, and turf, lawn and garden marketers.