

## **Zinc Phosphide in Subterranean Burrow Systems**

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Zinc phosphide was synthesized by Marggral in 1740 and was first used as a rodenticide by the Italians in 1911-1912. This toxicant became widely used in the United States during 1942-1943 when the availability of strychnine became uncertain due to the war.

Zinc phosphide is a gray-black powder that is practically insoluble in water. When placed in contact with the dilute acids in the stomach, phosphine (PH<sub>3</sub>) is released causing convulsions, paralysis, coma and death from asphyxia.

Zinc phosphide is poisonous to some degree to all animals and the lethal dosages are known for many species. In general, zinc phosphide is less toxic than sodium monofluoroacetate (1080) or strychnine and is better accepted than strychnine.

Zinc phosphide is known to break down rapidly when it is released into the atmosphere or converted to phosphates and zinc complexes. It has been registered only for use in sugarcane where translocation was shown not to be a problem. Much interest has been shown in recent years in registering zinc phosphide for use on rodent populations in alfalfa fields.

Many techniques have been utilized over the years to control the pocket gopher in alfalfa fields. These include exclusionary techniques, trapping, and a variety of toxic fumigants and baits. Hand baiting and trapping are feasible only where the infestation is light or confined. The major challenge in gopher control has been to find an effective technique where heavy and widely distributed infestations are present. The last major development in meeting this challenge occurred in 1958 when Walter Howard and Robert Kepner developed the mechanical bait applicator. The development of this machine was based upon the territorial behavior of the pocket gopher. An artificial burrow is constructed 10 to 12 inches below the soil surface and poison bait is metered into this burrow. When a gopher's burrow system is intersected, the new, artificial burrow is investigated and the poison bait found. This technique has proven to be an effective means of getting the gopher and bait together over a large area, and is economically feasible.

The purpose of the present study was to determine the quantity of zinc phosphide translocated into alfalfa hay when placed in subterranean burrows.

## METHODS AND MATERIALS

This project was conducted between April 15, 1982 and May 15, 1982 at the University of Arizona Yuma Valley Experiment Station at Yuma, Arizona. Plots were located in a 2-year old stand of Mesa Sirsa alfalfa hay, which was flood irrigated with Colorado River water.

Two percent zinc phosphide pellets manufactured by Bell Laboratories, Inc. were the source of zinc phosphide used in this test. These pellets were applied with the Elston Mechanical Bait Applicator into artificial burrows constructed at 8 inches below the silty clay loam soil.

Three rates of zinc phosphide bait pellets were applied in 50x50 foot plots placed in a randomized block design with three replications. The 1x rate was 3 lbs. per acre as recommended by Bell Laboratories, Inc. Three other treatments consisted of zinc phosphide applied at the rates of 6 and 9 lbs. per acre and an untreated check. Burrow spacing was 10 ft.

Five pound alfalfa samples consisting of the above ground portion of the plant were randomly collected from each plot after 24 hours, 48 hours, 7 days and 30 days. The samples were frozen and stored with dry ice upon collection in the field.

The alfalfa samples were shipped to the Soils, Water & Plant Testing Laboratory, University of Arizona, Tucson, frozen under dry ice in a special laboratory supplied freezer chest.

Frozen samples were run through a "Cuisinart" Food Processor just prior to analysis. A subsample was taken for moisture content and two or three subsamples taken for analysis.

The samples were taken from the freezer in a random manner, and processed and analyzed in that order. Six to ten grams of wet weight tissue were taken for dry weight determinations and ten to fifteen grams were taken for zinc phosphide analysis. The first 15 samples were analyzed in triplicate and the remainder were analyzed in duplicate. Duplicate reagent blanks were run with each set of samples.

All samples were analyzed by the procedure L-20 (10-9-1981) developed by Motomco Ltd.. This is a proprietary method that is available upon request from Bell Laboratories, Inc., 3699 Kinsman Road, Madison, Wisconsin, 53704. This procedure utilizes the quantitative acid conversion of a phosphide to phosphine gas in an inert atmosphere. The phosphine is quantitatively adsorbed by mercuric chloride and converted to mercuric phosphochloride which is then

quantitatively oxidized by standardized iodine. The excess iodine is back-titrated with standard sodium thiosulfate. Tests on the purified zinc phosphide (labeled 96%) showed only a purity of 85.9%.

Prior to starting the tissue analysis, pure (85.9%) zinc phosphide samples were run to determine the lower limits of the procedure. The limit for quantification was 1.0 mg, and 0.5 mg was the detection limit.

For these tests, a total of 48 samples were analyzed. No zinc phosphide was found within the detectable limits in any of the alfalfa tissues analyzed.

#### REFERENCES

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