1976

EFFECTS OF PREPLANT INCORPORATED HERBICIDE-INSECTICIDE COMBINATIONS ON SOYBEAN (GLYCINE MAX (L.) MERRILL) GROWTH AND DEVELOPMENT

by

STEPHEN MALCOLM IRONS

B.S., Kansas State University, 1976

A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Agronomy

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1978

Approved by:

Oliver E. Russ

Major Professor

TABLE OF CONTENTS

INTRODUCTION

Todays agriculture demands the use of a number of pesticides to control weeds, insects, and diseases. Using two or more pesticides to control a number of pests is becoming a common practice on agronomic crops, horticultural crops, lawns, and ornamentals. Insecticide-fungicide combinations are used on many vegetable, fruit, and ornamental crops. Both herbicides and fungicides are being used on cotton, peanuts, vegetables, and other crops. Herbicide-insecticide combinations are used on lawns, and some agronomic and horticultural crops. It is not uncommon for all three of these pesticides to be used in one field.

Problems have been encountered with herbicide and insecticide mixtures used to control weeds and insects. In some cases, formulation has made the combining of herbicides and insecticides impossible. Also synergistic interactions have been reported on sorghum (Sorghum bicolor (1.) Moench) and cotton (Gossypium hirsutum L.), causing many growers to refrain from using combinations on these crops.

Herbicide-insecticide combinations on soybeans in the Midwest are rare, mainly because insect populations seldom reach economic threshold levels and insecticide applications are not necessary. If insecticides are used on soybeans they are usually applied alone during the growing season. An example is the use of carbaryl to control bean leaf beetles which feed on the foliage.

The purpose of this research is to investigate the effects of certain herbicide-insecticide combinations on soybeans (Glycine max (L.) Merrill).

REVIEW OF LITERATURE

Johnson (22, 23) reported that some pesticide combinations affected soybean growth. Some herbicide-insecticide combinations reduced plant stand and plant vigor, but did not affect plant height. A few herbicides reduced plant height. Herbicide-insecticide combinations did not affect date of maturity, lodging, seed yield, or quality of the soybeans. Also none of the herbicide-fungicide combinations affected soybean growth.

Mobil Chemical Company (31) released a report indicating that injury symptoms were noted at high rates of ethoprop plus alachlor on corn (Zea mays L.), and ethoporp plus metribuzin on soybeans. Greater injury occurred when overhead watering was increased from ¼ inch to ½ inch.

Soybeans escaped injury from metribuzin when trifluralin was used in combination with metribuzin. Ladlie, Meggitt, and Penner (28) noted that soybean injury at high soil pH values was reduced by applying metribuzin in combination with trifluralin. Trifluralin also protected soybeans from injury caused by low rates of atrazine. Trifluralin reduced root development and greatly reduced atrazine and metribuzin uptake and content within the soybean plant. Reduced root growth was probably the reason for the lower absorption of metribuzin and atrazine.

Arle (1) attributed the reduced injury from diuron on cotton to the retardation of branch root development by trifluralin, thus resulting in decreased diuron uptake.

Sun and Adams (38) observed that a nutrient-herbicide interaction can take place in soybeans. Inhibition of photosynthesis resulted from a phosphorus-manganese-atrazine interaction. Atrazine exerts its herbicidal action by making manganese unavailable for photosynthesis. Excess phosphorus further enchances the effect of atrazine by precipitating manganese in the tissue.

Soybean tolerance to metribuzin is greatly influenced by herbicide rate, soil organic matter, and rainfall after treatment. Coble and Schrader (10) observed that soybean tolerance increased with increasing soil organic matter to the point where no injury occurred. Under low soil organic matter content, injury to soybeans from metribuzin is likely to occur if there is rain within ten days after treatment. Injury to soybeans is likely to occur when metribuzin is applied at higher rates.

Differences in absorption, translocation, and metabolism of metribuzin contribute to differential susceptibility of soybean plants and weed species. Hargroder and Rogers (18) found that hemp sesbania (Sesbania exaltata) absorbed appreciably more herbicide than did soybean plants. In hemp sesbania metribuzin was rapidly translocated and accumulated in all parts of the plant. Only in the roots and lower leaves of soybean did metribuzin accumulate to any extent. A higher rate of metribuzin degradation occurred in soybeans than in hemp sesbania.

Chemagro (9) places certain restrictions and precautions on the use of metribuzin.

1. Soybean injury may occur if metribuzin is used on calcareous soils or a soil with a pH of 7.5 or higher.
2. Do not apply to light soils (sandy loam or loamy sand) containing