Treating Irrigated Grain Sorghums With Pre-Emergence Herbicides

A. F. Wiese and H. E. Rea

During the last 4 or 5 years hybrid grain sorghum has become nationally important. During 1959, it was grown on over 13 million acres, being surpassed in acreage only by corn, wheat, and oats. In the past, sorghum has been a dryland crop in the drier parts of the Great Plains, and, as a result, annual weed control was not a serious problem. Weed control problems have intensified as sorghum production has moved into irrigated and more humid areas. However, adequate chemical weed control methods for this crop have not been developed and the only herbicide treatment generally recommended is 2,4-D application for broadleaf weed control. Even though pre-emergence herbicides for weed control in sorghum have been studied since 1951, this practice is not presently recommended in many areas of the country. Early work with pre-emergence herbicides was not successful since herbicides that killed weeds also killed sorghum (1, 4, 5, 8). During 1958 and 1959 several herbicides were tested which gave good weed control and did not injure sorghum. The most promising materials appeared to be 1-n-butyl-3-(3,4-dichlorophenyl)-1-methylethylene (neburon), 2-chloro-4-dimethylamino-6-isopropylamino-s-triazine (ipazine), 2-chloro-4,6-bis(isopropylamino)-s-triazine (propazine), and 2-chloro-4,6-bis(ethylamino)-s-triazine (simazine) (2, 3, 6, 7).

The purpose of this paper is to summarize results from studies conducted to determine the feasibility of pre-emergence weed control in sorghum under irrigated conditions. Studies were also conducted to determine if sorghum had physiological tolerance to any herbicides.

METHODS

Field Studies

Studies were conducted in 1957, 1958, 1959, and 1960 at the Southwestern Great Plains Field Station near Amarillo, Texas, in which various rates of propazine, ipazine, simazine, 2-chloro-4-methylamino-6-isopropylamino-s-triazine (G30026), 4-(MCPB), 2,4-DEP, fenac, monuron, diuron, and neburon, 5-(3,4-dichlorophenyl)-1,1-dimethylethylene (nonuron), neburon, 5-(3,4-dichlorophenyl)-1,1-dimethylethylene (diuron), 2-chloro-N,N-diisopropylacetamide (CDAA), CDAA plus trichlorobenzylcylohexide (CDAA-T), tris (2,4-dichlorophenoxyethyl) phosphate (2,4-DEP), sodium salt of 2,3,6-trichlorophenolacetic acid (fenac), sodium salt of 4-(2-methyl-4-chlorophenoxy) butyric acid (4-MCPB), dimethylamine salt of trichlorobenzoxic acid (TBA), and 3-amino-2,5-dichlorobenzoic acid (amben) were compared for cultivation to control of annual weeds in irrigated RS 610 sorghum. Herbicides were applied 1 day after planting. Grain yield was determined by harvesting a representative area from each plot. A weed control estimate on crab grass (Digitaria ischaemum), the predominant weed, and redroot pigweed (Amaranthus retroflexus) was visually made at harvest time and crop maturity was evaluated by determining the number of days from planting to flower initiation.

The experimental designs were randomized blocks with 3 replications and the plot size was 4 rows, 27 or 30 inches apart and 30 feet long. The plots were located on leveled borders of Pullman silty clay loam, a reddish chestnut soil with a slow intake rate. The surface soil contains about 1.5% organic matter and approximately 45% clay, 50% silt, and 5% sand. Each year about 25 inches of rainfall or irrigation and 120 pounds of nitrogen fertilizer were required to produce the crop. In order to create conditions which would leach herbicides near germinating sorghum seeds, some of the treatments in 1957 and 1960 were flood irrigated before the crop emerged.

In 1960, a 10-acre area of RS 610 sorghum planted in a conservation bench (9) was treated "pre-emergence" with propazine. The sorghum was planted in 40-inch rows and a 10-inch band was treated with 2 pounds per acre over each row making a total application of 0.5 pound per acre.

During 1960, three trials were conducted in fields near Dawn, Hereford and Plainview, Texas. At all locations various rates of propazine and CDAA-T were applied broadcast to plots 33 by 33 feet. In addition, at Plainview 18-inch band treatments were applied to 100 feet of 40-inch rows. The broadcast treatments at Dawn and Hereford and the band treatments at Plainview were replicated twice. At Dawn, RS 620; Hereford, DeKalb 62A and at Plainview, DeKalb 56A sorghum was planted. The predominant weed at Hereford was barnyard grass (Echinochloa crusgalli) and at Dawn and Plainview it was pigweed. Rainfall shortly after planting was unusually heavy at the off-station test locations.

Greenhouse Studies

These studies were conducted to determine if sorghum, corn or wheat had different physiological tolerances to an ethanol and isopropyl series amine of 2,4-dichlorophenoxyacetic acid (2,4-D), propazine, simazine, CDAA, and G 30026. Three hundred and fifty grams of air dry Pullman silty clay loam soil were placed in a pint paper cup and 20 seeds of one of the crops were placed on the soil. The seed were covered with \( \frac{1}{4} \) inch of peat moss to retard evaporation. The herbicides were then applied at the rates of 0, 4, 8, 16, 32 and 64 ppmw of the dry soil in enough water to bring the soil to field capacity. During the study, the cups were watered as needed to keep plants alive. Germination was determined as soon as possible and about 1 month after emergence the plants were scored from 0 (no injury) to 10 (plants all dead or no emergence).

RESULTS

Field Studies

Studies at the Experiment Station from 1957 through 1960 indicate that simazine, ipazine, atrazine, CDAA, 4-(MCPB), 2,4-DEP, fenac, monuron, diuron, and neburon were not suitable pre-emergence herbicides in sorghum because of poor weed control or sorghum injury. Sorghum injury was most pronounced when heavy rains or flood irrigation occurred before sorghum emergence. Yields and weed control obtained with treatments of propazine, CDAA-T, G30026, and amiben, the more satisfactory herbicides, are shown in Table 1. Treatment with propazine and CDAA-T, each at 2 pounds per acre, and amiben at 4 pounds per acre resulted in yields equivalent to the cultivated check even though weed control was not as good. On uncultivated check areas where crab grass was allowed to grow in competition with sorghum, yields were reduced about 500 pounds per acre. This weed probably did not cause more serious yield reduction because the sorghum started faster and shaded the weed. Water and fertilizer were maintained at high levels.

On the 10-acre conservation bench, complete control of pigweed was obtained in the 10-inch band treated with 2