28. Weed Control by Crop Kinds: Corn and Soybeans

CORN

Proper rotation, good seed bed preparation, fertilization, and cultivation until "lay-by" are basic in reducing weed populations. If properly carried out, they will, in most instances, keep weed infestations at moderate levels. Plowing should be followed by two or more diskings or harrowings, planting immediately following the last harrowing. Early post-planting cultivations are carried out with the spike-tooth harrow, weeder, or rotary hoe. These are effective only against small weeds; the harrow can be used until the corn is about 2 inches high, the weeder and hoe until it is 4 to 6 inches. Shovel cultivation should follow; maximum effectiveness ensues if the weeds between the rows are destroyed and those in the rows covered. Ordinarily no more than three cultivations are necessary; under favorable circumstances it may be possible to reduce the number to two.

Successful early cultivation will usually allow a field to go into "lay-by" in relatively clean condition. On the other hand, if necessary cultivations are skipped or carelessly conducted, serious weed problems may later ensue.

Chemical Control

The following discussion relates to the control of annual weeds, the usual kinds infesting corn in abundance. Perennial weeds, if present, may be stunted or injured by herbicidal treatments employed, but will not be killed. Special problems relating to infestations of major perennial weeds are discussed separately in a following chapter.

Generalized recommendations are not possible. Success with various herbicides and methods of procedure varies from region to region and within a specific state or farming region. The usefulness of a given treatment will depend upon the nature of the weed problem, the success of cultural control, and the weather. The employment of herbicides in corn has greatly increased the last five years because they have been progressively improved and are becoming cheaper.

Pre-emergence Treatment

There are several materials to choose from: 2,4-D, CDAA, simazin, Atrazine, and the dinitros. Application is usually made by spraying, but granular formulations are now available. Over-all coverage or band treatment may be made.

2,4-D, ester form, 1 to 2 pounds per acre in approximately 15 gallons of water is frequently employed. Seedlings of certain species of both grasses and broad-leaved weeds in the upper soil layers will be killed. Corn is ordinarily planted at a depth slightly below the affected portion of the soil. Thus it is possible to get the crop off to a weed-free start, eliminating the need for initial cultivations. In some cases, fields may be essentially weed-free for as much as four weeks.

The possibility of heavy rain immediately following pre-emergence treatment with 2,4-D constitutes a hazard in its use. Water may leach out part of the chemical and reduce effectiveness of treatment or, more important, wash it down to the corn seeds, resulting in stand reduction. 2,4-D moves more easily in light than in heavy soils; dosage is usually reduced in the former, and treatment is not advisable on sandy soils. On the other hand, if the soil is very dry and there is no rain at all, effect on the weeds may be negligible. The esters are fixed by the soils to a greater extent than amines, making them safer to use, and are, therefore, recommended.

Suggested dosages for CDAA are for complete coverage 4 quarts in 20 or more gallons of water; for band treatment 1-1/2 quarts in 6 gallons of water. Excellent control of grass seedlings is usually achieved. CDAA is most effective on heavier soils. The newer Randox-T is toxic to broad-leaved as well as grassy seedlings.

Simazin: 3 pounds per acre in 30 or more gallons of water, or in bands, 1 pound in 10 to 15 gallons of water, perhaps less in light soils, higher rates in high organic content soils. Simazin is effective against most annual weeds and tends to be more persistent in the soil than the above herbicides; hence may maintain weed free conditions for a longer period. It seems to be non-injurious to corn, but it is probably best not to follow with a legume the next year. Small-seeded legumes are sensitive to simazin and the possible consequences of soil carry-over are not yet completely known.

Atrazine is similar to simazin. As well as having pre-emergence utility, it may be employed early post-emergence. Atrazine is slightly more soluble than simazin and less persistent in the soil. It has been tailored for drier soils where low rainfall subsequent to planting may be expected, whereas simazin is best in higher moisture areas.

Post-emergence Treatment

Early season post-emergence application may be carried out when corn is 6 to 12 inches tall. If more than 12 inches high, drop extensions

should be used to reduce amount of spray hitting the corn. 2,4-D is used almost exclusively, 1/4 pound ester or 1/2 pound amine per acre. Spraying is feasible also at or after "lay-by" (drop extensions; high clearance equipment), and may be recommended if late-season broad-leaved weeds become a serious problem after cessation of cultivation. Somewhat heavier dosages are usually employed than for earlier applications. Some workers have suggested a double dosage procedure, 2,4-D amine as a directed spray from drop extensions: 1/2 pound on weeds in the rows and 1 1/2 pounds per acre between rows; nozzles may be arranged so that both dosages can be applied simultaneously. The idea is to get the broad-leaved weeds in the row and to achieve pre-emergence control of both grassy and broad-leaved kinds between rows.

2,4-D is capable of injuring the corn. It will cause brittleness which can result in lodging and breakage if the field is exposed to strong wind. Corn is most likely to be injured by herbicidal treatment during hot weather when it is growing rapidly. Various hybrids differ in degree of susceptibility. Spraying should be completely avoided any time from tasseling until the silks are brown.

Pre-emergence or Post-emergence

In comparing the above-discussed methods, it may be noted that pre-emergence application serves as insurance against later weed infestations (particularly if rain interferes with subsequent cultivations), may be effective against both grasses and broad-leaved weeds, and will not cause brittleness or reduce seed set. In event of rain immediately following treatment, stand reductions may ensue with some herbicides. On the other hand, post-emergence treatment is often employed when weeds have gotten out of hand and is primarily effective against dicotyledonous kinds.

Some Economics

The above has considered herbicidal treatment of corn with respect to methods and effectiveness of treatment. Obviously the cost of treatment as compared to benefits derived must be given due cognizance if a method is to be recommended.

The principal weeds causing yield reductions in corn are annuals, both grasses and dicotyledonous kinds. Conventional cultivation methods and good fertilization are capable of reducing weeds to moderate levels which, research indicates, reduce yields 6 to 8 bushels per acre as compared to weed-free conditions. Such losses may be as high as 20 to 30 bushels under low fertility conditions. On the other hand, at least half of the time, weather conditions will be suitably favorable for timing of cultivations so that losses will be appreciably less than 8 bushels.

Figuring 8 bushels as roughly equivalent to $10.00, the cost of post-emergence spraying must be weighed against the possible yield benefits; the possibility of wind damage as a result of lodging must also be considered.

Considering pre-emergence treatment with 2,4-D, the cost is approximately $1.20 per acre if one cultivation is saved (and subtracting its cost). If more than one cultivation can be eliminated, the expense will be further reduced. Yield benefits may range from meager levels to perhaps 8 bushels per acre. Other herbicides are considerably more expensive than 2,4-D (Randox $10 per acre blanket, $3 band; simazin $15 blanket, $5 band). Herein, economics will usually dictate band application and subsequent cultivation of weedy middles. Even so, successful elimination of in-row weeds, inaccessible to ordinary cultivation, and the reduction of corn root injury by close-to-the-row cultivation constitutes no small assist to the vigor of the crop plants.

The good farmer may be the one who is most apt to be interested in the use of herbicides in corn, but he is often the one who stands to gain least. Extensive weed infestations, against which application of herbicides is clearly profitable, are usually the results of poor cultivation and low nitrogen. Herbicides will improve yield but so will fertilization and cultivation.

The value of "after lay-by" spraying perhaps deserves separate consideration. It is sometimes stated that the weeds have already done their damage, or that the corn is way above them so why worry. To some extent this is true, but competition for water and mineral nutrients during the critical seed-ripening period can certainly not improve total yield. There is also the consideration of re-infestation. If numerous late season annuals are allowed to go to seed, a ready-made weed problem will be awaiting the next season. From this standpoint, if a significant number of weeds (e.g. more than one per 3 feet of row) such as cocklebur or butterprint have escaped cultivation, late season spraying with 2,4-D may be worth the trouble. This, of course, is not true if most of the weeds are grasses; it is too late to do anything about them.

SOYBEANS

Weeds are a major factor limiting efficient soybean production. This is the viewpoint expressed by Iowa farmers in a survey of grower's opinions. Weeds received first vote among major production problems. They were designated nearly four times as frequently as either soil fertility or weather conditions.

The principal weeds in soybeans are annuals. Grasses, smartweeds *(Polygonum)*, butterprint *(Abutilon)*, and pigweeds *(Amaranthus)* are common types. It is not possible to use a post-emergence herbicide to control annual weeds as in corn.

Rotation, good seed bed preparation, not planting too early (when

the soil is cold and beans emerge slowly), the choice of a variety adapted to the region and soil type, the employment of vigorous seed to give a full stand, and early season cultivation constitute basic tools for weed control in soybeans. In corn, high soil fertility reduces the weed problem; but, in soybeans recent Iowa work has demonstrated greater losses due to weeds under high nitrogen conditions than the contrary.

Timely rotary hoeing is perhaps to be emphasized as the single most important contribution to effective weed control in soybeans. This operation should be repeated 1 to 3 times as the weed seedlings emerge. If the beans are not solid-planted, 1 to 2 subsequent shovel cultivations will also be desirable.

With specific reference to the above observations, investigations in Iowa and Missouri have demonstrated yield increases of 4 to 10 bushels an acre when beans were rotary hoed. Timely versus untimely hoeing gave advantages up to 5 bushels in favor of the former. These data suggest, it is true, the desirability of catching the weeds at the right stage, but also that even inefficient use of the rotary hoe may be considerably better than none at all. Calculating beans at $2.00 a bushel, and the hoeing operations at $0.80 each ($2.40 per acre), this procedure would seem to be thoroughly worth-while.

Soybeans are good competitors once well established. If reasonable success is obtained in early season cultivation, the beans can usually proceed to maturity without a serious late season weed problem developing.

Why then are weeds to be considered a major problem in soybeans? There are probably several reasons. Not all growers employ the rotary hoe. Many may not use it to maximum efficiency either as to timing or speed of operation, and do not repeat the operation as necessary. Early planting, weather and soil conditions may grossly interfere with both bean stand establishment and hoeing. There are times of the year when a farmer may be too busy to get everything done at exactly the right time. And lastly, 2,4-D is not available as a post-emergence herbicide to rescue a weed infested field.

Pre-emergence chemical treatments frequently have application in solving some of these problems. Several herbicides are available, e.g. CDAA, DNBP, and Alanap. Alanap and CDAA are most frequently recommended in the North Central states. Alanap affects both grasses and most common broad-leaved weeds (not smartweeds, *Polygonum*). It is applied at the rate of 4 pounds per acre; this is about 3 quarts commercial preparation in band application. Dosages should be lower in sandy soils, possibly slightly higher in heavy mucks. Bean injury is a hazard. Randox is most valuable in areas with heavy annual grass infestations. The usual application rate is 4 pounds per acre, about 1-1/4 quarts of the formulated liquid for 14 inch bands. Soybean injury reports are minimal. Both of the above chemicals are likewise available in granular form.

What does pre-emergence treatment cost in terms of increased yields? Most published data (1957-1958 growing seasons) demonstrate

yield increases sufficient to justify the chemical treatments. But proportionately greater benefits, in terms of operational expenses, were derived through timely use of the rotary hoe. However, in the meantime, the price of applicable herbicides has dropped. For example, figures obtained from certain Iowa experiments carried out in 1957 were based on CDAA, 14 inch bands at $4.75 an acre. As of the present time, the cost of this chemical is nearer $3.00. The expense margin in favor of the mechanical procedure (hoeing) has been considerably narrowed. Considering the tempo and direction of present developments, it is possible, in a few years, that herbicidal treatment will constitute an integral and essential phase of profitable soybean production.