30. Control of Specific Weeds

Control methods for several of the more notorious perennial weeds have been intensively studied and deserve due consideration. Not infrequently, however, complete adherence to procedures for most quickly repressing a given weed is impractical. Weed control is ordinarily geared to cropping methods, and modes of action should be prognosticated upon a total weed situation rather than a single kind. However, infestations of perennial noxious weeds sometimes become so critical that it is desirable to take specific measures against the species concerned.

The following treats some of these weeds, as well as considering a few of the better known annual kinds. However, primary consideration of annual weed problems has previously been taken up on a crop basis.

There is one aspect in which economic considerations relating to annual weed control to some extent differ from those pertaining to major perennial weeds. We have thought of annual weeds primarily on a year-unit basis, and have asked the question, particularly with respect to herbicides: will increased yield benefits (this year) justify the cost of treatment? With persistent perennials it is well to view the problem from a longer range viewpoint. An established stand of a noxious weed may materially reduce soil productivity, and likewise the actual cash value of farm land. Therefore, weed control may sometimes be given first priority, crop yield receiving secondary consideration. Likewise, the use of expensive treatments, not economically sensible on a one-year basis, may be justified if accruing benefits of several years are considered.

CANADIAN THISTLE *(Cirsium arvense)*

The root reserves fluctuate, generally following a downward trend, until bud stage, usually in June. Subsequent to flowering there is a very rapid rise. Destruction of the tops then can be delayed until flower bud formation; initial control action should be followed by subsequent cultivations or mowings at monthly intervals.

Canadian thistle is one of the few weeds which can survive an ordinary oats-legume-corn rotation moderately well — a reason it is one of

the most feared weeds in the North Central states. Nevertheless, it is quite possible to prevent the weed from seriously interfering with crop production through consistent cultivation, herbicidal procedures, and the wise choice of smother crops.

Smother Crops and Cultivation

The usual smother crops are often recommended, i.e. solid planted soybeans, alfalfa, or if land is subject to erosion, sudan or forage sorghum. Alfalfa seems especially effective, particularly if thistles have already been somewhat weakened. This is perhaps because the legume recovers from cutting more quickly than the thistle. If a vigorous stand of alfalfa is secured and maintained for 2 or 3 years, a very satisfactory degree of control, if not eradication, will usually be obtained. Reasonably satisfactory results have likewise been obtained with brome as a perennial smother crop, subject areas being treated twice a year with 3/4 pound per acre 2,4-D.

Various cultivation-smother crop combinations can facilitate progress of a control sequence. For example, a Canadian thistle infestation can be fall plowed, reworked in the spring and planted to one of the annual smother crops. After harvest, fall cultivation until frost should ensue. This treatment should be followed by a perennial smother crop, alfalfa, as above discussed. Alternatively, it is possible to seed oats with no legume under-seeding and spray with 2,4-D or MCP, 1/2 pound per acre as near the bud stage of the thistle as possible, and again after harvest, 1 pound per acre.

Permanent Pastures

The thistles may be mowed at bud stage and at subsequent monthly intervals, or, initial mowing may be followed by applications of 2,4-D, 1 pound per acre. It will probably be necessary to continue this procedure for at least two seasons.

Herbicides

2,4-D is the most useful chemical. As above noted, it can be employed in pastures, and finds similar usefulness in nonagricultural areas, fence rows, along roadsides, etc. The thistles may likewise be sprayed in small grains or corn, but lighter dosages, as discussed under those crops, must be employed. Ordinarily the ester forms have been recommended; however, it has recently been suggested that 2,4-D amine or MCP may give better control as the ester kills the tops too quickly.

For small patches, a variety of soil-sterilizing chemicals, applied

dry or as a spray, will eradicate Canadian thistle. Chlorates have been so employed for at least 30 years. Soil sterilants are too expensive for application in extensive stands and will temporarily take land out of production.

Among the newer herbicides, amino triazole has merits for reducing stands of Canadian thistle. It can be applied 4 pounds per acre (8 pounds commercial preparation) to young plants. After a couple of weeks the land should be plowed and planted, preferably with a late-seeded smother crop. Corn may be grown. Treatment can be accomplished sufficiently early in the spring. This procedure may be necessary a second year, or spot application may be able to essentially finish the job. The price and appropriate dosage of the amino triazole do not rule out the possibility, if conditions demand it, of using the chemical over considerable acreage. Further, it is not necessary to take the land out of production.

Effectiveness of Methods

There is much variation in experience and opinion as to success in controlling Canadian thistles with 2,4-D. There may be several reasons for this. Some farmers report considerable or complete kill after 1 or 2 applications of the chemical; others indicate the weed thrives on herbicidal treatment. First of all, there is evidence that various strains or varieties of Canadian thistle differ in their susceptibility to 2,4-D; i.e., some are easier to kill than others. Also temperature and other conditions of spray application, and the degree of vigor of the stand may affect results. There is certainly much difference between farmers as to adequacy of treatment, the degree to which directions are followed, etc. Such differences are sure to affect the successfulness of the operations on hard-to-kill weeds. Emphatically, one treatment will not eradicate most stands of Canadian thistle. The majority of "no confidence" reports seem to come from people who expected immediate success or who were casual in follow-up applications.

Controlling weeds is one thing; eradicating is another. Perhaps, in many circumstances, reasonable control is as much as is practical. Frequently, complete eradication requires hand destruction of scattered plants; seedling emergence (if both sexes of plants were originally in the field) may continue for several years more. If thistles are reduced and proper rotation and cultivation methods subsequently employed, it is usually possible to proceed without significant yield losses.

PERENNIAL SOWTHISTLE *(Sonchus arvensis)*

Control procedures applicable to perennial sowthistle are essentially the same as those for Canadian thistle, discussed above.

Food reserves are lowest in late June or early July. This, then

seems the most propitious time for cultivation, mowing, or chemical treatment. One to two years of pastured grassland is effective in weakening heavy infestations. Alfalfa is an excellent smother crop for this weed, as it is for Canadian thistle, and two to three years of alfalfa will result in virtual elimination of scattered stands. Vigorous or dense infestations can be pretreated with a season of pasturing.

Chemical recommendations are essentially similar to those for Canadian thistle. 2,4-D is moderately effective, but repeated applications are usually needed.

HORSENETTLE *(Solanum carolinense)*

Methods discussed for the above two weeds are in general applicable to horsenettle.

This weed is of major importance in the southern portion of the North Central states region and south, areas in which winter cereals can be grown. The planting of these crops (wheat, barley, or oats) one or two seasons in sequence is often a practical method of reducing horsenettle infestations. After removal of the crop, the area should be plowed and worked until the next crop is put in or until frost. Since horsenettle is very late in emerging in the spring, it is then essentially treated to a fallow throughout most of its effective growing season. A follow-up with alfalfa should allow further weakening or elimination of the stand.

Soil sterilants and ammates will kill small infestations of horsenettle. 2,4-D is not very satisfactory. Some workers have felt that better success is obtained with brush killer (mixture of 2,4-D and 2,4,5-T).

LEAFY SPURGE *(Euphorbia esula)*

Leafy spurge is an early-emerging plant; food reserves are usually at a low ebb in early to middle May. The plant is notoriously difficult to kill either through cultivation or by herbicidal means.

Most successful control of heavy stands is achieved through combinations of pasturing, cultivation, and smother crops. A considerable variety of sequences of these operations have been recommended from time to time. For example, Minnesota has recently suggested (1) initial tillage followed by winter grain and cultivation alternations for several seasons, or (2) cultivation to smother crop (sudan grass) to cultivation, or (3) sheep-pastured winter grain to tillage to pastured sudan grass.

In permanent pastures, heavy grazing by sheep is consistently recommended.

As to chemical control, soil sterilants can be employed in small areas. For more extensive stands, either ammate or 2,4-D may be

used with certain merits. Ammate is the more effective but its usefulness is limited by cost.

Reports concerning the efficacy of 2,4-D are somewhat conflicting. Strong dosages are necessary (1 pound per acre) to kill the aboveground parts, the immediate effect of lighter treatments being primarily restricted to inhibition of seed production. However, a succession of lighter dosage applications (1/3-1/4 pound per acre, 1 to 2 times a year), possesses a cumulative effect in reducing leafy spurge. The esters, are superior to the amines.

Assuming a reasonable degree of effectiveness of 2,4-D on leafy spurge (this is no doubt subject to geographic and genetic variation), the use of this herbicide could easily be worked into several of the above enumerated cropping-cultivation sequences. A combination method which has met with some degree of success involves cultivation followed by fall seeding of bromegrass, the stand to be maintained two years, treated May and September with 1 pound per acre 2,4-D. If 2,4-D is employed in uncultivated pastures, dosages in the neighborhood of 2 pounds per acre at bud stage and as regrowth of the weed establishes itself are probably necessary for maximum effectiveness. Such treatment should be continued two years.

FIELD BINDWEED *(Convolvulus arvensis)*

Field bindweed is an extremely deep-rooted perennial which, if well established, possesses sufficient food reserves to withstand extensive periods of cultivation. It is a major weed primarily in the more arid portions of the country, especially the western Great Plains.

Cultivation and Fallowing

Cultivation should begin no later than bud stage. After cutting, the "pull" on the root system continues at least two weeks before the new leaves are big enough to begin to send food back to the roots. Subsequent cultivations should, therefore, be at approximately 14 to 18 day intervals.

Fallowing is employed as a means of reducing bindweed in the western plains states. Sometimes it is interpolated with fall-planted grain as described below. Fallowing is less frequently utilized in the corn belt and is not recommended on land subject to erosion.

Smother Crops and Pasturing

A number of crops are capable of some smothering action on field bindweed. Annual kinds like sorghum, sudan, or soybeans can be employed. They may be followed by a perennial, e.g. alfalfa. In some

areas, a spring and fall grain combination has been recommended. The spring crop should be removed as soon as practical and the ground worked several times before replanting. Any of the cereals can be employed for the fall crop, but rye, being less susceptible to winter killing, can be used farther north. The fall planting can be allowed to mature and can be harvested or, perhaps better from the standpoint of weed control, pastured. Following removal, the area should be fallowed and subsequently reseeded to winter rye or wheat. Alternatively, sudan can be employed as a summer forage. Pasturing sheep in these crops is said to be particularly effective in weakening bindweed. In subsequent seasons, the land should be planted with alfalfa or perennial grass.

Chemicals

Soil sterilants (sodium chlorate, monuron, borax, TBA) can be used for small areas. TBA, a relatively new herbicide, is said to have a considerably shorter effect on the soil than other sterilants.

Diverse results have been reported from the use of 2,4-D. Its employment appears to have been more successful in the humid portions of the North Central states than in the drier areas. In general, 1/2 to 1 pound per acre acid equivalent of this chemical, first applied at bloom stage and repeated several times, will hasten elimination of the bindweed. The 2,4-D can be employed in conjunction with the smother crop and pasturing sequences discussed above. In the corn-belt area it is possible to spray twice in oats (without legumes) and corn. If an oats to corn to soybeans sequence is employed, the land should be worked following combining or cutting of the small grain.

Seedlings

Even though a perennial infestation has been eradicated, the soil may contain numerous long-lived seeds which will continue to emerge in subsequent years. Up to approximately the 5-leaf stage, these seedlings behave like annuals. About this time the roots become capable of sending up more sprouts. Such seedlings can no longer be destroyed by merely cutting off the tops.

QUACKGRASS *(Agropyron repens)*

Quackgrass spreads from shallow, creeping rhizomes which grow close enough to the surface to be accessible to destruction. It is a cool season crop, succeeding best in moist soils. Aggressive growth takes place primarily in the spring and fall.

New infestations may arise from pieces of the rhizomes if these

are inadvertently spread by farm implements. Recent work has indicated that the rhizomes have an inhibiting effect on surrounding vegetation independent of ordinary competition.

Quackgrass also produces abundant seed and is frequently spread, not only in crop seed, but in straw for mulching, in feeds, and manure.

Cultivation and Smother Crops

Cultivation procedures will ordinarily maintain quackgrass within moderate limits. Stands may be weakened both as a consequence of reducing root reserves and the drying out of rhizomes brought to the surface. Infested soil should be worked repeatedly until the crop is planted. Two week intervals, or waiting until regrowth is 2 to 3 inches high is suggested. Useful tools: disk or spiketooth harrow. Maximum cultivation should subsequently be maintained as long as possible in row-planted crops. As soon as possible after harvest, tillage should be resumed and continued till freeze up. This procedure, putting greatest emphasis on spring and fall operations is perhaps most logical in the higher moisture corn belt portion of the North Central states. On the other hand, further west, greater emphasis should be given to mid-summer tillage procedures which bring rhizome fragments to the surface of the soil.

Efficient cultivation will usually prevent quackgrass from interfering with reasonably successful crop production. It probably will not eliminate the weed. The efficacy of cultivation is greatest in lighter soils, and under moderate rainfall. It may not be entirely successful in low heavy soils.

Smother cropping plus cultivation may be helpful. Quackgrass is not as easily smothered as some perennial weeds but solid-planted soybeans, forage sorghum, or sudan will weaken stands. Cultivation plus smother cropping two years in succession should result in a high degree of control.

In Grassland

Quackgrass may become progressively worse if an area is maintained in pasture or hay. If possible, the land should be thrown back into rotation. Heavy infestations of the weed may be weakened by intensive pasturing so that the sod can more easily be broken up and rendered susceptible to further treatment.

The above may not be possible in certain permanent forage areas. Perhaps disking, fertilization, and reseeding may be desirable as a means of pasture improvement. Or such a program could be initiated by prior treatment of the subject area with amino triazole (see below). Alternatively, cattle like quackgrass and it is reasonably good forage.

Chemicals

A number of chemical treatments are available for quackgrass. In many instances, particularly in extensive infestations, first consideration should be given to other methods (cultivation, pasturing, smother crops) as the use of herbicides may be an expensive alternative.

In small areas or in nonagricultural soil, soil sterilants may be the best choice: e.g. chlorates, urea compounds, dalapon in high dosages (1/8 to 1/4 pound per square rod). If resprouting occurs, a second application may be desirable.

For extensive stands in crop soil, dalapon, TCA, amino triazole, MH, or simazin are possible choices. The use of dalapon has been detailed with respect to discussion of that chemical and will not be repeated here. Amino triazole can be applied early in the season, 8 pounds commercial preparation per acre, the plants allowed to stand for a couple of weeks and then plowed under. A late planted crop, preferably a smother crop, as for example, soybeans seeded solidly, can then follow. A second year's treatment may or may not be necessary.

MH (maleic hydrazide) may be useful in small areas, i.e. gardens; application should be followed, after a week, by plowing and planting. This chemical scarcely kills the quackgrass but inhibits its growth and gives the crop a better chance to smother it.

Heavy applications of simazin (10 to 20 pounds per acre) have been shown to be capable of eliminating quackgrass. However, lighter dosages may suffice for adequate control. Recent Wisconsin studies with simazin and Atrazine, the chemicals applied fall or spring, 4 pounds per acre on land subsequently planted to corn, have yielded effective control.

PERENNIAL PEPPERGRASS *(Cardaria draba)*

Once established, perennial peppergrass is extremely difficult to eradicate, and any method except soil sterilization will require two years or more. Fallowing or smother crop procedures as previously described are applicable. Alternation of fall-seeded grain and fallowing, is sometimes practiced. 2,4-D is moderately effective, but repeated applications are necessary. If in grassland, heavy dosages (1 to 2 pounds per acre) can be utilized, two or three treatments should be applied from early bud to fall rosette stage. Application rates which can be employed in grains will prevent seed production but may not materially reduce stand.

Recent work in Idaho on irrigated land has demonstrated excellent control by combining chemical and cropping procedures. Since the weed emerges quickly in the spring, it was possible to use 2,4-D (2 pounds per acre) prior to breaking the land and planting corn. Similar,

although possibly less effective, procedures were used with small grains. Weakened stands could subsequently be put in alfalfa.

RUSSIAN KNAPWEED *(Centaurea repens)*

Although declared a noxious weed in several of the North Central states, Russian knapweed is primarily a western weed. In areas to which it has adapted, it is extremely resistant to cultivation and to 2,4-D. The smothering action of perennial grasses (wheatgrasses or brome) plus continued treatment with 2,4-D will, in two years' time, considerably weaken stands. A fall-seeded grain treated with 2,4-D and alternating with cultivation may also be recommended.

JOHNSON GRASS *(Sorghum halepense)*

Johnson grass is a major southern weed which extends into the North Central states from Kansas to southern Indiana. It is a tall vigorous perennial, closely resembling sudan grass, to which it is intimately related. It differs from sudan grass in the possession of an extensive perennial underground rhizome system.

There are several means by which Johnson grass can be controlled, or its competitive importance reduced. Cultivation is perhaps the best for well established and/or extensive stands, plowing in June followed by continued tillage, over a two year period. Intervals between cultivations can be based on rapidity of regrowth; new shoots should not be allowed to exceed 6 to 8 inches in height. Stands can be significantly weakened prior to cultivation through heavy pasturing. A rotation consisting of a perennial legume, a row crop, and a small grain will not eradicate the weed but is capable of keeping it under reasonable control. A suggested combination of procedures: keep the grass down in the early part of the season by pasturing or mowing; follow with cultivation until fall. Then seed a heavy stand of winter grain and vetch. The following spring harvest and plant to corn.

Soil sterilants (TCA, dalapon, sodium chlorate, urea compounds) or oils may be employed in noncrop land or for treatment of small areas. Several applications of the oils will be required; i.e. treatment should be repeated as the grass reaches a height of 8 to 10 inches. TCA and dalapon usually have a shorter term residual effect in the soil than the other sterilants, but rather heavy dosages are needed to eradicate the Johnson grass.

Dalapon appears to offer good potentialities for chemical control of Johnson grass in larger acreage cropped areas. The chemical can be applied (20 to 40 pounds per acre) as a foliage spray subsequent to crop harvest in late summer. Follow by plowing. There will be some carryover of the dalapon but corn can usually be grown the subsequent season. Early summer treatment of the Johnson grass will likewise

reduce stands but is more difficult of integration with crop production. On the other hand, if fall wheat is to follow, early summer (June) treatment may work out best. Kansas has recently reported reasonable effectiveness with dosages of 15 to 20 pounds per acre.

Inasmuch as Johnson grass ranges from the eastern seaboard to California, it is capable of succeeding in divergent agricultural areas, climates, and soil types. As may be expected, control requirements likewise differ. The above discussion relates primarily to the southern portion of the North Central states.

BULL THISTLE *(Cirsium vulgare)*

Bull thistle, a biennial, is not a major weed, but its formidable appearance and frequent abundance in run-down pastures render it an object of concern. Bull thistle cannot withstand cultivation and will quickly disappear if the area involved can be put into rotation. Mowing will prevent seed production. 2,4-D, best applied early in the season, 1 to 2 pounds per acre, will kill most plants. Scattered individuals may be spudded.

MILKWEED *(Asclepias syriaca)*

Milkweed is not a noxious weed. Nor probably is it to be classed as a major pest. But, since it is a spreading perennial, it is not easily eradicated by routine cultivation and rotation measures; furthermore, it is quite resistant to 2,4-D. It is particularly conspicuous when oats are turning yellow, for the large green leaves emphasize its presence. Frequent interest in the eradication of milkweed is expressed by farmers.

Control can usually be achieved through a combination of early season cultivation, followed by an annual smother crop, sudan or forage sorghum. After-harvest cultivation should follow. Similar treatment a second year followed by alfalfa will probably complete the job.

WILD MUSTARD *(Brassica kaber)*

This plant is primarily a weed of small grains. The use of clean seed and crop rotation should be capable of keeping it at moderate levels. It is highly susceptible to 2,4-D or dinitros as previously discussed under chemicals.

SHEEP SORREL *(Rumex acetosella)*

Sheep sorrel (also called red sorrel) is most frequently prevalent

in poor pastures. Acid soils or those low in fertility give this weed a competitive advantage. Therefore, liming and fertilizations are often capable of materially reducing its prevalence. Rotation of the area to include clean cultivated and/or smother crops is likewise effective. The weed is susceptible to 2,4-D but several applications are usually necessary.

DOCKS (*Rumex* spp.)

These plants are weeds of pastures, legume stands, small grains, and roadsides. They are rapidly eliminated under cultivation; hence, rotation, including corn and soybeans, is desirable. The use of 2,4-D where feasible, especially in grassland or nonlegume pastures, will speed their destruction.

RAGWEEDS (*Ambrosia* spp.)

Ragweeds occur in agricultural areas, pastures, and legume stands (usually common ragweed, *A. elatior*) or along roadsides and in alluvial waste areas (giant ragweed, *A. trifida*, more frequent). Both kinds may occur in untended areas around towns, but the common ragweed is most abundant. Common ragweed may be controlled by improving fertility conditions, putting the area into cultivation, mowing, or the use of 2,4-D as applicable. Mowing and roadside spraying with 2,4-D are the most frequent measures employed to suppress giant ragweed.

COCKLEBUR *(Xanthium strumarium)*

Cockleburs are conspicuous annual weeds frequently abundant about farm buildings and in cultivated soil. The very young seedlings (cotyledon stage) are poisonous to hogs and the animals should not be allowed access to infested areas during the spring germination period.

A rotation including 2 to 3 years of alfalfa will deplete cocklebur seed reserves in the soil. In cultivated crops the weed can usually be held in check through early season cultivation or 2,4-D treatment (except in soybeans).

Vigorous stands of cocklebur and other broad-leaved annuals (e.g. butterprint) sometimes develop after lay-by in corn. Seed production can be inhibited by high clearance applications with 2,4-D (1/4 pound ester, 1/2 pound amine per acre). Similar mowing, spraying, or cultivation can be carried out in post harvest small grain stubble, but the latter two techniques will mean the dissolution of any legume stand. In soybeans, if cockleburs escape early cultivations, they can only be removed by hand.

DODDER (*Cuscuta* spp.)

Because of the parasitic nature of dodder and the organic connection between it and crop plants which it attacks, many ordinary control procedures are inapplicable to this weed.

The consistent use of clean legume seed to prevent infestation of dodder-free soil is of paramount importance in avoiding a dodder problem. Dodder is a secondary noxious or restricted weed in all seed laws; its presence and rate of occurrence will, therefore, be indicated on seed tags of all subject seed lots merchandised by dealers.

If land is badly infested with dodder, the planting of crops other than legumes or flax for several years will reduce the number of seeds in the soil. Such a measure will probably not eliminate the dodder, as the seeds, if not stimulated to germinate, are capable of living in the soil a number of years. A succession of mowings of legumes will usually prevent seed production and a reinfestation of the soil by the dodder.

The possible utilization of CIPC and dinitro-fortified oils has been under investigation as a means of controlling dodder in alfalfa. The use of CIPC (6 to 8 pounds per acre) in connection with seed production of alfalfa seems definitely beneficial — assuming proper weather conditions.

POISON IVY (*Rhus toxicodendron*)

Chemical control of poison ivy is now recommended whenever feasible to eliminate contact hazards in hand digging and other mechanical methods. Poison ivy can be killed by 2,4-D, brush killer, ammate, amino triazole, or soil sterilants. The method employed usually depends upon the situation in which the ivy is growing. For example, grubbing and mechanical removal may be necessary if the ivy is contiguous to valuable plants. Alternatively, it can be cut and the stubs basal-treated with 2,4,5-T in oil. Ammate can be employed in situations as in orchards where, although the poison ivy is in close proximity to the trees, most of it is not in contact with them. Applied about 1 pound per gallon of water, the leaves should be thoroughly wet. Spray should not be allowed to drift to foliage of the crop trees. Retreatments for regrowth are often necessary.

Where crop plants are not a consideration, most efficient control can usually be gained through use of 2,4-D ester or brush killer. Soil sterilants, e.g. borax compounds or chlorates, may be employed for localized areas.

VERVAINS (*Verbena* spp.)

Inquiry is frequently made concerning these conspicuous plants and other weeds which frequently become overwhelmingly abundant in

permanent pastures. Their control has been discussed relative to control of pasture weeds on previous pages.

BUCKBRUSH (*Symphoricarpus* spp.)

The control of this and other brushy weeds has been treated under brush control.

FOXTAILS (*Setaria* spp.) AND OTHER ANNUAL GRASSY WEEDS OF CULTIVATED SOILS

Other major kinds may include witchgrass and relatives (*Panicum* spp.), crabgrass (*Digitaria* spp.), barnyard grass (*Echinochloa* spp.). Additional genera and species have conspicuous local importance.

Annual grasses, considering their prevalence, their rapid growth and competitive ability, and their abundant seed productiveness must, by any economic standard, be considered a (if not "the") primary weed problem in North Central states agriculture. Many of the recent developments in herbicidal weed control are directed specifically towards these plants.

Foxtail grasses and similar weeds fare best in conventional row crops, corn, and soybeans. The problems relating to their control have been treated in detail with respect to consideration of these crops. Annual grasses are not subject to the selective action of 2,4-D; hence, control is based primarily upon cultivation and pre-emergence treatment. Among current herbicides, CDAA (including Randox-T), and simazin are especially effective against germinating grass seeds.

A second aspect of the annual weed problem is the inclusion of a long term perennial, e.g. alfalfa, in the rotation picture in infested soil. Little will be gained in weak or open stands of the legume; annual grasses may thrive and set seed. But the environment created by an established, disease-resistant, well-fertilized alfalfa stand is not conducive to annual weeds. Furthermore, seed production is inhibited through mowing operations.

A third general consideration is the prevention of seed production which may restore seed reserves in the soil. This is most critical in row crops. Post-harvest mowing or cultivation may serve as a preventative measure in small grains. There is no panacea for late seed-producing grasses in corn, sorghum, and soybeans; the operator is dependent upon the efficacy of his early season weed control measures. Unfortunately some of these summer annuals are capable of germination and producing seed subsequent to the cessation of cultivation. Perhaps, in badly infested soil, a rotation could first be guided through a small grain-alfalfa sequence as a means of reducing weed seed populations before going to corn or soybeans. Efficient land use considerations would, of course, bear on any such decision.

Considering annual grasses in broader prospective, the use of clean seed is a major weed prevention tool. Forage crop seeds, and all too often soybeans, are frequently contaminated with seeds of grassy weeds. Control problems will persist if clean seed is not used.

It is sometimes observed that these are not "noxious" weeds and are not subject to restrictive legislation by seed laws. This is not entirely true. The total weed seed content (percentage by weight) must be indicated on the seed tag on all seed sold in commercial channels. It is not legal to sell crop seed if the total weed seed exceeds certain percentages, usually 1 to 3 per cent depending upon the state.

It is, of course, difficult to obtain crop seed completely free of contaminating weed seeds. However, weed seed can be reduced to a bare minimum and efforts should be made to purchase or to reclean seed so that it is essentially free of weeds. It is not difficult with present day commercial seed cleaning machinery to achieve a product of exceedingly high purity. This goal is not always attempted because a considerable proponderance of the sale market unfortunately is for cheaper, uncleaned seed.

As indicated above, the validity of the terms "noxious" and "non-noxious" as conventionally employed is becoming questionable in present-day agriculture. That the economic significance of annual grasses is beginning to receive legal attention is pointed up by the fact that Indiana has now designated tall foxtail *(Setaria faberii)* as a noxious weed and other states are considering similar moves.