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Weed Control

IN MINNESOTA

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The recommendations and discussions in this pamphlet are based on the *Recommendations of the Research Committee of the North Central Weed Control Conference for 1954.* This committee is comprised of representatives of state universities throughout the area. Since the effectiveness of herbicides depends on factors that vary from region to region, the recommendations have been modified where necessary to make them fit Minnesota conditions. Recommendations of chemicals are subject to approval by the Pure Food and Drug Administration.

UNIVERSITY OF MINNESOTA
Agricultural Extension Service
U. S. DEPARTMENT OF AGRICULTURE

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Chemical and Cultural Weed Control

in Minnesota

PERENNIAL WEEDS

Butter and Eggs

(Toadflax or Wild Snapdragon)

ON GOOD LAND a system of fallow alternating with a small grain crop has reduced the stand of this weed sufficiently to permit successful crop production. In the year preceding the fallow, fall tillage with a disk-type machine to cut off weed seedlings or sprouts from old roots is very important. In the fallow year, shallow tillage with a duckfoot cultivator and rod weeder should be given at frequent intervals to prevent regrowth from appearing above ground for more than five to eight days. This means eight to ten cultivations in a season.

If wind erosion is serious, the land should be worked in alternate strips of fallow and crop (the strips not more than 16 rods wide), or a rotation of fallow and fall rye should be used. Seeding down to grass after a previous season of fallow and repeated spraying with 2 pounds of 2,4-D ester has reduced the stand and vigor of the weed.

Soil sterilants can be used economically to eradicate small patches. CMU at 64 pounds per acre and sodium chlorate or boron-chlorate mixtures at 10 pounds per square rod have been satisfactory.

Bur Ragweed

Bur ragweed or perennial ragweed can be controlled by 2 pounds of 2,4-D ester per acre applied in the actively growing pre-bud stage. Sodium chlorate at 4 pounds per square rod, Polybor or Polybor chlorate at 6 pounds per square rod, and CMU at 60 pounds per acre will give satisfactory kills but are expensive except for small patches.

Canada Thistle

Cultural practices that have proved effective are (1) spring duckfooting every three to four weeks, followed by sowing of sorgo, sudan grass, or proso millet about July 1, (2) using alfalfa, alfalfa-grass mixtures, or reed canary grass where adapted and cutting for hay over several years, or (3) fallowing where erosion is no problem. Substituting an application of 2 pounds of 2,4-D for one of the cultivations has been more effective than cultivation alone.

Usually at least two applications of 2,4-D each year over a period of two or more years are necessary to eradicate this weed. The first application each year should be made at the bud stage, and one or more treatments made later in the summer

and/or early fall when the resprouting thistles are in the rosette stage. Rates over 1 pound per acre tend to be progressively less effective.

Good control has been obtained by treating infested areas with 2,4-D once or twice, then plowing and cultivating intensively as soon as new growth appears.

A very successful method for Canada thistles when practiced for two years is as follows: plow in the fall, sow oats in spring, spray when thistles are 4-6 inches tall with 8-10 ounces of 2,4-D or MCP, spray oat stubble with 2 pounds of 2,4-D, and plow deep in late October.

Two methods that are not so satisfactory are (1) no spraying of thistles in oats, plowing immediately after harvest, and spraying with 2,4-D when thistles had emerged or (2) no spraying of thistles in oats, plowing immediately after harvest, and cultivating until freeze-up.

Leafy Spurge

For extensive infestations on arable land, intensive cultivation alternated with cropping will in time bring even the most persistent stands under control.

Application of 2,4-D at the maximum rate the crop will tolerate will delay and often prevent the plant from developing seed. Repeated applications to infestations on grassland will reduce the stand but seldom eradicate it.

For small and scattered patches and for infestations on nonarable land, the soil-sterilant herbicides are recommended. Two treatments are being widely and successfully used: (1) sodium chlorate and boron-chlorate mixtures applied initially at approximately 5½ pounds per square rod or (2) boron compounds applied at the rate of 5 to 6 pounds of boron trioxide per square rod (15-18 pounds of Borascu, 8-10 pounds of concentrated Borascu, or 7-9 pounds of Polybor), followed by lighter applications to eradicate stray or surviving plants.

For extensive infestations on nonarable land, close pasturing with sheep over several years will be found effective.

Meadow Buttercup

Buttercup can readily be controlled by spraying with 2 pounds of MCP amine per acre in the spring when the weed is flowering.

Orange Hawkweed

Orange hawkweed can readily be controlled by spraying with 2,4-D ester at 2 to 3 pounds per acre in the bud to flowering stages and repeating the treatment in September.

Field Bindweed

Field bindweed can be controlled by intensive cultivation, followed by the sowing of a late-sown crop. Eight to ten days after each emergence, cultivate to cut off all plants about 4 inches below the surface. About July 1, when the plants have been weakened by this treatment, you may stop cultivating and sow soybeans, sorgo, or sudan grass to reduce erosion and yield some returns from the land. Alternate the cultivation and cropping until the weed is eliminated. Two to four years are required for eradication.

Applications of ½ to 1 pound of 2,4-D per acre in bud to bloom stage or in late fall are effective, but the treatment must be repeated to get a kill and to control seedlings. In small areas apply 4-6 pounds per square rod of dry sodium chlorate and follow a year later with spot treatment of any remaining plants.

CMU and boron compounds are also suitable if the effect on the soil is not objectionable. Use 80 pounds of CMU in a large volume of water per acre or 15 pounds of concentrated Borascu, 10-15 pounds of Polybor, or 8-10 pounds of Polybor chlorate per square rod. Any surviving plants should be treated again, beginning the second spring after the original treatment.

Perennial Peppergrass and Hoary Cresses

Where soil type and topography permit, duckfoot cultivations at two-week intervals will prevent seed production and reduce the stand. Sowing winter wheat or rye and cultivating after harvest will also give satisfactory reductions after two to three years. Where possible a control program should make use of the combined beneficial effects of crop competition and intensive cultivation.

To control the top growth of these weeds in growing crops, apply ½ to 1 pound of 2,4-D per acre when the weeds are in bud. Retreatment of fall rosettes at 1 to 2 pounds will give substantial stand reductions. Such a combination of treatments should give almost complete elimination after two or three seasons.

Use soil sterilants to eliminate small patches or scattered plants that remain after the treatments recommended above have been given. Use sodium chlorate at 4 pounds per square rod, concentrated Borascu or Polybor at 10-15 pounds, or Polybor chlorate at 8-10 pounds. Use CMU at 40 pounds per acre. Seedlings can be controlled by applying 2,4-D to the leaves, by cultivation, or by seeding bromegrass.

Perennial Sow Thistle

A successful crop method for perennial sow thistle is to plow in the fall, sow oats and sweetclover in the spring, cut oats for hay, and clip any thistles that bloom later; next year pasture sweetclover until the last of June or use the first crop for hay or green manure, plow about July 1, and cultivate every three to four weeks with a duckfoot cultivator until the ground freezes. The cultural practices recommended for Canada thistle are also successful for sow thistle.

Sow thistle is somewhat easier to kill with 2,4-D or MCP than Canada thistle.

Poverty Weed

Poverty weed can be controlled but not eradicated by spraying with 2,4-D ester at a dosage of 2 pounds per acre in the bud stage. CMU at 20 pounds per acre has given almost complete eradication.

Quack Grass

Cultivation is the cheapest method of eradicating quack grass on large areas if soil erosion is not a problem. Two methods are used: (1) the reduction of food reserves in the rootstocks to the point where the plant can no longer remain

alive or (2) the drying of rootstocks and top growth to the point where the plant dies. Occasionally the weed may be killed by exposing the rootstocks to freezing.

Weather in the spring usually does not favor killing quack grass by drying. Therefore, cultivating should be done whenever there is a leaf growth of 2 or 3 inches in order to exhaust the food reserves. These cultivations should be continued as late as possible before sowing a crop. A cultivator that shears off the shoot growth is more desirable than one that pulls the rootstocks to the surface. A sharp disk or a duckfoot cultivator is satisfactory.

During the summer the most effective control results from drying the rootstocks and roots by bringing them to the surface. A sturdy field cultivator with spring teeth set close together is satisfactory if clogging is not a problem. Where there is a dense growth, use a disk or remove some teeth from the cultivator. Best results come from working up old hay fields and pastures.

Ordinarily there is no advantage from plowing before cultivating, but close grazing prior to cultivation makes control easier. If hay is harvested, cultivate immediately after the first crop has been removed. If the field cannot be cultivated during early fall, some benefit will result from late-fall tillage.

In either method cultivations must be frequent and continued over a long enough period to free the soil of all living quack material. If the quack is in scattered patches, it is better to use a disk so rootstocks will not be dragged to clean parts of the field. In wet years or on poorly drained soils, cultivation is not very effective.

Patches of quack can also be eradicated with chemicals. Sodium chlorate may be applied at any time, though possibly the best time is in the fall. Use 2-3 pounds per square rod.

TCA is best applied in late summer or fall. Amounts required on undisturbed sod are much larger than on land that is plowed first. If the land is not plowed, 66 pounds or more of TCA per acre are needed. Good kills have resulted from two applications—one of 44 pounds the first year and one of 22 pounds the next. If the land is plowed a few days before treatment, 22 pounds per acre gives good control.

If the land is cropped later, a follow-up application of 18 pounds of TCA per acre or cultivation after harvest is recommended to eradicate the quack. Under these conditions better results were obtained following flax than following corn. TCA on land that has been cropped does not give as good a kill as on old sod.

Tolerance of crops is in the following descending order: flax, potatoes, red pine, oats, corn, barley, wheat, and soybeans, with the biggest break occurring between corn and barley. Normal growth of crops sown or planted in the spring following application of 22 pounds of TCA in the fall can be expected from flax, potatoes, oats, corn, strawberries, red pine, green ash, jack pine, white spruce, Russian olive, Bolleana poplar, Ural willow, and ponderosa pine. Where it has been dry following the application of TCA, however, it is advisable not to plant corn the following spring.

CMU may be used for eradicating quack on nonagricultural land. Early-spring or late-fall applications have been superior to those in June, and applications on undisturbed sod have been much superior to those on plowed sod. The minimum amount of CMU for a satisfactory kill of quack is 20 pounds. At over 20 pounds, normal development of crop plants is prevented for at least two years.

Quack may be temporarily suppressed by early spring foliage applications of 4-8 pounds per acre of MH, followed three to six days later by plowing and working down. Crops sown soon after do not seem affected.

Russian Knapweed

Where possible, duckfoot cultivations at two-week intervals will prevent seed production and reduce the stand. Sowing winter wheat or rye and cultivating after harvest will also give satisfactory reductions after two or three years. A control program should use the combined beneficial effects of crop competition and intensive cultivation.

Applications of 2,4-D at 1 to 2 pounds will control top growth of Russian knapweed and prevent seed production. Only slight reductions in stand can be obtained from repeated foliage applications.

Soil sterilants should be used to eliminate small patches or scattered plants which remain after the treatments recommended above. Use sodium chlorate at 6 pounds per square rod, concentrated Borascu or Polybor at 10 to 15 pounds per square rod, or Polybor chlorate at 8 to 10 pounds per square rod. Use CMU at 60 pounds per acre. Seedlings can be controlled by 2,4-D foliage sprays, by cultivation, or by seeding bromegrass.

Tansy

Tansy can readily be controlled by spraying with 2,4-D ester at 2 to 3 pounds per acre in the bud to flowering stages and again in September.

WEED CONTROL IN FIELD CROPS

Spring-Sown Small Grain

WHEAT AND BARLEY are less sensitive than oats to 2,4-D applications made during the growing season. Wheat is less sensitive than barley. All three crops are sensitive as seedlings—from emergence to the two-leaf stage. Wheat and barley are relatively tolerant from the time five full leaves appear until the early-boot stage. During this period ¼ to ⅓ pound ester or ½ to ⅔ pound amine salt of 2,4-D can usually be used to control broad-leaved weeds without injury to the crops.

Avoid spraying wheat and barley in the boot or shot-blade stage of development. Varietal differences in wheat have been unimportant and in barley have been small. Feebar, Plains, and Moore have shown somewhat more susceptibility than Barbless, Mars, Kindred, Montcalm, and Vantage.

Some injury to oats should be expected from spraying any time from seedling to early-boot stages of growth, with the time of jointing apparently the most sensitive. However, weed control generally will more than offset losses resulting from 2,4-D injury. Applications of 2,4-D (see rates for wheat and barley) made from early-boot through heading stages are generally safe with some yield depressions resulting from treatment at the early-boot stage. Oats are more tolerant of MCP than of 2,4-D, permitting the use of ½ pound per acre. Susceptibility of the weed population should be known before using MCP.

At rates adequate for susceptible weeds like mustard, the stage of application is not so important as it is when ½ pound and over of 2,4-D amine is used. Mindo and, to a lesser degree, Clinton and Andrew oats have been more susceptible to 2,4-D than Bonda, Ajax, Zephyr, Shelby, James, Gopher, and Branch.

In general during seasons when growing conditions are poor due to drouth or cold weather, use the upper limits of the range of rates given. Likewise, when the growth rate of weeds and crops approaches maximum the lower rates can be used. If there is occasion for preharvest treatments, as much as 1 pound of 2,4-D ester may be applied at any time after the milk stage without appreciable injury to the crop. Contact herbicides can be used to give more rapid drying of weeds where treatment has been delayed until near harvest time.

Fall-Sown Wheat

Winter wheat may be treated with 2,4-D in dosages sufficient to control most annual broad-leaved weeds. The crop will meet with little injury if the 2,4-D is applied in the spring from the fully tillered through the jointing stages of growth. From ¼ to ½ pound of 2,4-D to the acre as an ester or up to ¾ pound as an amine are suggested dosages. Similar applications made in the fall usually result in damage to the crop and are not recommended.

Preharvest treatment applied when the wheat is in the milk to hard dough stage should be looked upon as an emergency measure to be used only when weeds threaten to interfere seriously with harvesting. A dosage of 1 pound of 2,4-D to the acre is usually required at this stage and may result in damage to the crop. Weed control at this stage is often not satisfactory.

Weeds and weedy grasses which are resistant to 2,4-D may best be controlled by proper presowing cultivations and crop rotations.

Flax

Cultural practices—Weeds are generally more of a problem in flax than in small grain; therefore, growers should sow flax on relatively clean land. Early after-harvest tillage of small grain stubble to control perennial weeds, prevent weed seed production, and stimulate annual weed seed germination in late summer and fall is a recommended method of preparing land for flax. However, this method should not be followed where after-harvest tillage results in serious wind erosion.

Another desirable weed control practice is to prevent weed seed production in corn, soybeans, and other cultivated crops and prepare the seedbed for flax by shallow tillage. Delayed sowing of flax to permit spring tillage for wild oat control has been successful in some areas, although this method is sometimes detrimental to the flax. For delayed sowing, early-maturing varieties such as Sheyenne or Marine are recommended.

Herbicides—Flax should be sprayed with MCP or 2,4-D as soon as there is sufficient emergence of susceptible weeds to make spraying practical. Spraying may reduce yields of seed and straw unless weed competition is reduced sufficiently to offset injury from spraying.

MCP is less likely to injure flax than 2,4-D and is therefore the preferred material. Use 2 to 3 ounces per acre of MCP or

2,4-D in sodium or amine formulations for susceptible weeds like wild mustard. Use 4 ounces for lambsquarters, pigweed, stinkweed, cocklebur, marsh elder, and ragweed.

For moderately resistant weeds, spot spraying at heavier rates may be necessary. Use MCP at 5 to 6 ounces per acre to prevent seed production by Canada thistle. Use 2,4-D ester at 3 ounces per acre to control Russian pigweed and Russian thistle.

TCA at 5 pounds per acre will kill green foxtail, yellow foxtail, giant foxtail, and barnyard grass in young flax. For best results the flax should be at least 2 inches tall and the weeds less than 2 inches. TCA can be applied in mixture with MCP or 2,4-D to kill susceptible grass weeds and susceptible non-grass weeds with one application.

Corn

Post-emergence treatment—Some injury to corn may be expected from spraying with 2,4-D. Until the corn is tasseled, stalk brittleness commonly follows over-all spraying, and severe loss from breakage may result if a storm occurs or if you cultivate shortly after the treatment. Hybrids vary in their susceptibility to 2,4-D, but differences are not important at rates below ½ pound per acre. Do not spray seed fields unless the tolerance of the parents is known.

Corn is most susceptible for about a week after leaves appear and during the period from two weeks before silking until the silks are dry. Susceptibility is associated with rapid growth except during this latter period when severe reduction in seed set may result regardless of growing conditions. Injury is not important at ¼ pound of 2,4-D amine per acre—an amount sufficient to kill susceptible weeds such as cocklebur and wild mustard. Rates necessary to control more resistant weeds such as Canada thistle usually reduce yields.

Five pounds of TCA applied to the soil following the last cultivation have controlled common and giant foxtail without reduction of corn yields. The chemical should be applied with drop nozzles in order to wet not more than the lower 6 inches of stalk. When 2,4-D is combined with TCA, broad-leaved annual weeds can also be killed.

Pre-emergence treatment—This treatment is not recommended.

Soybeans

Weed control in soybeans by either pre-emergence or post-emergence applications of herbicides has not been dependable. There are no post-emergence sprays recommended for soybeans but pre-emergence treatments offer some possibilities. DNBP applied pre-emergence at 6 to 9 pounds per acre has been the most consistent, but it is very expensive. The lighter rates are recommended for the lighter soils. As with all pre-emergence herbicides, the results will vary with weather conditions.

Early seedbed preparation and frequent cultivation to kill weeds until planting time have been disappointing in their results. Somewhat larger yields of soybeans have been obtained following such tillage since a better seedbed resulted, but this method has not been effective for weed control. Post-emergence cultivation with the rotary hoe or weeder is effective if done when the weeds are very small.

For weed control in soybeans sown in 6-inch noncultivated rows, the use of winter wheat or winter rye as a companion crop has been promising. One bushel of wheat or rye per acre is drilled in immediately following the sowing of soybeans.

Peas

Annual broad-leaved weeds may be controlled when in the two- to four-leaf stage by applying from ¾ to 1 pound per acre of DNBP as an amine salt in approximately 40 gallons of water.

Broad-leaved annual weeds may also be controlled by applying from 2 to 6 ounces per acre of MCP amine or sodium salt to peas when they are 3 to 7 inches in height.

Sugar Beets

Recommended crop rotations and methods of cultivation suited to conditions within the particular sugar beet-growing area are the principal means of weed control.

Where annual grasses other than wild oats are known to be a problem, the application of 5 to 7 pounds per acre of TCA just before the emergence of the beets is recommended.

If weather makes it impossible to apply the spray before emergence of the crop, it is best to wait ten days. TCA at these rates may then be used to control annual grasses. Some beets will be stunted. This should be considered an **emergency treatment only.**

Forage Legumes

Seedling legumes generally are slow growers and thus are poor competitors with weeds. Management practices in preceding crops to make the land as weed-free as possible for the legume seedlings are desirable. Such practices as the use of inter-tilled crops and after-harvest tillage in seasons preceding legume establishment are suggested.

Clipping of seedling legume stands (except sweetclover) when sown alone, mowing the stubble of companion crops (if done low enough and continued late enough to kill most of the annual weeds), and patch mowing for perennial weeds help to control weeds in seedling legumes.

The use of herbicides on seedling legumes is to be avoided unless the crop is seriously threatened by weeds. When weeds are a serious problem, seedling stands of ladino clover, alsike clover, red clover, and alfalfa may be sprayed with the sodium or amine salts of 2,4-D or MCP at rates of ¼ pound or less per acre without serious losses of legume stand. Sweetclover usually will not tolerate either 2,4-D or MCP.

The dinitro sprays also may be used on these legumes for control of very small annual weeds, but results are highly dependent on the weather. The amine salt of DNBP at rates of ¾ to 1 pound in 25 to 40 gallons of water per acre is suggested. With high temperatures or humid conditions, use lower amounts of DNBP.

TCA at 5 to 7 pounds per acre may be used to control many annual grasses in seedling stands of alfalfa and sweetclover but cannot be used when wheat, oats, or barley is the companion crop. TCA cannot be used on alsike and red clover.

Best results are obtained from spraying when there is a canopy effect from the weeds, from a companion crop, or both.

The use of 2,4-D or MCP on established legumes is an emergency measure. They should be applied in the early spring while the crop is still dormant or immediately after hay harvest. The dinitro products may be used as recommended for seedling legumes. Established stands of alfalfa and sweetclover may be sprayed with TCA at 5 to 7 pounds per acre for control of many annual grasses (not wild oats) without permanent injury to the crop. Alsike and red clovers should not be sprayed with TCA.

WEEDS IN PASTURE AND RANGE GRASSES

GOOD MANAGEMENT and controlled grazing are most important in any attempt at weed control in pasture land.

In very weedy pastures where good perennial grasses are thin, frequent cultivation in late summer or early fall to kill the old sod and then reseeding are probably the most important improvement practices. In order that the reseeding be successful, a good firm seedbed should be prepared. Protect new seedlings from grazing until established, and graze moderately thereafter.

Plowing and seeding to adapted grass where practicable will almost eliminate many of the perennial pasture weeds. Spot spraying with 2,4-D is effective for susceptible perennial weeds.

Mowing is the recommended practice for controlling many kinds of weeds if done at the right time and if repeated for two, three, or four years. In general, mow such herbaceous weeds as thistles when in the bud to bloom stage.

Spraying with 2,4-D or 2,4,5-T or a mixture of the two gives better control of more kinds of weeds by a single application than does a single mowing. Spraying while the weeds are actively growing gives best results, and repeated treatments for two or more years are usually necessary. These materials may be used at rates necessary for weed or brush control without much injury to the grasses.

Seedlings of perennial grasses may be treated with 2,4-D to good advantage if the broad-leaved weeds are a problem and if the land is not heavily infested with seeds of the weedy annual grasses. Rates up to ¾ pound ester per acre may be used after the grass seedlings have reached the two- to four-leaf stage.

WEEDS IN HORTICULTURAL CROPS

THE RATES of application of chemicals recommended for use in garden crops are based on over-all coverage. If only a narrow strip over the row is sprayed, the amount of chemical should be reduced accordingly.

Vegetable Crops

Asparagus—After the early spring disking and before spears have emerged, apply 2 pounds of 2,4-D or 4 to 6 pounds of SES per acre to control most annual broad-leaved weeds in established asparagus plantings. To control both broad-leaved weeds and grasses, add 5 to 8 pounds of TCA to the above spray mixtures, or use 6 to 8 pounds of DNBP amine, 4 to 8 pounds of NP, or 1 to 2 pounds of CMU per acre. Use the lower rate

of each of these chemicals on mineral soils and the higher rate on muck soils.

During the cutting season, weeds can be kept under control by using a wire weeder or by applying granular calcium cyanamid at the rate of 300-400 pounds per acre immediately after a cutting and when the weeds are small. The dust form of calcium cyanamid applied at 75-100 pounds per acre is also effective if weeds are small and if there is enough dew to stick the dust on the foliage.

Following the disking after harvest of an established asparagus bed, apply the above rates of 2,4-D, SES, DNBP, or NP before any spears appear. If 2,4-D was applied earlier in the season it should not be used again after harvest.

To control weeds in asparagus seedbeds, use 80-100 gallons of Stoddard solvent, 1 pound of DNBP, or 1 pound of 2,4-D per acre as pre-emergence sprays.

To kill quack grass in small areas of an asparagus planting, spot treatment using 40 to 50 pounds of TCA per acre just after disking is recommended. Such treatment will result in some injury to the crop but may be worth while to prevent spread of the weed.

Beans—The use of pre-emergence sprays to control weeds in the row, together with cultivation between rows, has proven quite successful. The application of 6-9 pounds of DNBP amine or 15-25 pounds of sodium PCP per acre of actual sprayed area will control annual weeds for a considerable period. The higher rates should be used when sprays are applied immediately after planting.

When spraying is delayed until shortly before bean emergence—at a time when many weeds have emerged—the lower rates may be used with equal effectiveness.

Beets—For the control of annual grasses, apply TCA at 8-10 pounds per acre at least two days before beet emergence. If weather makes it impossible to spray before emergence of the crop, wait 10 days after emergence and apply 10 pounds of TCA. Since some beets will be stunted by the latter treatment, this treatment should be used as an emergency measure only.

Cabbage, cauliflower, rutabaga, turnips, brussels sprouts, broccoli—When any of these crops is direct-seeded, a pre-emergence spray of 5-8 pounds of TCA per acre applied two to three days before crop emergence may be used to control annual grasses.

Carrots, celery, dill, parsnips, parsley—Small annual weeds can be controlled by the application of 80-100 gallons of Stoddard solvent per acre if the entire area is sprayed. Apply the spray when most of the first crop of weeds has emerged but before any of them is more than 2 inches tall.

The oil is most effective, and often at lower rates, when it is applied at night when there is little air movement and humidity is high. Early-evening applications are best in areas where exceptionally heavy dews may cause run-off of the chemical if it is applied later at night.

Do not spray carrots and parsnips after the tap root is more than one-fourth inch in diameter or after five or more leaves are present. Apply Stoddard solvent to celery only in the seedbed.

Onions—For the control of weeds that have emerged before the onions, use 40-80 gallons of Stoddard solvent, 16-20 pounds of potassium cyanate, 75-100 pounds of calcium cyanamid dust, or 3-5 per cent sulfuric acid at 100 gallons per acre as pre-emergence applications. On muck soils use CMU at 2 pounds

per acre. Apply these chemicals eight to ten days after seeding the onions.

For control of weeds in onions in the loop stage or after the first true leaf is at least 2-3 inches long, post-emergence sprays of 2-3 per cent sulfuric acid at the rate of 100 gallons per acre or 12-16 pounds of potassium cyanate in 50-100 gallons of water per acre are recommended. Purslane is controlled only in the seed-leaf stage, and lambsquarters and grasses are usually not killed.

Provided the field has not been sprayed with a pre-emergence herbicide, CMU can be effectively applied at the rate of 2 pounds per acre on muck soils to control weeds in onions having one to two leaves.

For the control of weeds in onions having three to five leaves but not yet "laid by," basal applications of 3 to 4 per cent sulfuric acid at 100 gallons per acre, 16 to 20 pounds of potassium cyanate, or 8 pounds of CIPC in 50 to 100 gallons of water are recommended. Apply such sprays so as to avoid hitting the tops of the onion plants. This can be done by using shields over the spray nozzles or over the onion row, or by using drop nozzles.

In older onions which are bulbing and which have been laid by, apply a basal spray of DNBP at 1¾ or 2 pounds of CMU in 50-100 gallons of water per acre to control late-germinating weeds such as purslane. DNBP can also be applied as an overall pre-harvest spray after the onion tops are down in order to kill weeds which may interfere with harvesting operations.

Potatoes—While blind cultivation is generally preferred to control weeds, in wet weather chemical pre-emergence treatments may be valuable. Good results have been obtained by using 2,4-D at 1-2 pounds, DNBP amine at 3-6 pounds, and sodium PCP at 10-20 pounds. Apply these chemicals two to six days before emergence. Where annual grasses are a problem, TCA at 8-10 pounds per acre may be used as a pre-emergence spray.

During wet weather if broad-leaved weeds threaten to take over a potato field after emergence of the potato plants, you can use 2,4-D amine at 1 pound per acre to control the weeds. If this application is made when the tubers are setting, crop yields may be reduced as much as 25 per cent. Thus this treatment should be used only as an emergency measure during that period. It should never be used in fields being grown for seed certification.

If, following mechanical vine destruction, adverse weather interferes with digging, annual grasses may present a problem. In such instances, DNBP at 1¼ to 1¾ pounds in 5-10 gallons of oil will check the growth of weeds and weedy grasses. The chemical treatment alone will not ordinarily be sufficient where there is a normal vine growth.

Sweet corn—Use 2,4-D to control weeds in sweet corn by following the same recommendations as given for field corn.

Vine crops—Weeds in cucumbers, muskmelons, and watermelons have been successfully controlled with NP. Apply it pre-emergence immediately after planting these crops, using 2-3 pounds per acre on sandy soils, 3-4 pounds on sandy loams, or 4-6 pounds on clay and silt loams. As a post-emergence treatment when these vine crops are grown from transplants, do not use more than 4 pounds per acre. Because of danger of injury to the crop, NP should not be applied to extremely early plantings of vine crops when the soil is cold.

Summer squash and pumpkins are less tolerant of NP than are winter squash, cucumbers, muskmelons, and watermelons and thus should not be sprayed with NP.

To be effective in controlling weeds, NP must be applied before weeds emerge as this chemical kills germinating weed seeds only. It will not kill weeds which have already emerged.

Fruits and Ornamentals

Apples—Poison ivy in apple orchards can be controlled with ammonium sulfamate applied as a wetting spray at 1 pound per gallon. Also recommended are 2,4-D (amine, sodium salt, or low volatile ester) or 2,4,5-T (low volatile ester) at 1½ to 2 pounds per 100 gallons of water. Avoid applying the latter two chemicals when fruit buds are forming in late June and July. Keep herbicidal sprays off the trunk and leaves of the trees.

The same materials can be used to control brambles and perennial weeds, but these weeds may be more difficult to eradicate than poison ivy. Perennial weeds and woody plants are more susceptible when the topmost leaves on the new growth are reaching full size. Some regrowth may occur and it is usually necessary to make a second application later in the same season using ammonium sulfamate. This second application may be replaced with a treatment of either 2,4-D or ammonium sulfamate in the following season.

Grapes—Where weeds beneath the trellis cannot be controlled effectively with the hoe, use an oil emulsion containing 10-20 gallons of aromatic or fuel oil together with 2 pounds DNBP or 4 pounds PCP per 100 gallons of spray. Use a suitable emulsifying agent and make certain the oil remains emulsified.

Apply 40 to 50 gallons per acre in a strip 18 inches wide beneath the trellis, using a low-pressure sprayer. Keep the spray off foliage and do not spray young vines which do not have a protective coating of loose bark.

Raspberries—Young weeds can be successfully controlled by basal sprays of ½ pound of 2,4-D (amine or sodium salt) or 2 to 4 pounds of DNBP amine. Make the first application early in spring before new shoots have emerged. Delay the second application until the young canes are tall enough so that the basal spray will not hit the growing tips. DNBP should be used at 2 pounds per acre for the second application.

SES at 3-6 pounds per acre can be used at any season without injury to raspberry plants. However, to be effective SES must be applied before the weeds emerge.

Strawberries—The use of 1-2 pounds of 2,4-D amine or 3-6 pounds of SES per acre is recommended. In a new planting 1 pound of 2,4-D can be applied during the period from three to four weeks after setting to September when fruit buds begin to form. Treatment at the time runners are beginning to form may inhibit their production.

For the control of overwintering weeds, a late-fall application of 2,4-D at 1½ pounds per acre will give excellent control of susceptible weeds. If overwintering weeds were not sprayed in the fall, apply 1 pound of 2,4-D when you remove the mulch in the spring.

During the fruiting year 2,4-D can be used at 1½-2 pounds per acre but should not be applied to strawberries in bloom.

SES can be applied without injury at any time after plants are set out, and repeat applications may be made as needed. SES, however, must be applied before weed emergence and thus is not effective when applied to a weedy strawberry planting.

Gladiolus—When applied before the emergence of the gladioli, two pounds of 2,4-D, 8 pounds of DNBP amine, or 3-6 pounds of SES will control most annual broad-leaved weeds. Where annual grasses are a problem, a pre-emergence spray containing 10 pounds of TCA is effective. Post-emergence treatment using 1 pound of 2,4-D sodium salt when the gladioli are 6 inches tall or before the leaf blades open will control most of the weeds in the row. Injury may result if plants are treated with higher concentrations or at later stages of growth.

SES at 3-6 pounds per acre can be used either as a pre-emergence or post-emergence spray without injury. To be effective, SES must be applied prior to weed emergence.

Cormels grown for size increase are more subject to injury from herbicides than flowering-size corms.

Turf—Annual broad-leaved weeds in new turf can be controlled by ordinary mowing and management practices which favor the development of turf grasses. Herbicidal sprays should not be applied until the turf is one year old.

In established turf perennial broad-leaved weeds can be controlled by 2,4-D applications when the weeds are in active growth. A concentration of 0.1 to 0.2 per cent of 2,4-D amine applied at a volume of 1 gallon per 1,000 square feet will control most weed species. For resistant weed species, better control is obtained when 2,4-D esters are used, but nearby ornamentals may be damaged more from drift.

Crabgrass can be controlled by applications of phenyl mercuric acetate (PMA) at 0.3 ounce or potassium cyanate at 3 ounces per 1,000 square feet. These should be applied as soon as you see crabgrass seedlings. Additional applications at seven- to ten-day intervals may be required.

UNDESIRABLE WOODY PLANTS

BOTH 2,4-D and 2,4,5-T are useful in controlling undesirable woody plants. Ammonium sulfamate is also effective where it is not important that only certain plants be killed. Soil treatments using sodium chlorate, sodium chloride, CMU, and borax formulations may be useful for spots where complete kill of all vegetation is required and where higher treatment costs are justified.

The chemical 2,4,5-T will kill some plants not killed by 2,4-D and vice versa. For general treatment of mixed brush populations, mixtures of 2,4-D and 2,4,5-T are recommended. Applications of 2,4,5-T are especially effective in killing blackberry, wild rose, chokecherry, poison ivy, and some other species not as readily killed by 2,4-D. For most species and methods of treatment repeated applications during several years are necessary.

Foliage sprays—Treat woody plants that are sensitive to either 2,4-D or 2,4,5-T with wetting foliage sprays containing at least 2 pounds of acid per 100 gallons of carrier. For more resistant species use higher concentrations. Under most conditions water is preferable to oil as a carrier. Use ester formula-

tions for most situations, and near sensitive crops use low-volatile esters.

Ammonium sulfamate applied at concentrations of ¾ to 1 pound per gallon of water is also effective. With this chemical you must use special care to prevent corrosion of equipment. The addition of "stickers" and "spreaders" is advisable.

Foliage sprays are most effective when applied after the plants have reached the full-leaf stage in the late spring and before they approach dormancy in late summer.

Cut-surface treatments—Woody plants may be killed by applying chemicals to freshly cut surfaces of stumps or to "frills" or "girdles" cut into the trunks near the ground line of standing trees. This type of treatment can be used at any time of the year but is not usually as effective in the spring. This method is effective for trees too large to spray conveniently and some shrubs resistant to foliage sprays.

Esters of 2,4,5-T in oil solutions at concentrations of 8-16 pounds of acid per 100 gallons of diesel or fuel oil applied liberally are usually effective. Ammonium sulfamate applied as a dry powder or as a concentrated water solution (6-9 pounds per gallon of water) is also recommended. Esters of 2,4-D may also be effective on some species.

Basal bark sprays—Sprays applied to the basal bark and ground line are often effective in killing trees under 6 inches in diameter. Use esters of 2,4,5-T at concentrations from 8-16 pounds per 100 gallons of oil for most species. For buckbrush, esters of 2,4-D are preferred. Wet thoroughly the entire basal bark encircling the tree as well as the root collar at the ground line.

Woody weeds on roadsides and right-of-ways—Foliage sprays, basal applications, and cut-surface treatments may all be useful depending on the size and abundance of the vegetation. Aerial spraying in these situations is still in the developmental stage.

Woody weeds in forests, tree plantations, and farm woodlands—Chemicals may be useful in reducing competition by brush to desirable evergreens. They can also be used in connection with preparation of areas to be planted to forest plantations. In many of these chemical applications temporary control rather than permanent eradication of the woody weeds may be enough to accomplish the purpose.

For purposes of freeing young evergreens from brush competition, foliage sprays as described are generally recommended. Where the brush consists of hazel, willow, or alder, 2,4-D is adequate. For the control of blackberries, raspberries, cherry, ash, basswood, and maple, 2,4,5-T is more effective. For mixed brush populations, mixtures of 2,4-D and 2,4,5-T are recommended. Such applications, properly made, will usually be effective in reducing competition to evergreen seedlings for three to five years. Where control for a longer period is necessary, repeat the sprayings.

Where brush control is necessary before planting trees for forest plantations, foliage treatments using 2,4-D, 2,4,5-T, or ammonium sulfamate can be used. If evergreens are already present use 2,4-D or 2,4,5-T to avoid killing them.

Chemical treatment can be useful in reducing overhead competition in established plantations and in eliminating poorly formed trees or inferior species from sapling or pole-size forest stands. For this purpose cut-surface applications in frills or basal applications are recommended.

Eradication of poisonous or disease-carrying plants—European barberry, the alternate host of stem rust of wheat, oats, barley, and rye, may be killed by these methods: (1) common salt applied around the base of the plant, (2) ammonium sulfamate applied to cut surfaces of cane stubs at the ground line, (3) sprays containing 14 pounds MCP ester in 100 gallons of oil, and (4) 2,4-D and 2,4,5-T plus PCP as a basal spray with special emphasis on the ground line.

Currants and gooseberries are the alternate hosts of white pine blister rust. Upland species of these plants can be killed by basal treatments using 14 pounds of 2,4,5-T ester in 100 gallons of oil.

Poison ivy can be killed by foliage sprays of ammonium sulfamate or 2,4,5-T as previously described. The entire plant and ground area should be drenched. A dormant season spray of 12 pounds of 2,4,5-T ester per 100 gallons of oil may also be used. Treatments using borax formulations dissolved in water (1 pound per gallon) may also be used.

WEEDS IN WASTE PLACES

WEEDS in places where it is difficult to plow or mow or where complete vegetation control is desired can be controlled with herbicides, but the cost on an acre basis may be rather high. Larger dosages than those recommended will give better and more lasting control. Larger dosages are generally more necessary on low ground than on high, dry locations.

Lower dosages and less water or other carrier are needed if applications are made before growth becomes large and dense.

For a temporary kill, 3 pints of DNAP or DNBP phenol in 3 or more gallons of diesel oil diluted with water to 40 gallons per acre gives a quick kill, but grass and perennial weeds quickly recover.

Polybor chlorate at about 1,600 pounds per acre (10 pounds per square rod) in 1,000 or more gallons of water gives a quick kill of all herbaceous vegetation and should last for at least one season.

CMU at 40 or more pounds per acre applied in either fall or spring gives nearly complete vegetation control for at least one or two years. CMU is very slow acting and if applied in April it might take until July for all vegetation to be killed. Some deep-rooted weeds such as morning glory and Canada thistle may require a follow-up application with 2,4-D in order to keep the ground bare of vegetation.

WEED KILLERS AND LIVESTOCK POISONING

THE CONTROL of weeds by the use of various chemicals has presented the problem of poisoning of livestock. Poisoning is sometimes attributed to the use of herbicides on plants where livestock have grazed, but generally, reported cases of poisoning are the result of accident or mismanagement.

Investigators have found that even when dosages larger than those recommended by the manufacturers were sprayed on pasture forage and grazed by such animals as sheep, swine, cattle, horses, and chickens, none of the herbicides used had any serious effect. Since the rates used were two to four times

greater than the recommended dosage, it seems that farm use of these materials for pasture weed control is reasonably safe.

The sprays used in these experiments were DNBP, DNBP ammonium salt, TCA, PCP, and three forms of 2,4-D: sodium salt, amine salt, and ester.

Another investigator has found that a sheep will die if dinitros are introduced directly into its stomach. The same amount of chemical sprayed on green vegetation and fed to the animal causes no trouble, however.

A disease called methemoglobinemia can result from many substances such as fertilizers, preservatives, explosives, and other industrial compounds, as well as weed killers. In this disease tissues cannot use oxygen from the blood. Sodium nitrite is most likely to produce this disease, followed by nitrate and chlorate.

Swine, cattle, and sheep are all very susceptible to this disease. The symptoms include a gradually increasing bluish tint in the mucous membranes and a chocolate-brown color to the blood.

As the disease progresses, the heart beats faster and breathing becomes quicker. The animal loses control of its movements, it trembles, saliva comes from its mouth, the eyeballs make jerky movements, and the animal finally lapses into a coma.

One form of this disease is sodium chlorate poisoning, which occurs since animals are attracted by the salty taste of the chemical. The symptoms of this type of poisoning include diarrhea and blood and urine changes. Later the symptoms of methemoglobinemia mentioned above appear, and the animal dies.

Methemoglobinemia should be treated early with an intravenous injection of methylene blue. This can cure animals even in advanced stages of the disease.

It is rare for animals to feed on foliage treated with arsenicals since these kill the foliage quickly and the animals also do not like its taste. However, arsenicals can contaminate feed or water and thus result in poisoning.

Dinitro compounds kill weeds quickly and they rarely poison animals except when they get into feed. It has been found that a pound of another weed killer, 2,4-D, can be fed to a cow over a two-week period without the animal developing symptoms of poisoning.

There have been several instances in Minnesota where sprays containing 2,4-D were thought to have caused the death of animals, but investigation revealed that death was due to other causes such as poisons in the plants themselves.

To insure proper use of their products and protect users manufacturers take every precaution possible before releasing them to the public. But problems that could not be anticipated may develop in large-scale use of these products. For this reason it is always a good idea to be careful and avoid unnecessary exposure of animals. Always study the directions on the container carefully before using any weed killer.

FARM SPRAYER CALIBRATION AND ADJUSTMENT

UNIFORM APPLICATION of spray chemicals is essential to control weeds. A small variation in the rate of application may fail to kill the weeds or may injure the crop, thereby causing a loss of time, effort, and money.

To calibrate the sprayer accurately it is first necessary to determine whether or not each nozzle is discharging at a uniform rate. Clean each nozzle thoroughly and then with the sprayer in a stationary position, run clear water through at normal spraying pressure. Catch the discharge from each nozzle in a quart fruit jar, watching to see whether the level of the liquid in the jars rises uniformly. Nozzles which vary from the rest should be replaced.

If there is a gradual decrease toward the ends of the boom in the amount of liquid from each nozzle, the boom is too small. Boom capacity can be checked by catching the discharge from a nozzle at the end of the boom and from one near the inlet hose feeding the boom. Fruit jars should be placed under the nozzles simultaneously.

Compare the discharge from the two nozzles. If there is variation the nozzles should be interchanged and another test made. If the variation remains relatively the same the boom is too small or restricted. The variation should not be over 10 to 15 per cent. When it is more than that, a new boom should be provided as its cost will be a small fraction of the crop to be saved or the chemical which is wasted.

A simple method for determining the amount of liquid a sprayer applies per acre is as follows:

1. Start with a full tank of clean water and have the pressure adjusted as you will use it in the field (usually 30 to 40 pounds).

2. Drive exactly ⅛ of a mile (40 rods) in a field at the speed you will use when spraying—usually 4 to 5 miles per hour. Mark the notch the throttle is in and keep it in this notch when spraying.

3. Refill the tank, carefully measuring the amount of liquid required.

4. Calculate the application rate as follows:

$$\frac{\text{Number of gallons used} \times 66}{\text{Boom coverage in feet}} = \text{Gallons per acre}$$

Example: If 2½ gallons were used in ⅛ mile and the width covered by the boom is 24 feet, multiply 2½ by 66 and divide by 24. The result is 6.9 gallons per acre.

$$\frac{2.5 \times 66}{24} = \frac{165}{24} = 6.9 \text{ gallons per acre}$$

Here is the way to determine the amount of 2,4-D to be put in the tank.

1. Divide the number of gallons the tank will hold by the number of gallons your sprayer applies per acre. This will give you the number of acres one filling will spray.

2. Multiply the number of acres the tank will spray by the amount of 2,4-D to be used per acre. This will give the amount of 2,4-D to be used per tank.

Example: If the tank holds 55 gallons and the sprayer applies 6.9 gallons per acre, one tank will spray 8.0 acres (55 divided by 6.9 equals 8.0). If 1 pint of spray material is required per acre, 8.0 pints would be required for each tankful. That is, 1 pint per acre $\times$ 8.0 acres $=$ 8.0 pints per tankful.

When refilling a partially filled tank, first determine the number of gallons you will need. Then divide this by the num-

ber of gallons the sprayer applies per acre to get the number of acres you will spray with what you are adding. Multiply this by the number of pints of 2,4-D required per acre to get the amount of 2,4-D to be added to the tank. Add the 2,4-D and then fill the tank with water.

The case may arise where you want to spray a small area and you will not need a full tank of solution. The problem then is to determine how much water and 2,4-D to put in the tank. Multiply the number of gallons per acre that the sprayer applies by the number of acres to be sprayed. This is the total amount of solution required.

Then multiply the amount of 2,4-D supplied per acre by the number of acres to be sprayed to get the total amount of 2,4-D to be added to the tank. Add the 2,4-D to the tank before the water.

Example: If 5 acres are to be sprayed and the sprayer applies 6.9 gallons per acre, $5 \times 6.9 = 34.5$ gallons of solution to be applied to five acres. If 1½ pints of 2,4-D are to be applied per acre, $5 \times 1\frac{1}{2} = 7\frac{1}{2}$ pints of 2,4-D. Add the 2,4-D to the tank and then enough water to bring the liquid level in the tank up to the 34.5 gallon mark.

Vibration, wear on pump, corrosion, partial clogging of nozzles and strainers, and changes in field conditions are factors which affect the discharge rate of the sprayer. For these reasons keep close watch on the spraying operation and check the calibration often.

Remember that calibration of a sprayer is accurate only for the set of conditions under which it is made. Changes in speed, pressure, or field conditions are factors which will make a new calibration necessary.

AERIAL SPRAYING

THE most advantageous use of aerial spraying at present is for brush control; for weed control in small grains, pastures, ranges, and other large areas; and for preharvest applications.

Even distribution is essential in all herbicide applications and a minimum of drift is desirable. Therefore, the swath width should be 40-45 feet or less and the altitude should be as close to the foliage as safety of the pilot and equipment will permit (boom 4 to 5 feet above foliage on flat terrain and even growth—more clearance on uneven growth and terrain). The plane should be operated crosswind in order to maintain constant ground speed, but where it is necessary to fly parallel to the wind, it is desirable to fly upwind only.

Spray when the wind velocity is as low as possible. The following wind velocities are suggested as maximums for these representative conditions:

2,4-D in mixed farming area at 1-2 gal/acre	wind velocity 5 mph
2,4-D in mixed farming areas at 5 gal/acre	wind velocity 8 mph
2,4-D in range country at 1-2 gal/acre	wind velocity 8-10 mph
Chemical driers anywhere at 5-8 gal/acre	wind velocity 8-10 mph

If aerial spraying is recommended in areas where susceptible crops are grown, use only low volatile materials.

Large droplets minimize probability of drift, so nozzles with large holes should be used. Each nozzle should be equipped with a positive shutoff. Since light oil carriers break up in finer

droplets than water because of lower surface tension, water or emulsions should be considered where drift presents a hazard.

Many chemicals settle out of solution or emulsion when allowed to stand, so mix each planeload just prior to take-off or agitate the spray solution in an auxiliary tank thoroughly before removing each planeload. It is desirable that each plane have positive agitation equipment in the tank.

All owner-operators and pilots should be familiar with the character of the chemical being used, and owner-operators should exercise close control over the operation of their planes. In the interests of safe operation, each plane should be equipped with all of the necessary safety equipment (helmets, masks, dump valves).

The following are considered desirable features of aerial spray equipment:

Tank—The spray tank should be of light-weight material; aluminum and stainless steel are preferred for corrosion resistance. The tank should have a large filler opening to allow for easy cleaning and filling, and it should have baffles to prevent surging.

Pump—Positive displacement pumps of the gear type produce high pressures and require a relief valve, while centrifugal pumps with lower maximum pressures do not need a relief valve and are capable of handling suspensions. Pumps driven by external fans need a brake assembly and engine-driven pumps require a clutch.

Booms—Streamlined booms produce less drag than round ones. All booms should be fitted with caps at the ends for cleaning. The boom should have fewer nozzles in the 3- to 4-foot space left of center and more nozzles to the right of center to overcome spray displacement caused by propeller slip stream.

PREHARVEST APPLICATIONS

THE PRESENCE of weeds and green crop material in many crops at harvest time frequently complicates harvest operations and results in considerable loss of seed. Experiments in the North Central Conference area have been rather limited in this field, and in view of this the following suggestions are offered:

Flax—1.25 to 1.87 pounds of DNBP or 2-4 pounds of PCP applied in 5-10 gallons of diesel fuel per acre have given satisfactory drying of flax. Also suggested for limited trials is 1.25 pounds Endothal plus 6.25 pounds of ammonium sulfate in 20 gallons of water per acre.

Soybeans—Use the same materials and rates that are recommended for flax. Apply the treatment when the beans are nearly mature, or some reduction in yield and quality may be expected.

Alfalfa and clovers—Recommended treatments are DNBP at 1.25 to 1.87 pounds in 5-10 gallons of diesel fuel per acre or PCP at 4-6 pounds in 5-10 gallons of diesel fuel per acre. If weedy grasses are present, 1 pound of Endothal with 4 pounds of ammonium sulfate in 20-30 gallons of water per acre may give more satisfactory results.

MECHANICAL CONSIDERATIONS

MECHANICAL CONSIDERATIONS of a good program of weed control involve equipment used in seed cleaning, tillage, chemical spraying, and harvesting. It is recommended that all of these implements be included if possible in setting up the weed control program.

Tillage Equipment

The effectiveness of tillage operations depends on the timing, speed, and adjustments of the implement. Consider all three variables carefully in connection with the soil type and condition and the crop.

The adjustment of a cultivator is especially important. It should give as much weed control as possible within the crop row and avoid injury to the plant or pruning of the roots. Use floor line diagrams for proper spacing and depth adjustments of tillage implements.

Sprayers

Be careful in the selection, service, and repair of a farm weed sprayer. Deal only with reputable dealers and manufacturers capable of furnishing service and parts when needed.

Take into consideration the fact that other pest control operations may require use of a sprayer around the farm. This is especially important in the choice of the pump and the sprayer mounting.

Choose equipment constructed of materials which are resistant to corrosion by the common herbicides. Choose materials, coatings, hose, and gasket material which are unaffected by the oils and solvents used with these herbicides.

Some of the desirable features of a good weed sprayer are as follows:

Tank—The tank should be strong enough to withstand the pressure of the fluid splashing around inside and its size should be suitable to the discharge of the pump and the amount of spraying to be done. An opening should be provided which will allow for cleaning the inside when necessary, and there should be some provision for draining. Be sure there is a method provided for agitation within the tank either by mechanical means or by sufficient by-pass from the pump.

Suction strainer—This strainer should be fine in order to remove as much foreign material from the solution as possible and yet large enough that it will not throttle the suction action of the pump. Since this requires a compromise, take special care to have your spray solution clean when you fill the tank. The strainer should be easily removable for cleaning if necessary.

Pump—The pump should be large enough and effective enough to maintain adequate working pressure and flow to meet the particular conditions of the spraying operation. An important point to consider in the case of power take-off pumps is maintaining the pressure and flow at reduced PTO speeds when used with tractors where the choice of gear and speed may require operation at less than full throttle.

Regulating valve and pressure gauge—These two closely associated appliances should be within easy reach and sight of the

operator. The markings on the gauge should be suited to the spraying operation.

Boom—Booms should be strong and adequately hinged to prevent breakage and permit convenient transportation. They should be large enough to prevent a significant pressure drop at the end nozzles. In view of the concentrations at which many herbicides are used, be especially careful in selecting nozzles and be sure they are performing well.

Other features essential to a good sprayer are a quick-acting shut-off valve, line filter between the pump and boom, individual filters at each nozzle, and some device for measuring the fluid in the tank.

Calibration—The sprayer should be calibrated to each particular operation. The best method of calibration is to make initial adjustments to suit the machine and job requirements, then make a trial run to determine the actual output, and then mix the herbicide accordingly. Check this calibration frequently during the operation for such things as wear on the hole of the nozzle. Such checking is especially important when abrasive solutions are used.

Maintenance—After each use of the sprayer, flush the tank, pump, boom, nozzles, and exterior of the equipment with water. When you prepare the sprayer for winter storage, coat all bare metal parts with oil. As an added precaution, leave pumps disassembled during any long storage.

For each piece of harvesting equipment a strict individual cleaning program should be followed before moving the machine from place to place.

DESCRIPTION OF HERBICIDES

All rates of 2,4-D, 2,4,5-T, MCP, and TCA refer to acid equivalent, rates of PCP, DNBP, and DNAP refer to phenol equivalent, and rates of PMA, IPC, CIPC, CMU, MH, SES, NP, and KOCN refer to active ingredient. Avoid direct contact with skin and eyes—especially repeated or prolonged contact with all chemicals.

Ammonium sulfamate—Ammate

Borascu—agricultural borax, contains 34 per cent B_2O_3

Calcium cyanamid—Aero Cyanamid, special grade or granular

CMU—3-(p-chlorophenyl)-1, 1-dimethylurea, contains 80 per cent active ingredient

Concentrated Borascu—contains 61.5 per cent B_2O_3

DNAP—4,6-dinitro-o-sec-amyl phenol, Sinox General

DNBP—4,6-dinitro-o-sec-butyl phenol, Dow General, contains 5 lbs. of active ingredient per gal.

DNBP ammonium salt—Sinox W and Dow Selective, contains 1 lb. of active ingredient per gal.

DNBP amine salt—Premerge, contains 3 lbs. active ingredient per gal.

Endothal—disodium 3,6-endoxohexahydrophthalate

IPC and CIPC—isopropyl-N-phenylcarbamate and isopropyl-N-(3-chlorophenyl) carbamate

MCP—amine salt of 2-methyl-4-chlorophenoxyacetic acid

Methyl-bromide—bromomethane, soil fumigant

MH—sodium salt of maleic hydrazide, contains 40 per cent active ingredient

NP—N-1-naphthylphthalamic acid; Alanap is the sodium salt, containing 2 lbs. active ingredient per gal.

PCP—sodium salt of pentachlorophenol, water soluble

PMA—phenyl mercuric acetate, 10 per cent active ingredient

Polybor—contains 66.6 per cent B_2O_3

Polybor chlorate—contains 50 per cent B_2O_3 and 25 per cent sodium chlorate

Potassium cyanate—contains 91 per cent active ingredient

SES—2,4-dichlorophenoxyethyl sulfate, Crag Herbicide

Sodium chloride—common salt

Sodium chlorate—highly flammable when mixed with organic materials

Stoddard solvent—petroleum distillate, contains 15 to 18 per cent aromatics

TCA—sodium salt of trichloroacetic acid

2,4-D—2,4-dichlorophenoxyacetic acid, formulated as sodium and amine salts and esters

2,4,5-T—2,4,5-trichlorophenoxyacetic acid, formulated as sodium and amine salts and esters

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