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Chemical Weed Control in Crops

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Figure 1. Sprayer swaths should lap for even coverage of fields sprayed. However, such skips leave check areas to show the value of controlling such weeds as mustard. Such checks have shown a decrease of 50 bushels in oats where mustard wasn't sprayed.

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Chemical Weed Control in Crops

Clean seed, proper seedbed preparation, good rotations, and sound soil management practices are prime requisites for controlling weeds in crops. They will eliminate many annual weeds and prevent infestation by most perennial weeds. Herbicides are valuable supplements to these practices. However, if we rely solely on chemicals and neglect standard practices, resistant weeds would increase.

Once weeds become established, special practices are needed to eliminate them. These practices include the use of special cultivation, competitive crops, and herbicides in addition to the practices already mentioned. One application of any one method seldom eliminates all perennial weeds. Even though the weeds may be eliminated, a new infestation can become established from dormant weed seed in the soil. Some of these seeds remain viable for as long as 20 years and many years of diligent work are required to eradicate them.

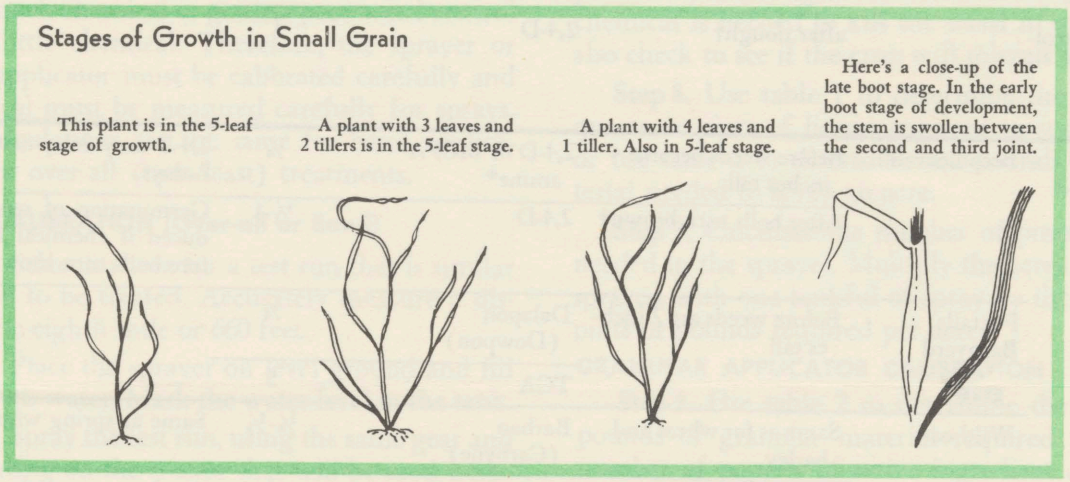
Numerous tillage and chemical methods that will control weeds in crops are available. In fact, it is possible to eliminate some of the most persistent perennial noxious weeds while growing crops if the proper combination of crops, cultivation, and herbicides is used.

For detailed information, see publications that discuss control and elimination of specific noxious weeds or wild oats, or weed control in crops and trees.

When using chemicals for weed control in crops (small grain especially), it is important to do it at the earliest possible time. This is important for two reasons: (1) the weeds are easier to kill when young and (2) the weeds are competing with the crop for moisture and nutrients. If competition is not removed early, weeds will cause yield reductions in the crop. This quite often happens by the time weeds are 6 inches tall.

In experimental work weed-free wheat yielded 45 bushels per acre. Wheat infested with mustard sprayed at the 4-leaf stage yielded 43.5 bushels per acre, sprayed at the 6-leaf stage yielded 39.8 bushels per acre, sprayed at the early boot stage yielded 17.1 bushels per acre, the same as unsprayed wheat.

The most desirable growth stages for spraying both crops and weeds are relatively short. At this time the weeds are not easily seen; therefore, it is necessary to make a close inspection to determine the extent of the weed problem as well as the growth stage of the crop.



CONTROLLING WEEDS IN CROPS

On pages 2-4 are maximum pounds of 2,4-D and MCPA acid equivalent that can be tolerated by crops without serious injury to the crop under most conditions. Use only enough to control the weed.

Also presented are the rates of Dalapon, TCA, Diallate, Triallate, Trifluralin, 4(2,4-DB), Barban, Atrazine, Amiben, and CDAA in pounds of acid equivalent or active ingredient required for each acre of area treated to control the weed under the specified conditions. In band applications the actual area treated will be treated at the same rate as an over-all (broadcast) treatment, but the over-all acreage will have less total chemical applied.

In Canadian tests, higher yields were obtained when sufficient herbicide was applied to control the weeds. Rates of ¼, ½, 1, and 2 pounds per acre of herbicide were applied. Highest yields were obtained when 1 pound of 2,4-D or MCPA was applied to control perennial sowthistle in oats and 1 pound of 2,4-D was applied to control hemp nettle in oats and barley. The lower rates did not control the weeds and weed competition was more injurious to yield than the 1-pound rate of herbicide which gave good weed control and also damaged the crop. These data indicate that the use of a higher rate of application does not reduce crop yields if it controls the weeds.

Trade or brand names are listed in parenthesis after the chemical name. Trade names for 2-4,D, MCPA, and similar chemicals are too numerous to list here.

Crop	Weeds	Safest time to spray (Most tolerant growth stages of crop)	Chemical	Rate lbs./A.	Remarks
Oat Varieties Mo-0-205 Garry	Broadleaved	3-leaf to dough	2,4-D ester	½	(see "Weed Control in Small Grain" fact sheet)
			2,4-D or MCPA amine*	¾	
		after dough†	2,4-D	1	
Dupree Minhafer		5-leaf to dough	2,4-D ester	⅓	
			2,4-D or MCPA amine*	½	
Burnett Andrew		after dough†	2,4-D	1	
Other recommended varieties					
Spring wheat and barley (see "Weed Control in Small Grains" fact sheet)	Broadleaved	5-leaf to early boot	2,4-D ester	½	
			2,4-D amine	¾	
		after dough†	2,4-D	1	
	Wild oats	2-leaf stage, not more than 14 days after weed emergence	Barban (Carbyne)	⅓-⅜	Use 50-60 pounds pressure. Use as little water as possible. (1 gal./A. for air and 5 gal. for ground.)
		Pre-emergence	Triallate (Far-go) or (Avadex BW)	1¼ barley 1 wheat	Apply to a smooth surface and incorporate into soil no deeper than 2 inches immediately after treatment.
Winter wheat and rye (see Weed Control in Small Grains" fact sheet)	Broadleaved	Spring, fully stooled to boot	2,4-D ester	⅓	Do not spray in the fall.
			2,4-D amine	½	
		after dough†	2,4-D	1	
Flax (See "Weed Control in fact sheet)	Broadleaved	Before weeds become 4 inches tall	2,4-D or MCPA amine*	¼	2,4-D may delay maturity from 3-7 days.
		After bolls turn brown†	2,4-D	½-1	Germination of seed may be reduced if chemical is applied before bolls turn brown.
	Foxtails Barnyard grass	Before weeds are 2-inches tall	Dalapon (Dowpon)	¾	
			TCA	5	
	Wild oats	Same as for wheat and barley	Barban (Carbyne)	¼-⅓	Same as spring wheat and barley.
		Pre-emergence	Diallate (Avadex)	1½	Apply to a smooth surface and incorporate into soil no deeper than 2 inches immediately after treatment.
Corn (See "Weed Control in Corn" fact-sheet)	Broadleaved	Postemergence before silking after several days of cool weather	2,4-D ester	¼-½	Stalks often become brittle and may suffer damage due to breakage. Use drop nozzles after corn is knee high.
			2,4-D amine	½-¾	
		After tasseling†	2,4-D	1	Use high-clearance sprayer with drop nozzles.
	Numerous broadleaved and grassy annuals	Pre-emergence	Atrazine (Atrazine 80W)	2-3	Must have ½-1 inch of rainfall within 2½ to 3 weeks after application. Band appications will reduce cost. Carryover will damage small grain but will not damage corn seeded next year. Less carry-
		Early postemergence (before weeds are 1 inch tall and the corn is 4-5 inches tall)			

(cont.)

Crop	Weeds	Safest time to spray (Most tolerant growth stages of crop)	Chemical	Rate lbs./A.	Remarks
					over damage to small grains will occur if band applications are disked diagonally before the grain is seeded. Rainfall less critical for post-emergence. Use low rates on light soils.
		Pre-emergence	Atrazine (Atrazine 80W) + linuron (Lorox)	1+1	**Trial basis only.** Must have rainfall as with atrazine above. This mixture will minimize atrazine carryover to small grain next year.
		Pre-emergence	CDAA-T (Randox-T)	3.1	Must have ½ inch of rainfall within the first week after application. For several reasons granuals may be preferred over sprays here. Band applications will reduce cost. Very irritating to skin and eyes, wear protective clothing.
	Grassy annuals	Pre-emergence	(Ramrod)	4	**Trial basis only.** Must have rainfall as with CDAA-T. Dust from handling wettable powder may irritate eyes.
	Numerous broad-leaved & grassy annuals	Postemergence (directed spray) treat when corn is 8-16 inches tall	Dalapon-2,4-D mixture	1½-2 dalapon and ¾ 2,4-D	Use directed spray applicator that has attachments to lift corn leaves and nozzles that direct spray to base of corn plant and weeds in row. Do not allow dalapon to contact corn leaves as plants will become stunted and deformed.
		Treat when corn is 15 inches tall	Linuron (Lorox)	2	Use as above. More effecttive if surfactant is added. Kills leaf tissue it contacts and yields may be reduced if leaf kill is extensive.
Sorghum (See "Weed Control in Sorghum" fact sheet)	Broadleaved	4-12 inches tall	2,4-D ester	⅓	Heights are determined by measuring from ground to where a new leaf is emerging.
			2,4-D amine	½	
		After heading†	2,4-D	1	Use high-clearance sprayer with drop nozzles.
	Grassy annuals	Pre-emergence	CDAA (Randox)	4	As CDAA-T for corn.
	Numerous broadleaved and grassy annuals	Pre-emergence (medium to heavy soils only) Early postemergence before weeds are 1 inch tall and the crop is 4 to 5 inches tall	Atrazine (Atrazine 80W)	2-3	As atrazine for corn. **Do not apply pre-emergence treatment to light soils.**
		Pre-emergence	Propazine (Propazine 80W)	2	Rainfall requirements similar to atrazine. Carryover will damage small grain seeded next year.
Soybeans (See "Soybean Production" fact sheet)	Numerous broadleaved and grassy annuals	Pre-emergence	Amiben	3	Must have ½-1 inch of rainfall after treatment but before weeds emerge. Band application will reduce cost. Do not use on beans grown for hay or silage.
		Pre-emergence	Trifluralin (Treflan)	½-1	**Trial use only.** Use light rates on light soils and heavy rates on heavy soils. Incorporate immediately after application to a depth of 2 to 4 inches with a disk har- (cont.)

Crop	Weeds	Safest time to spray (Most tolerant growth stages of crop)	Chemical	Rate lbs./A.	Remarks
					row, harrow, or power driven rotary harrow. Is not effective on cocklebur, velvet leaf and ragweed. Store above 40° F. Do not feed forage or let livestock graze treated field.
	Grassy annuals		CDAA (Randox)	4	As CDAA-T for corn.
	Some broadleaved annuals such as cocklebur	Postemergence 7 to 10 days before soybeans bloom	4(2,4-DB) (Butyrac 175) or (Butoxone SB)	2-3 oz.	**Trial use only.** This rate is equal to 1 gallon of 1.75 lb./gal. acid equivalent material applied to 10 acres of beans. Use 10 to 12 gals. spray solution per acre.
Field Beans (Dry Beans)	Numerous grassy and some broadleaved annual weeds	pre-plant	EPTC (Eptam)	3	Apply to smooth surface soil and incorporate in soil 1½-2" deep immediately after application. **Don't graze or feed treated vines to livestock. Don't use on lima beans.**
Birdsfoot trefoil Alfalfa Red clover Alsike clover	Lambsquarters Mustards Ragweed Pigweed Marsh elder	New seedings when companion crop or weed canopy is 10-15" tall or established stands right after mowing	2,4-D amine or MCPA amine*	¼	
	Kochia Russian thistle Lambsquarters Pigweed	When legume is over 2 inches tall and weeds less than 3 inches	4(2,4-DB) amine	½-1	Do not graze or harvest for feed for at least 30 days after treatment. Do not use over ¾ lb. on red clover. Higher rates will kill tops of Canada thistles and bindweed.
			4(2,4DB) ester (Butyrac 118) or (Butoxone)	½-¾	
	Mustards Pennycress Smartweeds Ragweeds		4(2,4-DB) amine	1-1½	
			4(2,4DB) ester	¾-1	
Alfalfa Sweet clover Birdsfoot trefoil	Foxtails Barnyard grass	Seedlings alone or in flax, established stand after mowing	Dalapon (Dowpon)	1-2	Forage from treated crops should not be fed to livestock. Do not use high rate of dalapon in flax.
			TCA	5	
Alfalfa	Annual weeds	Preplant without companion crop	EPTC (Eptam)	2-3	Apply to smooth surface and incorporate into soil. Do not graze treated area or cut for hay within 60 days.
Grasses	Broadleaved	Seedlings after 4-leaf stage	4(2,4-DB) (Butyrac 118) or (Butoxone)	½-1	Don't graze or harvest for feed for at least 30 days after application.
			2,4-D MCPA	¾	Chemical residue may appear in milk if dairy cows graze within 5 days after spraying. Palatibility of poisonous plants may be increased and injure livestock. Keep livestock off treated area for 7 to 10 days.
		Established stands, any time (except heading time for seed fields), best weed control in June	2,4-D, MCPA, or 2,4-5-T	¾-2	Use ester formulations for woody and brushy plant control.

*MCPA is not so apt to injure the crop; however, it is less effective as a weed killer. Use only if mustards or lambsquarters are predominant weed species.

†Treatment at this stage will not remove weed competition early enough to improve crop yield; however, it may prevent weed seed production and will facilitate harvesting operations for small grain or flax.

AMOUNT OF CHEMICAL FOR WEEDS

The quantity of herbicide required for control varies with the weed species. The same amount of herbicide is less effective as the weed matures. The amount of 2,4-D or MCPA required to control numerous weeds at different stages of growth is listed below.

¼ lb./A.	⅓ lb./A.	½ lb./A.	¾ lb./A.	1 lb./A. or more
Kochia, 2-4 in.	Kochia, 4-8 in.	Kochia, over 8 in.	Canada thistle	Blue lettuce
Marsh elder, 2-4 in.	Marsh elder, over 4 in.	Cinquefoil	Dandelion	Yarrow
Ragweeds, 2-4 in.	Ragweeds, over 4 in.	Gumweed, 6-12 in.	Field bindweed	Goldenrod
Pennycress, 4-6 in.	Pennycress, over 6 in.	Mare's tail	Perennial sowthistle	Hoary cress
Pigweeds, 2-4 in.	Pigweeds, over 4 in.	Puncture vine	Floodman's thistle	Leafy spurge
Mustard, 4-6 in.	Mustard, over 6 in.	Plantains	Bull thistle	Russian knapweed
Lambsquarters, 4-6 in.	Lambsquarters, over 6 in.		Burdock (early)	Sand sage brush
	Cocklebur, 2-6 in.	Cocklebur, over 6 in.		Vervain
	Sowthisle, annual, 2-6 in.	Sowthistle, annual, over 6 in.		Toadflax
	Sunflower, 2-6 in.	Sunflower, over 6 in.		Water hemlock*
	Lady's thumb, 2-6 in.	Lady's thumb, over 6 in.		Fringe sage*
	Velvet leaf, 4-6 in.	Velvet leaf, over 6 in.		Buckbrush*
	Wild lettuce, 4-6 in.	Wild lettuce, over 6 in.		Bur ragweed*
	Russian thistle, 2-4 in.	Russian thistle, 4-6 in.		Big sage brush*
	Wild buckwheat, 2 leaves			Wildrose*
	Morning glory, annual			Willows*
	Peppergrass, annual			

* These weeds require at least 2 lbs. acid equivalent per acre.

CALCULATING THE AMOUNT OF CHEMICAL TO APPLY PER ACRE

When applying chemicals in spray or granular form, it is essential to know exactly how much chemical is applied per acre. With sprays, it is also essential to mix water and chemicals in the right proportions. If this is not done, there is danger of injuring the crop with too much chemical or getting poor weed control with too little chemical. Therefore, the sprayer or granular applicator must be calibrated carefully and the chemical must be measured carefully for sprays.

The calculations are the same for band applications as for over-all (broadcast) treatments.

SPRAYER CALIBRATION (Over-all or Band)

Step 1. Select an area for a test run that is similar to the field to be treated. Accurately measure a distance of one-eighth mile or 660 feet.

Step 2. Place the sprayer on level ground and fill the tank with water. Mark the water level in the tank.

Step 3. Spray the test run, using the same gear and throttle setting on the tractor that will be used when spraying—usually 3 to 5 miles per hour. Also use the same spray pressure that will be used when spraying —somewhere between 30 and 50 pounds.

Step 4. Return the sprayer to the original filling position, on level ground, and measure the amount of water required to refill the tank to the mark.

Step 5. Multiply "66" times the amount of water required to fill the sprayer. Divide this answer by the width (feet) of the spray swath. This may be the width of swath from a regular field sprayer or may be total of several bands (4 x14″=56″ or 4⅔′) or (6 x 7″=42″ or 3½′). This gives the number of gallons applied per acre.

Step 6. Determine the number of acres that can be sprayed with one tankful of spray. Divide the number of gallons in the tank by the number of gallons applied per acre.

Measurement of Chemical for Sprays

Step 7. Determine the amount of chemical needed per acre by checking in the fact sheet to see how much chemical is needed to kill the weed in question and also check to see if the crop will tolerate this amount

Step 8. Use table 1 to determine the number of quarts or pints of liquid required to spray an acre, or use table 2 to determine the pounds of dry material needed to spray an acre.

Step 9. Calculate the number of pints or pounds needed in the sprayer. Multiply the acres that can be sprayed with one tankful of spray by the number of pints or pounds required per acre.

GRANULAR APPLICATOR CALIBRATION

Step 1. Use table 2 to determine the number of pounds of granular material required to give the number of pounds of active ingredient desired. For example, 20 pounds of CDAA granules containing 20% active ingredient contain 4 pounds of CDAA.

Step 2. Consult applicators manufacturer's rate chart to determine the approximate setting required for the number of pounds of granules to be applied (20 pounds in step 1). Adjust setting on each hopper.

Step 3. Select an area for a test run that is similar to the field to be treated. Accurately measure a distance of one-eighth mile or 660 feet.

Step 4. Fill hoppers and attach a container (sack, pail, etc.) to each hopper for catching granules separately from each hopper.

Step 5. Put machine in gear and drive the test run, driving at the same speed that will be used when applying the chemical.

Step 6. Multiply "66" times the number of pounds collected from each hopper separately. Divide each answer by the total width (feet) treated by each hopper (2 x 14″=28″ or 2⅓′ feet for 2-row bands.) This gives the pounds of granular material applied per acre. If this is not the desired amount (20 pounds in step 1), readjust machine and repeat entire procedure until desired amount is obtained.

Table 1. Conversion of Pounds to Pints or Quarts for Liquid Formulations

If you wish to apply this many pounds per acre	Your chemical contains this much acid equivalent or active ingredient per gallon						
	1.00	2.00	2.64 or 2.68	3.00	3.34 or 3.40	4.00	6.00
	Apply this amount on each acre						
⅛	1 pt.	½ pt.	⅜ pt.	⅓ pt.	3/10 pt.	¼ pt.	⅙ pt.
¼	1 qt.	1 pt.	¾ pt.	⅔ pt.	⅗ pt.	½ pt.	⅓ pt.
⅓	1⅓ qt.	1⅓ pt.	1 pt.	8/9 pt.	7/9 pt.	⅔ pt.	4/9 pt.
½	2 qt.	1 qt.	¾ qt.	⅔ qt.	1⅕ pt.	1 pt.	⅔ pt.
¾	3 qt.	1½ qt.	1⅛ qt.	1 qt.	9/10 qt.	1½ pt.	1 pt.
1	1 gal.	2 qt.	1½ qt.	1⅓ qt.	1⅕ qt.	1 qt.	1⅓ pt.
1½	1½ gal.	3 qt.	2¼ qt.	2 qt.	1⅘ qt.	1½ qt.	2 pt.
2	2 gal.	1 gal.	3 qt.	2⅔ qt.	2⅖ qt.	2 qt.	2⅔ pt.

Table 2. Conversion of Pounds Active Ingredient to Pounds of Product for Powders and Granules

If you wish to apply this many pounds per acre	Your chemical contains this percentage of acid equivalent or active ingredient							
	4%	8%	10%	11.7%	20%	75%*	80%†	84%+
	Apply this amount on each acre							
1	25 lb.	12½ lb.	10 lb.	8½ lb.	5 lb.	1⅓ lb.	1¼ lb.	1⅕ lb.
2	50 lb.	25 lb.	20 lb.	17 lb.	10 lb.	2⅔ lb.	2½ lb.	2⅖ lb.
3	75 lb.	37½ lb.	30 lb.	25½ lb.	15 lb.	4 lb.	3¾ lb.	3⅗ lb.
4	100 lb.	50 lb.	40 lb.	34 lb.	20 lb.	5⅓ lb.	5 lb.	4¾ lb.
5	125 lb.	62½ lb.	50 lb.	42½ lb.	25 lb.	6⅔ lb.	6¼ lb.	6 lb.

*85% sodium salt of dalapon. †90% sodium salt of TCA.
+95% sodium salt of TCA.

SAFETY FIRST

Use care in following the directions listed above or on the manufacturers label. The use of herbicides is recommended only when the chemicals are registered by the U. S. Food and Drug Administration as to tolerances for application on crops raised for human food and livestock feed. Read the label first—not afterward.

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