EVALUATION OF PESTICIDE SUPPLIES AND DEMAND FOR 1979

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ABSTRACT

Pesticide supplies for the 1979 crop season appear adequate for all major uses. Production is expected to be up about 2 percent and inventories are up about 4 percent. Net supplies should be about 5 percent greater overall than last year. Because of increasing production and distribution costs, prices are expected to advance slightly over last year's levels, 2 to 3 percent. Pesticide demand estimates, up 5 to 6 percent over last year, are based primarily on farmers' planting intentions for 1979. Supply estimates are based on a survey of basic pesticide manufacturers and discussions with major distributors.

Key words: Pesticide production, pesticide supply, pesticide demand, pesticide prices, pesticide outlook, pesticide regulations.

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PREFACE

This report is prepared annually to provide manufacturers, distributors, growers, and policymakers with comprehensive pesticide situation and outlook information. Supply sections are based on a survey of pesticide manufacturers and on discussions with distributors. Demand sections are based on January 1979 farmer planting intentions and on available data on rates of use. Information on pesticide regulations is based on data from the U.S. Department of Agriculture, the U.S. Environmental Protection Agency, and other sources.

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Supply Outlook

Farm pesticide supplies should again be adequate for the 1979 season--about 5 percent greater than last year. Insecticide supplies are up about 7 percent and herbicide supplies up 4 percent, while fungicide supplies are down 2 percent from a year ago.

Pesticide production is scheduled for an overall increase of only 2 percent over last year, compared to a 10- to 15-percent a year rise during 1972-75. Production for 1979 is expected to be up 1 percent over 1978 for herbicides, 2 percent for insecticides, and 7 percent for fungicides.

Manufacturers' carryover stocks into the 1979 season at 27 percent of last years' production are reported to be up about 17 percent over last year, with herbicide stocks up 18 percent and insecticide stocks up 26 percent. Fungicide stocks, however, are down about 27 percent.

Production facilities are operating at a slightly lower output rate than last year--81 percent of capacity, compared to 83 percent a year ago. Producers expect to expand production capacity for herbicides and insecticides by 3 or 4 percent in 1979. New production facilities, however, are expected to add 11 percent to total fungicide capacity in 1979.

Demand Outlook

Herbicide use is likely to be up about 5 percent over last year because of some increase in acreage and more intensive use. Herbicide use on corn and soybeans is expected to be 5 percent greater than last year. Use is likely to be up 6 percent for cotton and 2 percent for small grains.

Insecticide use should be up about 6 percent overall, primarily because of greater use on cotton.

Pesticide Prices

Average farm pesticide prices are likely to be up 2 to 3 percent, but prices of some products, particularly among the corn herbicides, will probably be down slightly.

Manufacturer prices of pesticides were generally unchanged between January 1978 and January 1979. The price of 2,4,5-T, however, more than doubled during this period. Manufacturer prices are expected to remain mostly unchanged in 1979.

Regulations

Federal pesticide control law was again revised in 1978. New features

should help expedite the registration process and make pesticides more readily available for local and minor use situations.

Pesticide reregistration is continuing. Pesticides which exceed certain hazard trigger levels are being reviewed under the Rebuttable Presumption Against Registration (RPAR) process. About 85 products, accounting for over one-fourth of all farm pesticides are currently included in this activity. As of mid-February 1979, final position documents were issued on two products: DBCP and chlorobenzilate. Proposed decisions were also issued for amitraz, pronamide, and endrin.

Fourteen pesticides were identified January 9, 1979, for restricted use classification. These products, or selected formulations, are to be applied only by certified applicators. Most commercial farmers are now certified to apply restricted use pesticides.

World Trade

World trade accounts for about one-fourth of the U.S. pesticide production in terms of dollar value, and about one-third in terms of pesticide quantities. With demand in the developing countries growing and restrictions on domestic pesticide use increasing, exports are likely to comprise an increasing share of U.S. production.

Evaluation of Pesticide Supplies and Demand for 1979

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INTRODUCTION

This study analyzes the factors affecting pesticide supply and demand for the 1979 crop season. The supply section of this report is based on data obtained from 16 basic pesticide manufacturers (which account for slightly over half of the farm pesticides produced) and from regional pesticide distributors. The demand section is based on 1979 farm planting intentions and data for acres treated and rates of application.

The need for updated market and outlook information on farm pesticides has become increasingly important in recent years because of uncertainties in supplies, demands, and Government regulations. Pesticide use is determined by the kinds of commodities produced, crop acreages, pest populations, weather conditions, and pesticide prices. Pesticide supplies are affected by market prospects, available production capacity, and carryover stocks.

PESTICIDE SUPPLIES

Pesticide supplies for 1979 are expected to be slightly larger--about 5 percent--than last year. Insecticide and herbicide supplies are up 7 percent and 4 percent respectively, with fungicide supplies 2 percent below last year's level (table 1).

Manufacturers are again limiting pesticide production increases for 1979, with an overall production rise of only 2 percent anticipated. This compares with average annual increases of 10 to 15 percent during 1972-75. The modest increase in output is attributed to substantial herbicide price declines last season and to herbicide and insecticide stock accumulations during the year.

Manufacturers' starting inventories for 1979, at 27 percent of last year's production, are reported to be up an average of 17 percent over the start of the 1978 season. Insecticide inventories going into the 1979 season amounted to 29 percent of last year's production, up 27 percent from a year ago. Beginning 1979 herbicide inventories were equal to 26 percent of the 1978 production, up

Table 1--Pesticide production and inventories for basic pesticide producers, 1978 and estimated 1979 1/

Item	Fungicides	Herbicides	Insecticides	All pesticides
		Percent		
Projected 1979 production (percent of 1978)	107	101	102	102
Inventory carryover:				
For 1979 (percent of production) 2/	24	26	29	27
Percent change from 1978	-27	18	26	17
Projected 1979 net supply (percent of 1978)	98	104	107	105

1/ Based on a survey of 16 basic pesticide producers conducted in November-December 1978.

2/ Inventories at the start of the season are based on production in 1978.

18 percent from a year earlier. Starting 1979 fungicide stocks, at 24 percent of last year's production, were 27 percent below year earlier levels.

Because of fairly stable market prospects and substantial capacity expansions in recent years, few producers are adding to their production capacity this year. New facilities are expected to add only 4 percent to total pesticide production capacity for 1979 (table 2). This is about the same overall increase as was reported for 1978. Insecticide and herbicide production capacity is expected to be 3 and 4 percent greater, respectively, than last year. Additions to fungicide facilities, however, are expected to increase capacity for 1979 by 11 percent over 1978.

With a modest increase in capacity and only a small increase in output anticipated, facilities are operating at slightly lower utilization rates. Overall, pesticide facilities are reported to be operating at 81 percent of capacity compared to 83 percent last year.

Production in 1979 should be unhindered, with no raw material shortages expected. However, operating costs are increasing because of higher petroleum and labor costs. Government actions may cut into markets for some products on which final Rebuttable Presumption Against Registration (see discussion in this report) decisions are being made. Higher prices for some raw materials may also result in minor shifts in product mixes.

Table 2--Pesticide production capacity utilization and capacity expansion, 1978 and expected 1979 1/

Pesticide	Production as a percentage of capacity		Capacity expansion percentage change	
	1978	Projected 1979	1977-78	Projected 1978-79
	Percent			
Fungicides	83	80	3	11
Herbicides	81	79	3	4
Insecticides	87	85	4	3
All pesticides	83	81	5	4

1/ Based on a survey of 16 basic pesticide producers conducted in November-December 1978.

PRICES

With insecticide and herbicide supplies adequate in relation to demand as last year, prices are subject to continued downward pressure. Overall, a slight pesticide price rise of about 2 to 3 percent is likely because of increased costs such as for petroleum. Price increases will probably be greater for fungicides and insecticides than for herbicides. Although an overall price increase is anticipated, prices of some products, especially among the corn herbicides, should be down marginally.

Farm prices of insecticides and fungicides in 1978 were generally 2 to 10 percent higher than a year earlier. Herbicide prices were mostly down by similar percentages. Prices farmers paid for methyl parathion, captan, and carbaryl in 1978 were up 12 percent, 9 percent, and 3 percent, respectively, over the previous season (table 3). Prices of 2,4-D, atrazine, and trifluralin on the other hand, were down 11 percent, 8 percent, and 4 percent, respectively.

The price of atrazine dropped from $3.40 per pound of active ingredient in 1976 to $2.53 per pound in 1978. This drop can be attributed to increased output when a new producer entered the market and to increasing competition from other herbicide products. The 2,4-D herbicide suffered a similar price drop during this period. Prices which had doubled in the previous 2-year period dropped as a result of slack demand on the part of wheat growers in 1977 and 1978.

Manufacturers' asking prices for a group of major pesticide products as reported in "Chemical Marketing Reporter" were generally unchanged between

Table 3--Average prices paid by farmers for selected pesticides, 1976, 1977, and 1978

Pesticide product 1/	Price per pound of active ingredient 2/			Price change	
	1976	1977	1978	1976-77	1977-78
	------Dollars------			---Percent---	
Insecticides:					
Carbaryl	2.16	2.33	2.40	8	3
Malathion	2.86	2.78	2.76	-3	-1
Methyl parathion	2.34	2.00	2.23	-15	12
Parathion	2.65	2.60	2.66	-2	2
Toxaphene	.98	.91	.93	-7	2
Herbicides:					
Atrazine	3.40	2.75	2.53	-19	-8
Alachlor	--	3.68	3.71	--	1
Trifluralin	--	6.40	6.15	--	-4
2,4-D	2.53	2.10	1.87	-17	-11
2,4,5-T	4.38	4.75	4.95	8	4
Fungicides:					
Zineb	1.68	1.77	1.83	5	3
Captan	--	2.26	2.46	--	9

-- = Not available.

1/ Carbaryl, 80 percent wettable powder; malathion, 5 pounds per gallon emulsifiable concentrate; methyl parathion, 4 pounds per gallon emulsifiable concentrate; parathion, 4 pounds per gallon emulsifiable concentrate; toxaphene, 6 pounds per gallon emulsifiable concentrate; atrazine, 80 percent wettable powder; alachlor, 4 pounds per gallon emulsifiable concentrate; trifluralin, 4 pounds per gallon emulsifiable concentrate; 2,4,-D, 4 pounds per gallon emulsifiable concentrate; 2,4,5-T, 4 pounds per gallon emulsifiable concentrate; zineb, 75 percent wettable powder; and captan, 50 percent wettable powder.

2/ Prices for 1976 are reported for March 15. Prices for 1977 and 1978 are reported for May 15.

Source: (8 and earlier issues).

January 1978 and January 1979 (2).1/ However, the asking price for 2,4,5-T more than doubled during this period (table 4). While most January 1979 asking prices were unchanged from a year ago, farm prices of insecticides and

1/ Underscored numbers in parentheses refer to items in the reference section at the end of this report.

Table 4--Manufacturer asking prices for selected basic pesticides, January 1978 and January 1979

Pesticide product	Reported price per pound 1/		Percentage change 1978-79
	January 1978	January 1979	
	---Dollars---		Percent
2,4-D acid	.83	.83	0
DDVP	3.20	3.20	0
Malathion	.95	.95	0
Methoxychlor	.83	.83	0
Methyl parathion	.92	.92	0
Parathion	.87	.87	0
2,4,5-T acid	1.12	2.50	123
Toxaphene	.38	.38	0

1/ Prices reported for second week of January each year.

Source: (2).

fungicides were generally up and herbicide prices were down. Manufacturers' asking prices are expected to remain about the same in 1979.

PESTICIDE DEMAND

Total pesticide use by farmers in 1979 is expected to be somewhat higher than a year ago. Factors contributing to this increase include improved crop price prospects, and nearly stable pesticide prices. More intensive use of pesticides and more crop acres should also contribute to the gain.

January estimates indicate that farmers intend to plant slightly more corn than last year (10). Farmers planned to increase cotton acres by 6 percent, soybean acres by 4 percent, and spring wheat acres by 2 to 3 percent.

Herbicides

Herbicides will continue to be the dominant agricultural pesticide. With the exception of cotton, the rates of application and the proportion of acreage

treated with herbicides are increasing. Farmers are applying herbicides to previously untreated cropland and using more herbicides on treated land to obtain better weed control. In the corn producing States, 90 percent or more of the acreage is treated with herbicides. Current increases are largely because of more intensive use such as using specific herbicides on problem weeds. Rates of application and the proportion of acreage treated with herbicides seem to have stablized for cotton.

In 1979, total herbicide use by farmers is expected to increase about 5 percent, while net supply should be up about 4 percent. This is mainly due to modest increases in rates of application and the proportion of acreage treated for most major crops. Increases in corn, soybean, and cotton acreages should add to herbicide use. An increase in cotton acreage will add about 6 percent to herbicide use on this crop. More intensive use will be an important factor contributing to an expected 5-percent increase for corn and soybeans.

Herbicide use on small grains, including wheat, oats, and barley, is likely to be up 2 percent. Increases in the acreage of durum and other spring wheat over last year are adding to herbicide use, but this will be offset in part by a reduction in the acreages of other small grains.

Insecticides

The most important factor contributing to an expected overall 6-percent increase in insecticide use in 1979 is cotton. Insecticide use on this crop is expected to be up about 8 percent. Net supply of insecticides should increase about 7 percent over last year. In addition to a planned 6-percent acreage increase, more insecticides will probably be used on cotton with typical infestations, since cotton infestations last year were reported light in certain areas. With acreage expected to be about 1 percent above last year for corn, insecticide use on that crop will be up only slightly from 1978.

PEST CONTROL COSTS

Pesticides account for a significant share of total variable production costs 2/ for some crops: 21.0 percent for peanuts, 16.1 percent for soybeans, and 10.2 percent for cotton in 1978. However, pesticides accounted for less than 10 percent of total variable costs for all grain crops: corn, 8.5 percent; grain sorghum, 5.1 percent; rice, 8.3 percent; and wheat, 3.1 percent (9).

Costs of pest control chemicals in 1979 are expected to range from $1.21 per acre for wheat to $58.11 per acre for peanuts (table 5). These figures do not include the cost of application, which may add 30 to 50 percent to the total costs. Average pesticide chemical costs for the crop season are projected to amount to $17.30 an acre for cotton, $20.00 for rice, $8.72 for corn, and

2/ Total variable production costs do not include machinery ownership, general farm overhead and management, or land costs.

$9.13 for soybeans. These costs are generally expected to be about 3 percent higher than they were last year (9).

Table 5--Per acre pesticide costs for selected crops, United States, 1977, 1978, and projected 1979

Crop	1977	1978	Projected 1979
		Dollars per acre	
Cotton	19.47	16.57	17.30
Corn	8.95	8.35	8.72
Grain sorghum	3.08	2.95	3.08
Rice	20.89	19.50	20.00
Wheat	1.14	1.16	1.21
Soybeans	9.34	8.74	9.13
Peanuts	59.37	55.65	58.11

Source: (9).

Studies for previous years show substantial regional pesticide cost differences. For example, per acre pesticide costs for cotton in the humid Delta and Southeastern regions were seven or eight times greater than in the Southern Plains; per acre pesticide costs for peanuts were three times as great in the Southeast as in the Southern Plains.

While farmers are using more pesticides, particularly herbicides, the pesticide share of variable production costs has not increased in recent years because pesticide prices have been rising at a slower rate than those for other farm inputs.

EMERGENCY USE AND CONDITIONAL REGISTRATION PESTICIDES

Because of difficulties in controlling tobacco budworms and bollworms on cotton in 1977 and because of the withdrawal of chlordimeform from the market, the use of several synthetic pyrethroid insecticides and a new organophosphate insecticide was permitted. Pydrin, Ambush, and Pounce, 3/ were granted emer-

3/ Pydrin, Ambush, Pounce, Bolstar, Curacron, and Dimilin are proprietary products.

gency exemptions from registration under Section 18 of the Federal Insecticide Fungicide Rodenticide Act (FIFRA) in 1977. Emergency exemption was also granted for an organophosphate, Bolstar 3/. Use of these insecticides was again permitted in 1978, along with Curacron 3/. In addition, chlordimeform was again available for cotton under restricted conditions in 1978.

The synthetic pyrethroids have been used extensively in the last 2 years to control tobacco budworms and bollworms in cotton. However, these products do not control the boll weevil, which had been kept in check when materials such as EPN and methyl parathion were used more extensively for bollworm and tobacco budworm control. Cotton with evidence of boll weevil economic damage should be treated with products such as methyl parathion, azinphosmethyl, or EPN in late season spray programs.

At least four of the new products will again be available for the 1979 season. As of mid-February, conditional registration was expected for Ambush, Pounce, Pydrin, and Bolstar. Emergency exemption from registration may also be requested for Curacron. Available supplies of these products were largely used up last season, although manufacturing capacity appears adequate for 1979. Use of these products has cut heavily into the markets for conventional cotton insecticides such as toxaphene, methyl parathion, and EPN.

A boll weevil-specific product now under registration review, diflubenzuron (Dimilin) 3/, is a chitin inhibitor purported to have little harmful effect on the beneficial predator and parasitic arthropods of the bollworm and the tobacco budworm.

PESTICIDE REGULATIONS

A review of current regulatory activities is an important aspect of evaluating pesticide availability and pest control prospects.

Federal Pesticide Act of 1978

After lengthy review, Federal pesticide control legislation was amended in 1978 (7). Major features of the Federal Pesticide Act of 1978 include:

(1) Compensation For Data Requirements: Data compensation has been a major concern to both holders of the data and those who wish to use it. Reactions from the initial registrants and the potential users have been generally favorable to the compensation for data amendments. Assurance of a period of exclusive use and compensation should encourage the development of new products, but is likely to increase the cost to ultimate users of the products.

(2) State pesticide authority: States would have primary enforcement responsibility, subject to certain important pre-conditions, with increased authority to register federally registered pesticides for additional uses to meet local needs for use within that State.

(3) Use inconsistent with labeling requirements: The 1978 law specifies that certain uses would not be considered inconsistent with labeling. These include: (a) use against a target pest not specified on the label unless the

label specifically states that the pesticide may be used only for pests identified on the label, (b) mixing a pesticide with fertilizer unless specifically prohibited by the labeling, (c) use of a pesticide at less than the label dosage, concentration, or frequency, (d) employing any method of application not prohibited by the label, or (e) any use that the EPA Administrator determines to be consistent with the purposes of the Act. The Administrator has until March 31, 1979 to require definite label amounts of dilution for a pesticide used for agricultural or forestry purposes.

(4) Conditional registration in absense of data for complete registration: Conditional registration could be granted for: (a) a pesticide and proposed use which is identical or substantially similar to current registrations, and approval would not significantly increase the risk of an unreasonable adverse effect on the environment, (b) new uses of currently registered products, subject to similar qualifications, and (c) active ingredients not contained in any currently registered products, but only to permit use of the product for a period of time sufficient to obtain the required data, and after the Administrator has determined that there would be no unreasonable risk and that the use is in the public interest.

(5) Data requirements for minor use pesticides: Consideration will be given by the Administrator to the incentives for undertaking the development of required data for minor use pesticides. This will include appraisals of volume, pattern, and extent of use; the impact of the cost of meeting registration requirements; and the degree of exposure to man and the environment. New rules such as waiving efficacy requirements under certain conditions, increasing State authority to register pesticides, easing labeling requirements, and allowing conditonal registration should help alleviate the minor pesticide use problem.

(6) Waiver of data requirements pertaining to efficacy: The Administrator may waive efficacy data requirements for any pesticide registration application. The 1978 Act further provides that if a pesticide is found to be efficacious by any State, a presumption is established that the Administrator shall waive data requirements pertaining to efficacy for use of the pesticide in that State.

(7) Other features of the Federal Pesticide Act of 1978 include simplification of registration procedures, changes in classification from restricted to general use, continued State authority to certify applicators prior to completion of reregistration, permits for experimental use, and consideration of a generic approach to registration. In general, the Act was amended in an effort to streamline the pesticide regulatory process, encourage pesticide research and development, and provide greater pesticide use flexibility for growers.

Status of Pesticide Reregistration

Federal law requires that all pesticides registered before 1970 must be reregistered. To expedite the reregistration process, a regulatory process termed "Rebuttable Presumption Against Reregistration" (RPAR) was initiated by EPA. The major objectives of this process are to: (1) determine if certain risk criteria are exceeded by a pesticide, and if so, (2) weigh the benefits

of the use of a pesticide against risks, and (3) conduct pesticide review and evaluation on a more informal basis and with greater public participation than in the past.

Issuance of an RPAR notice does not constitute a ban, but eventually it could result in the cancellation or restriction of the use of some or many of these products. During the review process, the products can be used as they had been previously. The entire review process is scheduled for completion within about 300 days after the initial RPAR notice is issued. However, delays can and do occur, and review progress is considerably behind schedule.

The potential impact of the RPAR process on farm pest control prospects is tremendous. Final decisions could result in a ban on the use of many important pest control products. In addition, the time of indecision associated with the review tends to reduce the availability of certain products. Some processors and growers tend to avoid a product as soon as an RPAR is issued, thus discouraging the production and distribution of products used in small and specialized markets.

As of February 1979, RPAR's had been issued for 28 products, and 57 products were in the pre-RPAR review stage. Slightly over one-fourth of all agricultural pesticides, in terms of quantities of active ingredients, are being reviewed in the RPAR process. Thus far, final RPAR decisions have been announced for 2 products, dibromochloropropane (DBCP) and chlorobenzilate. In addition, proposed notices of determination have been issued for endrin, amitraz, and pronamide 4/.

DBCP is a soil fumigant used for nematode control in cotton, peanuts, and certain fruits and vegetables. Potential high exposure uses of DBCP for 19 commercial vegetable crops, 22 home garden uses, and peanuts were cancelled. Other uses of DBCP are to be continued if certain precautionary measures are used (16).

Chlorobenzilate is a miticide used primarily on citrus, although small amounts were used on a variety of other agricultural and horticultural crops. Use on citrus in Florida, Texas, California, and Arizona would be continued, although certain protective measures would be required. Users are also required to provide EPA with exposure information (14).

Registration for the use of amitraz, a miticide-larvicide, was requested for use on pears and apples. In its proposal, EPA would deny use for apples because it appears that the benefits do not outweigh the risks. EPA has also recommended that amitraz be granted a 4-year conditional registration for use on pears. The applicant must furnish additional benefits data and a mouse oncogenic bioassay, and amend the label to restrict use as specified (13).

4/ On March 1, 1979 EPA issued an emergency suspension order for major uses of 2,4,5-T and silvex, including forests, pastureland, and powerline rights-of-way. The order did not include rangeland or rice field uses.

Endrin is used primarily for insect control in cotton and small grains, and for rodent control in orchards. Use on cotton would be retained west of Interstate Highway 35; use on small grains would be continued for control of the pale-western cutworm, army cutworm, and grasshoppers, with some handling restrictions. On orchards, use would be retained for pine voles and the western meadow mouse, but discontinued for the eastern meadow voles (17).

The 85 products under review in the RPAR process include 35 to 40 percent of the insecticides, 40 to 50 percent of the fungicides, miticides, and defoliants, and 50 percent of the growth regulators used by farmers.

Decisions thus far indicate that EPA is examining the hazards and benefits associated with each use of a product. Pesticide compounds for which benefits are shown to be high and risks low, appear to have a good chance of being registered.

Restricted Use Pesticides

The Federal pesticide law requires that certain hazardous pesticides be classified for restricted use and are to be applied only by certified applicators. As of June 30, 1978, the State cooperative extension services reported that 88 percent of the commercial applicators and 79 percent of the private applicators had been trained to help meet requirements for certification to apply restricted use pesticides.

A proposed list of 23 pesticides for which some or all uses were to be restricted was published in the Federal Register on February 9, 1978. Included in the list were such major agricultural pesticides as parathion, methyl parathion, azinphosmethyl, demeton, paraquat, methomyl, and others. EPA identified 38 additional pesticides that were being considered for restricted use classification on September 1, 1977. Furthermore, on January 9, 1979, some or all uses of 14 of these pesticides were proposed for restricted use (table 6). Uses of these products are being restricted because of potential human hazards and/or harmful residues. Final rulemaking on these 14 products is anticipated later in 1979.

NONCHEMICAL PEST CONTROL

Farmers have traditionally used a variety of nonchemical pest control techniques--fall crop residue destruction, crop rotation, or careful pest monitoring. However, in the wake of the readily available synthetic chemicals for almost every pest control need, some growers have been relying increasingly on these materials. Pesticides have often been used as a replacement for good management practices, or as insurance.

Because of the increasing cost of chemical control, pest resistance to some chemicals, and the potential health and environmental hazards in using more pesticides, nonchemcial pest control techinques have been reemphasized. Among the techniques used to reduce pesticide use or improve the efficiency of pesticide use are: (1) monitoring or scouting for pests to determine the optimum times for application, (2) destroying stalks or crop residue to reduce over-wintering pest populations, (3) rotating crops, and (4) using biological control methods when feasible.

Table 6--Uses and formulations of restricted use pesticide products, proposed Jan. 9, 1979

Active ingredient and formulation	Use pattern	Classification
Carbofuran:		
All concentrate suspensions and wettable powders 40% and greater	All uses	Restricted
All granular formulations	Rice	Restricted
All granular and fertilizer formulations	All uses except rice	Under evaluation
Clorofenvinphos:		
All concentrate solutions or emulsifiable solutions 21% and greater	All uses (domestic and non-domestic)	Restricted
Clonitralid:		
All wettable powders 70% and greater	All uses	Restricted
All granulars and wettable powders	Molluscide uses	Restricted
Pressurized sprays 0.55% and less	Hospital antiseptics	Unclassified
Dioxathion:		
All concentrate solutions or emulsifiable concentrates greater than 30%	All uses	Restricted
Concentrate solutions or emulsifiable concentrates 1/ 30% and less and wettable powders 25% and less	Livestock and agricultural uses (nondomestic uses only)	Unclassified
All solutions 1/ 3% and greater 1/	Domestic uses	Restricted
2.5% solution 1/ with toxaphene and malathion	All uses	Under evaluation
Disulfoton:		
All emulsifiable concentrates 65% and greater, all emulsifiable concentrates and concentrate solutions 21% and greater with fensulfothion 43% and greater, all emulsifiable concentrates 32% and greater in combination with 32% fensulfothion and greater	All uses	Restricted
Nonaqueous solution 95% and greater	Commercial seed treatment	Restricted
Granular formulations 10% and greater	Indoor uses (greenhouse)	Restricted
All granular and fertilizer formulations including cartridge injection	All uses except indoor greenhouse	Under evaluation
Endosulfan:		
All emulsifiable concentrates, wettable powders and dusts	Aerial applications	Restricted
	Nondomestic outdoor applications to: orchards citrus, nut crops, ornamental, corn, cotton, pineapples, grapes, blueberries, alfalfa 2.0 lbs./acre and greater	Restricted
	All other uses	Unclassified
Emulsifiable concentrates 33% and greater	All uses	Restricted
All formulations	Watercress	Restricted
Emulsifiable concentrates 21% and greater, pressurized sprays 10% and greater, and smoke fumigants 15% and greater	Indoor use (nondomestic)	Restricted
Antifouling paint 2% and less	Wooden boat surfaces	Unclassified
All formulations greater than 5% endosulfan	Domestic uses	Restricted
All formulations containing 5% or less endosulfan	Domestic uses	Unclassified
3% granular	Sugarcane	Under evaluation
2% granular	All uses	Under evaluation

Continued--

See footnote at end of table.

Table 6--Uses and formulations of restricted use pesticide products, proposed Jan. 9, 1979--continued

Active ingredient and formulation	Use Pattern	Classification
Ethoprop:		
Emulsifiable concentrates 40% and greater	All uses	Restricted
All granular and fertilizer formulations	All uses	Under evaluation
Fenamiphos:		
Emulsifiable concentrates 35% and greater	All uses	Restricted
All granular formulations	All uses	Under evaluation
Fensulfothion:		
Concentrate solutions 63% and greater, all emulsifiable concentrates and concentrate solutions 43% and greater, all emulsifiable concentrates 32% and greater in combination with disulfoton 32% and greater	All uses	Restricted
Granular formulations 10% and greater	Indoor uses (greenhouse)	Restricted
All granular and fertilizer formulations	All uses except indoor greenhouses	Under evaluation
Fonofos:		
Emulsifiable concentrates 44% and greater	All uses	Restricted
Emulsifiable concentrates 12.6% and less with pebulate 50.3% and less	Tobacco	Unclassified
All granular and fertilizer formulations	All uses	Under evaluation
Monocrotophos:		
Liquid formulations 19% and greater	All uses	Restricted
Liquid formulations 55% and greater	All uses	Restricted
Phorate:		
Liquid formulations 65% and greater	All uses	Restricted
All granular formulations	Rice	Restricted
All granular and fertilizer formulations	All uses except rice	Under evaluation
Phosacetim:		
Baits 0.1% and greater	All uses	Restricted
Phosphamidon:		
Liquid formulations 75% and greater	All uses	Restricted
Dust formulations 1.5% and greater	All uses	Restricted

1/ Percentages given are the total of dioxathion plus related compounds.

Source: (12).

Integrated Pest Management

A program which incorporates available nonchemical and chemical pest control techniques into an effective, efficient, comprehensive unit is referred to as Integrated Pest Management (IPM). This program has received the support of the President and officials in the U.S. Department of Agriculture (USDA) and EPA. USDA, cooperating with the State cooperative extension services, has been conducting pest management projects since 1971. As of the end of 1978, the extension services had initiated pest management projects on major crops in all but three States. States are expanding the programs as technology and resources permit.

Reactions to the programs have generally been favorable. Results of the projects show that: (1) pesticide use can be cut 30 to 70 percent where unwarranted or poorly timed applications are made, (2) use of certain pesticides may increase where farmers are unaware of losses caused by pests and where use of a pesticide is the most feasible control method, (3) nonchemical pest control methods can often be substituted for or augment pesticide use, (4) situations develop where no combinations of available pest control methods can prevent serious losses, and (5) economic benefits to farmers and society occur from savings in cost of pesticides and their application, or in increases in yield and quality of the commodity.

While IPM is a desirable solution to many pest control problems, it may not always be feasible. In addition, complete implementation of the program is likely to require considerable time and cost. A recent State extension service report on IPM indicated that if two-thirds of the cultivated acreage in the United States were covered in IPM programs, 1,900 additional extension workers and 7,000 private advisors would be needed.

Boll Weevil Eradication

A trial cotton boll weevil eradication effort in North Carolina last year appeared very sucessful in reducing boll weevil populations. The trial program will continue this year. Results of the trial will be used to determine the feasibility of a Belt-wide eradication program. Eradication of the boll weevil would eliminate cotton growers' expenses in controlling this costly pest, and help reduce the costs of controlling other major cotton insects, such as the tobacco budworm and the bollworm.

PESTICIDE RESEARCH AND DEVELOPMENT

Increased data requirements for pesticide registration have become a major factor in the growing cost and time requirements for introducing new pesticides. The average cost for research, development, and registration required to bring a new pesticide on the market increased eightfold during 1967-77 (6). The average time required in the research, development, and registration process increased from less than 6 years to over 9 years during this period. For each new product first registered in 1977, about 30,000 compounds were screened. This compares with 5,000 to 6,000 products screened for each new pesticide registration 10 years earlier. The number of new pesticides registered dropped from 10 to 12 annually in the late sixties to three in 1977.

The added costs of developing new pesticides will result in a continuing increase in the cost of pesticides to farmers. Increasing research and development costs are also limiting new products to major market uses. Thus, obtaining pesticides for specialty or minor uses is becoming more difficult. Growing research and development costs and associated risks may also limit such activities to a few major pesticide producers with adequate resources. As a result, industry concentration may increase gradually over time.

WORLD TRADE

The world pesticide market should increase about 4 percent a year during 1974-84 (5). Markets in the less developed nations are expected to grow at four to five times the rates projected for Europe and North America.

The less developed nations will comprise a relatively greater share of the world pesticide market as they seek to expand agricultural output. On the other hand, most developed nations are concerned about problems associated with intensive pesticide use and are seeking means to limit the use of those that pose serious environmental or human health hazards.

The United States is a major supplier in the world pesticide market. About one-fourth of the U.S. pesticide production in terms of manufacturers' dollar sales is exported each year. In terms of quantities of ingredients, about one-third of the pesticides produced here are exported. Insecticides account for a major share of the exports--slightly over 50 percent in 1977. However, insecticides are becoming relatively less important, dropping from 66 percent of all export sales in 1967 to 51 percent in 1977. On the other hand, herbicides increased from 23 percent of export sales in 1967 to 37 percent in 1977. Herbicide exports increased from 11 percent of production in 1967 to 18 percent in 1977, while the share of insecticides exported dropped from 43 percent of production in 1967 to 40 percent in 1977.

The United States is the major pesticide supplier for Canada. Canadian imports were reported up 27 percent for the first 8 months of 1978. Projections by the Canadian Government anticipate a modest growth in farm pesticide demand for 1979 (1).

Growing pesticide markets are also reported for Europe. Growth in European pesticide demand last year was significantly stronger than in the United States, according to one analysis (3). Pesticide volume in France, for example, was up 10 percent, while prices there were up 7 percent. Similar gains are predicted for 1979.

Exports can be expected to comprise an increasing share of U.S. herbicide sales, as many areas of the world are substituting chemicals for hand and mechanical weed control.

Insecticide exports will probably continue to level off as domestic production of organochlorine and other broad spectrum, nonpropriety products is reduced.

Imports account for only a very minor share of domestic U.S. pesticide sales--about 5 percent in 1977. This, however, was up from only 2 percent in

1967. A gradual increase in pesticide imports can be expected, but imports are not expected to account for a major share of the domestic market in the forseeable future. Restrictions on the major uses of certain products, however, could result in the closing of some domestic plants and importation of materials for the remaining uses.

CONCLUSIONS

With adequate supplies of pesticides, and prices increasing less than for some other farm inputs, farmers should find the 1979 season good in terms of pest control costs. While prices overall are expected to advance a few percentage points, prices of some products, particularly among the corn herbicides, are likely to go down marginally. Since manufacturers are reporting fairly large beginning stocks, farmers will find it profitable to shop around. Dealers providing a complete pest control service continue to offer an advantage over those whose primary attraction is price.

Because of new features in the Federal Pesticide Act of 1978, farmers should find pesticides easier to obtain for special local problems and for uses on minor crops. In general, the 1978 Act was intended to expedite pesticide registration and regulation.

IPM, which utilizes cultural, biological, and other measures, as well as chemicals to control pests, continues to attract more growers. Increasing participation in IPM programs should result in better pest control, lower costs, and fewer hazards to the environment and human health.

As of mid-February 1979, EPA had issued final RPAR position documents for only two pesticides. They had also issued proposed decisions on three others.

Thirty-seven pesticide products have been identified within the last year for which some or all uses are to be restricted. Persons planning to apply restricted-use pesticides must be certified applicators. Information on how to become a certified pesticide applicator can be obtained by contacting the cooperative extension service listed under county government in a local telephone directory.

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This publication reports research involving pesticides. It does not contain recommendations for their use, nor does it imply that the uses discussed here have been registered. All uses of pesticides must be registered by appropriate State and/or Federal agencies before they can be recommended.

CAUTION: Pesticides can be injurious to humans, domestic animals, desirable plants, and fish or other wildlife -- if they are not handled or applied properly. Use all pesticides selectively and carefully. Follow recommended practices for the disposal of surplus pesticides and pesticide containers.