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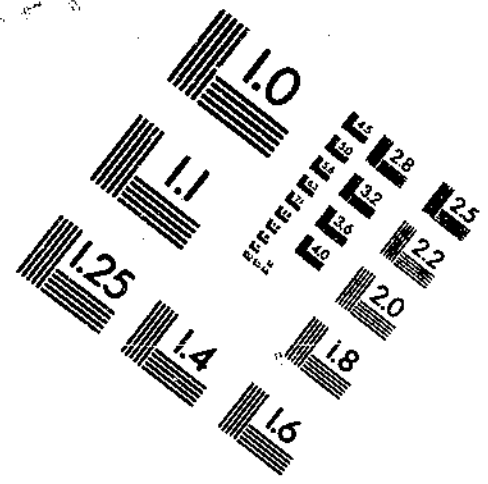
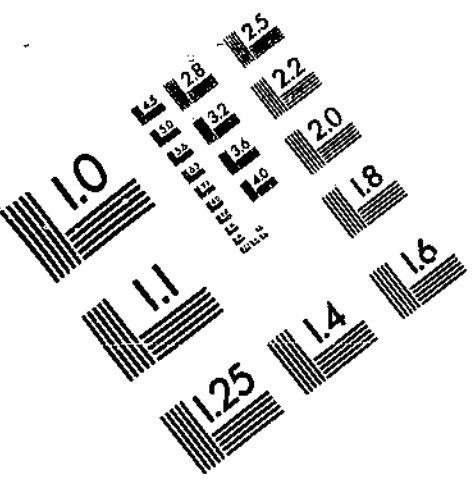
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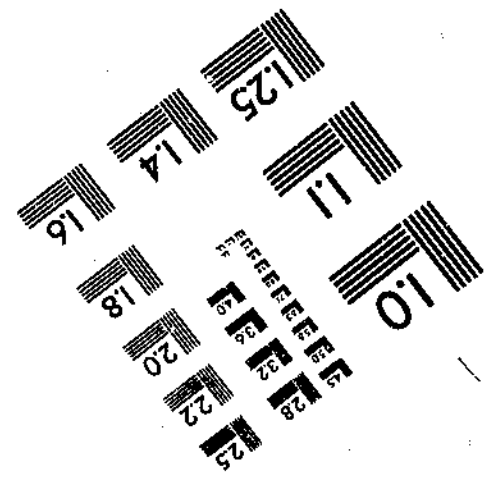
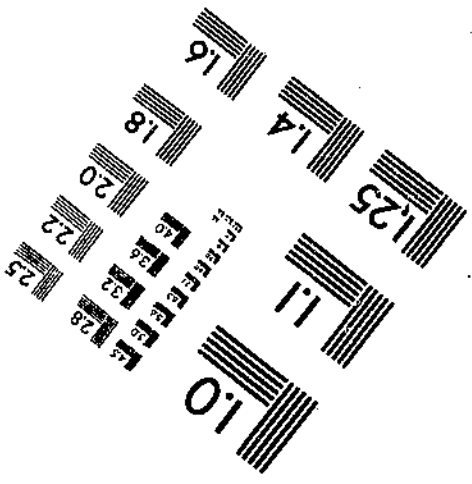
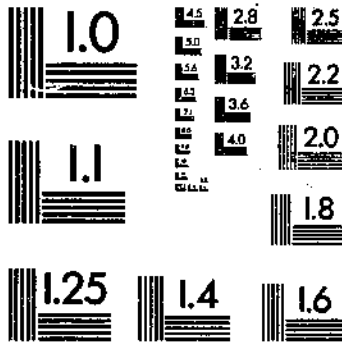
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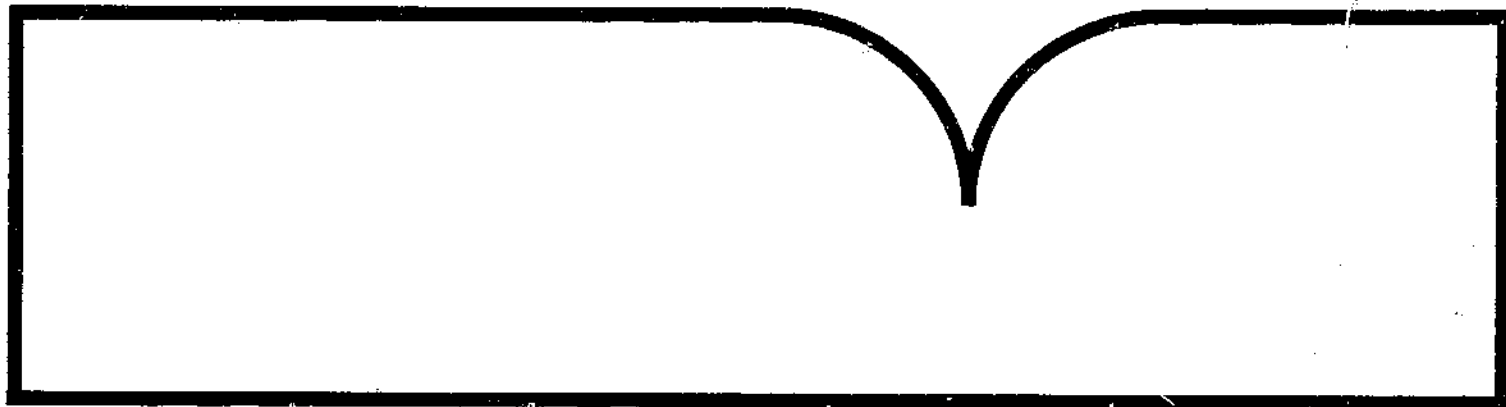


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Pesticide Use in Florida's Grapefruit Packinghouses

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A USDA survey of 103 Florida grapefruit packinghouses showed that 74 reported postharvest pesticide applications, most often using imazalil, sodium ortho-phenylphenate (SOPP), and thia bendazole (TBZ). These three postharvest pesticides were applied to the following quantities of grapefruit: 18 million cartons (imazalil, 32 million cartons (SOPP), and 55 million cartons (TBZ). Imazalil, SOPP, and TBZ were used on 29 percent, 51 percent, and 86 percent, respectively, of the grapefruit received by Florida packinghouses. Wax, sometimes containing pesticides, was applied to 52 million cartons of Florida grapefruit, 82 percent of the grapefruit processed by the packinghouses.

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Pesticide Use in Florida's Grapefruit Packinghouses

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In this report...A USDA survey of 103 Florida grapefruit packinghouses showed that 74 reported postharvest pesticide applications, most often using imazalil, sodium orthophenylphenate (SOPP), and thiabendazole (TBZ). These three postharvest pesticides were applied to the following quantities of grapefruit: 18 million cartons (imazalil), 32 million cartons (SOPP), and 55 million cartons (TBZ). Imazalil, SOPP, and TBZ were used on 29 percent, 51 percent, and 86 percent, respectively, of the grapefruit received by Florida packinghouses. Wax, sometimes containing pesticides, was applied to 52 million cartons of Florida grapefruit, 82 percent of the grapefruit processed by the packinghouses.

During the late 1980's, public concern mounted about government policies to regulate pesticides in food. Questions about which foods were treated with pesticides were difficult to answer because comprehensive pesticide-use surveys of fruit and vegetable producers were not current or were unavailable. Moreover, most of the attention given to pesticide use focused on preharvest applications. However, for some fruits, vegetables, and other foods, pesticides are also applied after harvest during the packing or shipping operation.

Congress directed USDA to initiate the Pesticide Data Program (PDP) in 1990 to provide pesticide-use and residue data in food crops. Grapefruit was the first commodity chosen for a detailed postharvest pesticide-use survey. Florida is the leading grapefruit-producing State, with 75 to 80 percent of U.S. production.

Florida's 103 grapefruit packinghouse operators were surveyed during the summer of 1992. Personal interviews were conducted with the operator or other informed employees in each firm. Firm characteristics and pesticide-use questions related only to the 1990/91 season.

The authors are agricultural economists, Specialty Agriculture Branch, Commodity Economics Division, ERS. We gratefully acknowledge the assistance of Shannon Hamm and Phil Kaufman, Economic Research Service, and Jim Smith, National Agricultural Statistics Service, USDA

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USDA's Pesticide Data Program

USDA's Pesticide Data Program (PDP) was designed to address public concern about pesticide issues and to provide a data base for government agencies to respond effectively to food safety and water-quality issues. Funding, at \$17 million over 3 years, was approved by Congress in January 1991 for use in fiscal years 1991, 1992, and 1993. Four agencies have direct responsibilities for administering the PDP: Agricultural Marketing Service (AMS), National Agricultural Statistics Service (NASS), Human and Nutrition Information Service (HNIS), and Economic Research Service (ERS). The PDP now includes a pesticide residue monitoring program (AMS), a program to estimate specific food intake values in the U.S. population (HNIS), a pesticide-use data base (NASS), and economic analysis of pesticide policy effects (ERS). The PDP focuses on fruits and vegetables.

The PDP's pesticide-use data base is designed to maintain statistically reliable data on pesticide use in the production of fruits, vegetables, and other farm products. For this reason, NASS keeps comprehensive lists of potential agricultural pesticide users. The pesticide-use data base includes information mainly about preharvest pesticide use by farmers. The Florida postharvest handlers survey, however, is an initial attempt to gather postharvest pesticide-use data from packinghouse operators. Depending on funding, further development of postharvest handler surveys for other commodities and other States could build on the Florida survey.

Florida Packinghouse Operations

Packinghouse functions involve receiving, cleaning, sorting, treating, packing, and shipping. Upon receiving grapefruit, the packinghouse may also apply ethylene, a naturally occurring plant substance, to "degreen" the fruit peel. Prewashing field dirt from the fruit before it is initially sorted is also a common practice. After the initial sort for gross quality defects, another wash is sometimes applied, followed by wax application. After a final sort to meet product standards, the grapefruit is placed in cartons and shipped. Grapefruit not shipped to the fresh market is usually sold to processors, leaving what is usually a small number to be discarded.

During the packinghouse operation, postharvest pesticides can be applied as drenches, dips, sprays, drips, and foams. Methods of application depend on the chemical and physical properties of the postharvest pesticide. Thiabendazole (TBZ) can be applied as a drench on unwashed fruit, and the TBZ-containing solution with added chlorine can be recirculated. TBZ also can be applied in a nonrecovery spray further along the packingline. Imazalil is designed to be a nonrecovery spray and sodium orthophenylphenate (SOPP) is applied as a soap or foam, replacing the detergent during washing.

Results of the Survey

About 75 percent of packinghouse operators furnished adequate information for the enumerator to complete the survey. Grapefruit received by the 74 responding packinghouses totaled 63.1 million cartons (table 1). Fresh-market grapefruit sales amounted to 45.5 million cartons.¹ The firms reported a wide range of grapefruit volume. The quantity of grapefruit received averaged 853,000 cartons per firm, ranging from 200 cartons to 3.2 million cartons.

Of the 63.1 million cartons of grapefruit received, 77 percent was received by corporations, 13 percent by cooperatives, and 10 percent by individually owned or partnership firms (table 1). Corporations received an average 1.04 million cartons, ranging from 900,000 to 3.2 million cartons per firm. Eighty-three percent of the fresh-market grapefruit was received by the Indian River District, while the remaining 17 percent was received in Florida's interior and gulf regions.²

The three postharvest fungicides used most often were imazalil, SOPP, and TBZ (table 2). Imazalil, effective against green mold, can eliminate certain molds which have acquired resistance to benzimidazoles. TBZ is a benzimidazole fungicide, effective against stem-end rot and green mold. SOPP reduces stem-end rot and green mold and somewhat controls sour rot.

Operators applied imazalil to an estimated 18.2 million cartons, 29 percent of the grapefruit received by Florida packinghouses. SOPP was applied to 32.2 million cartons, 51 percent of the grapefruit received by Florida packinghouses. Eighty-six percent of the grapefruit (54.6 million cartons) was treated with TBZ.

Most packinghouses subcontract with input supply firms to service their postharvest pesticide needs (table 3).

Besides delivery of the pesticide product, other services in a contract may include cleaning and filling applicators. Of 37 firms using imazalil, 34 firms used a contract service. Of 40 firms using SOPP, 36 firms used contract service. Contract service was used by 58 of 66 firms reporting TBZ use.

Table 1--Florida grapefruit packinghouses: Summarized survey results for the 1990/91 season

Item	Responses	Grapefruit volume handled		
		Average	Range	Total
	Number	-----1,000 cartons-----		
Grapefruit:				
Total received	74	853	0.2-3,200	63,141
Fresh-market sales	74	615	0.2-2,242	45,512
Type of organization:				
Individual ownership or partnership	13	468	0.6-2,000	6,078
Incorporated	47	1,043	0.9-3,200	49,038
Cooperative	14	573	0.2-2,127	8,025
Region:				
Indian River	42	1,245	0.6-3,200	52,310
Interior and gulf	32	338	0.2-2,229	10,831

Table 2--Postharvest pesticide applications to grapefruit, in Florida packinghouses, 1990/91 season

Pesticide	Packinghouses		
	using pesticide	Grapefruit treated	
	Number	1,000 cartons	Percent
Imazalil	37	18,200	29
Sodium orthophenylphenate	40	32,220	51
Thiabendazole	65	54,606	86

Table 3--Contract services and noncontract postharvest pesticide treatment of grapefruit in Florida packinghouses, 1990/91 season

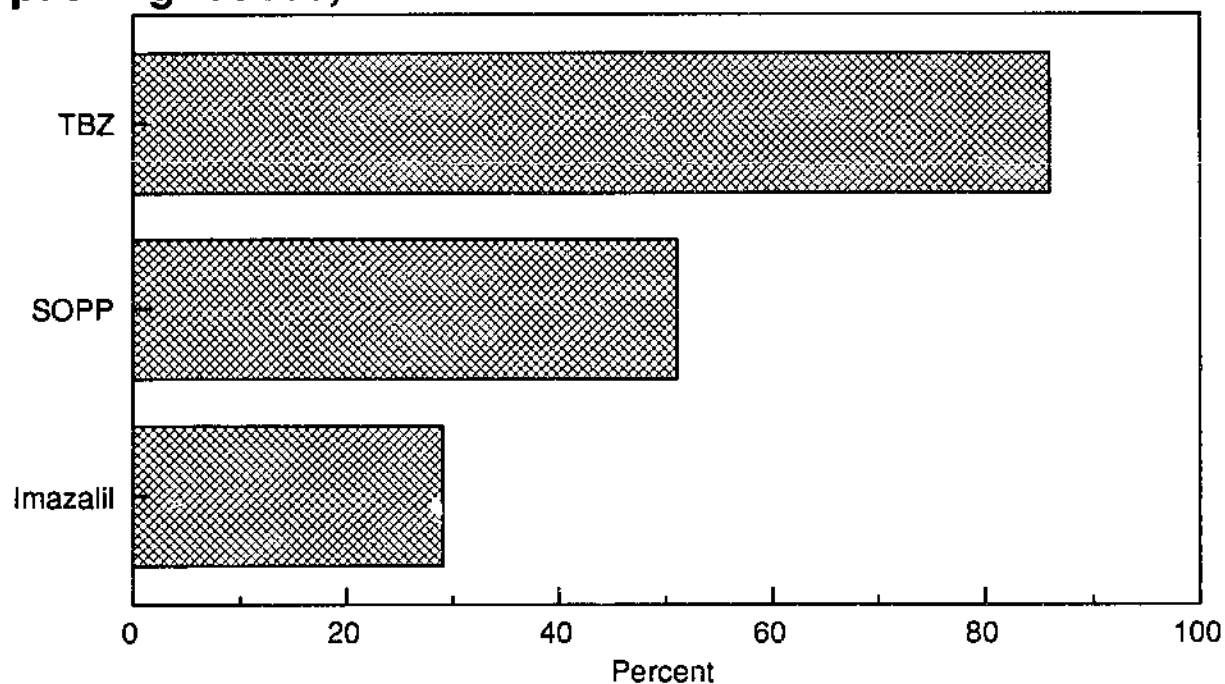
Pesticide	Contract services	Noncontract use	Total
	Number of firms		
Imazalil	34	3	37
Sodium orthophenylphenate	36	4	40
Thiabendazole 1/	58	8	65

1/ One firm used TBZ by contract service and inhouse.

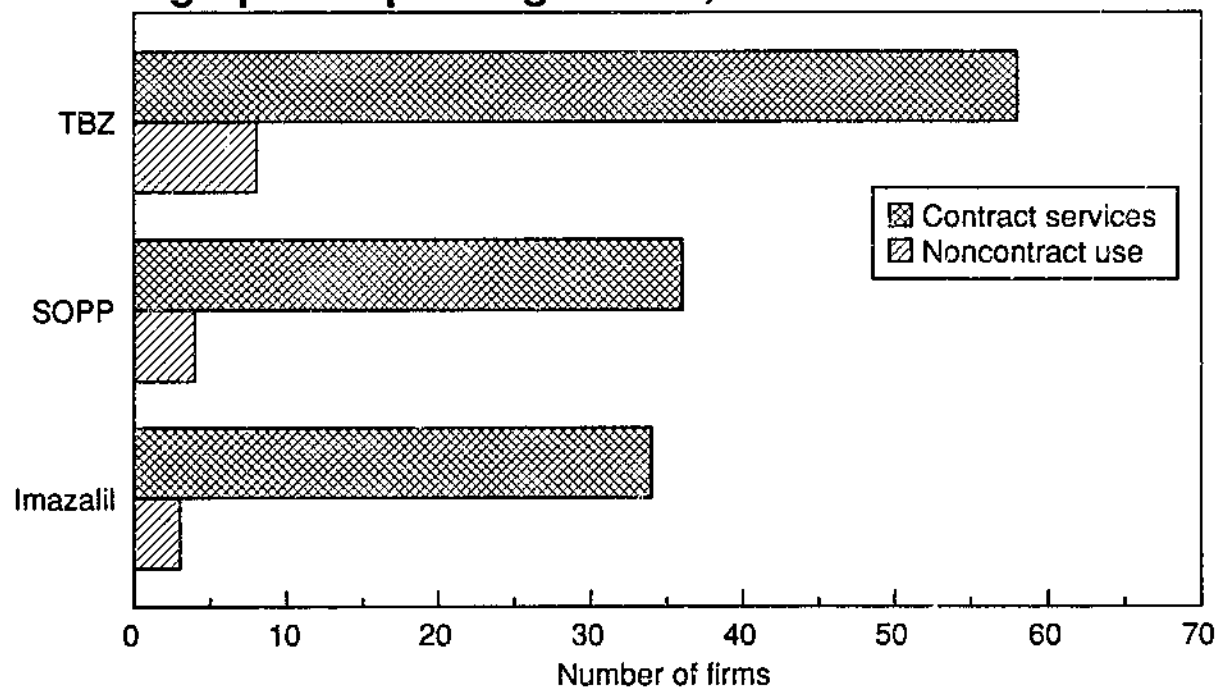
¹The survey total is 95 percent of the reported 1990/91 total fresh-market grapefruit shipped from Florida, according to *Citrus Fruits--1992 Summary*, published by USDA, NASS (Sept. 1992).

²The Indian River District includes a narrow region of east coast counties. Gulf counties are in southwest Florida, and the interior region is mostly central Florida counties.

Pesticide use on grapefruit at Florida packinghouses, 1990/91



Contract services for pesticide use at Florida grapefruit packinghouses, 1990/91



The site of application varied for the three most often used postharvest pesticides (table 4). Imazalil is applied more often at the washing and waxing sites, SOPP is applied more often at prewashing and washing, and TBZ is applied more often at waxing, but also at the washing and prewashing sites. Drip application is the most frequent method used for all three pesticides. The spray application is more frequent for TBZ, compared with the other two pesticides.

Table 4--Site and method used to apply pesticides to grapefruit in Florida packinghouses, 1990/91 season

Item	Imazalil	SOPP	TBZ
<i>Number 1/</i>			
Site:			
Receiving	0	1	4
Prewashing	3	10	9
Washing	24	28	15
Waxing	8	1	41
Other	2	0	0
Method:			
Drench	0	4	8
Dip	0	1	0
Spray	4	6	22
Drip	33	20	34
Foam	0	7	0
Other	0	2	1

1/ Number of survey responses may be more than survey respondents due to multiple sites per firm.

Table 5--Grapefruit treated with wax and postharvest pesticides in Florida packinghouses, 1990/91 season

Item	Postharvest pesticides used in wax				Total using wax 1/
	Imazalil	SOPP	TBZ	No pesticide	
<i>Number</i>					
Firms treating	8	D	41	26	73
<i>1,000 cartons</i>					
Quantity treated	4,057	D	35,316	14,865	51,742
<i>Percent</i>					
Proportion treated	6	<1	56	24	82

D= Number cannot be reported due to disclosure problems.

1/ Total using wax includes some firms using more than one pesticide in a single wax application.

The postharvest pesticide questions were limited to packinghouse operations. Information was not obtained for off-site treatments such as a drench treatment over the harvested truckload or fumigation before shipping to areas with special phytosanitary requirements. Therefore, this survey of packinghouse operators may underestimate the total quantity of grapefruit treated with postharvest pesticides.

While wax was an agent for postharvest pesticides, it was also applied without pesticides (table 5). Forty-one firms reported using TBZ in wax applications, and eight reported using imazalil in wax. But, 26 firms applied wax with no pesticide additives. Grapefruit treated with wax not containing a pesticide totaled 14.9 million cartons, 24 percent of the grapefruit received. An estimated 35.3 million cartons were treated with wax containing TBZ, 56 percent of the total grapefruit received. Six percent of the total grapefruit was treated with a wax-imazalil combination. Less than 1 percent of grapefruit was treated with a wax-SOPP combination.

Conclusions

This is USDA's first survey in the PDP to obtain information about postharvest pesticide applications in packinghouses. USDA's survey of Florida grapefruit packinghouses showed the most frequently used postharvest pesticides are imazalil, SOPP, and TBZ. TBZ is applied to more grapefruit than SOPP and imazalil combined. Nearly all packinghouses use a contract service to treat grapefruit with postharvest pesticides. Wax is applied to most grapefruit during the packing operation, and TBZ is likely to be included in the wax.

For more information, call John M. Love (202) 219-0886, or write: Commodity Economics Division, ERS, U.S. Department of Agriculture, Room 1240, 1301 New York Avenue, NW., Washington, DC 20005-4788.

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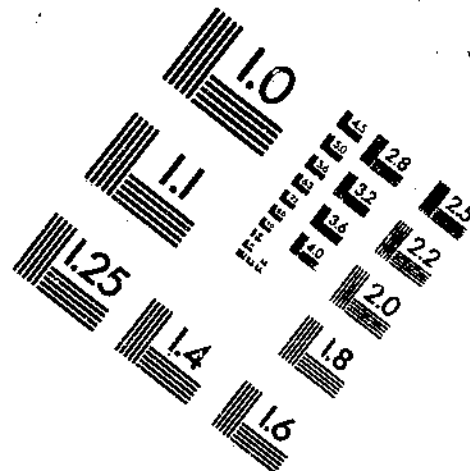
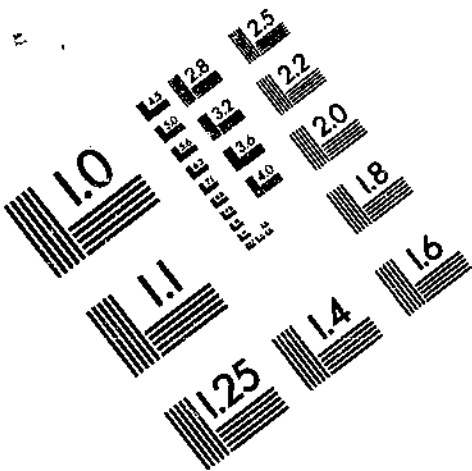
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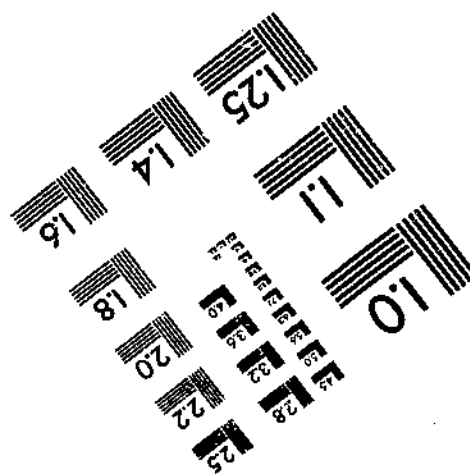
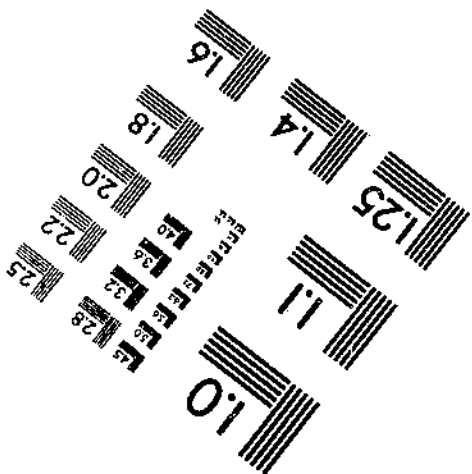
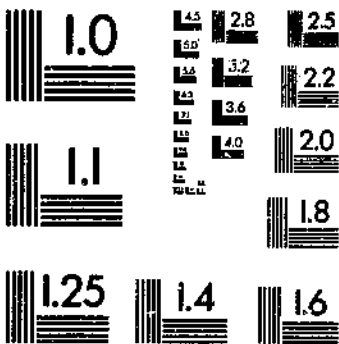
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