

**WEEDS AND HERBICIDES IN ARIZONA:
SURVEYS OF PLANT POPULATIONS AND
GROWER PRACTICES**

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Abstract

Cotton fields were surveyed for weeds in 1995 late in the season, either immediately before harvest or after harvest using the quantitative survey method of Thomas (1985, Weed Sci. vol. 33:34-43). The 82 fields surveyed across the state were randomly selected and were a subset of the fields used by the USDA-Arizona Agricultural Statistics Service to determine objective cotton yield estimates during the season. An inverted "W" pattern was used to systematically walk each sample field. Each leg or transect on the inverted "W" contained 5 equally spaced quadrats for a total of 20 quadrats per field. Each quadrat consisted of 2 adjacent cotton rows by 10 feet of row. With a statewide average row spacing of 37.47 inches, an average of 116 m² were surveyed in each field. All weeds in each quadrat were identified, counted, and data for each species in each quadrat was recorded for subsequent data entry and computer analysis. Only mature weeds were counted since these weeds were not controlled by the cultural practices and herbicides used by the grower. Four measures of weed abundance were calculated. Frequency (F) was the number of fields in which a species occurred in at least one quadrat expressed as a percentage of the total number of fields. Field uniformity (U) was the number of quadrats in which a species occurred expressed as a percentage of the total number of quadrats. Mean field density (MFD) was the mean number of plants m⁻² for each species expressed over all fields surveyed. Relative abundance (RA) summarized the relative importance of a weed species based on frequency, field uniformity and mean field density measures. RA was calculated as the sum of relative F ($RF = F / \sum \text{all } F \times 100$), relative FU ($RU = U / \sum \text{all } U \times 100$), and relative MFD ($RMFD = MFD / \sum \text{all } MFD \times 100$). The 15 most common weeds in the 1995 survey are listed in Table 1 according to their relative abundance.

The Arizona Agricultural Statistics Service summarized 1995 pesticide use data from 55,244 use records contained

in 34,128 Arizona Department of Agriculture 1080 forms. This form requires applicators to provide information on the pesticide applied including but not limited to : brand name, EPA registration number, rate, total chemical, total acres, label restrictions, days to harvest, section, township, range, and application method. All commercial applicators who apply pesticides are required to submit a 1080 form, all pesticide application by air must be reported, and all products on the State's "Groundwater Protection List" must be reported. Some common herbicides such as prometryn, Prowl (pendimethalin) and Treflan (trifluralin) are not on this list. Private applicators (i.e., growers who apply a pesticide on their own field) are not required to submit a 1080 form to the Arizona Department of Agriculture, however, they must keep a record of the application. Although many herbicide applications are not reported, the list of chemicals in Table 2 does give some indication of the relative importance of the various herbicides. Three soil-applied herbicides, prometryn, pendimethalin, and trifluralin, accounted for 75 percent of the total acres treated and 66.4 percent of the active ingredients applied (Table 2). Prometryn, which is tank mixed with pendimethalin or trifluralin prior to or at planting, or used as a post-directed spray, or as a layby treatment, was the most commonly applied herbicide. The six most widely used herbicides accounted for about 90 percent of both the acres treated and the total amount of active ingredient applied. Only one of these herbicides, MSMA, was a postemergence foliar applied herbicide. Soil applied herbicides accounted for 92.5 percent of the treated acres and active ingredient applied, but this figure is approximate because some of these herbicides (including prometryn, cyanazine, diuron, oxyfluorfen, and fluometuron) are occasionally used as foliar-applied, post-directed, postemergence herbicides. Herbicides that are strictly postemergence herbicides (i.e., MSMA, fluazifop-p-butyl, clethodim, sethoxydim and glyphosate) accounted for about 7.5 percent of both the treated acres and active ingredient applied.

The Arizona Agricultural Statistics Service in collaboration with the University of Arizona also conducted a telephone survey of 249 randomly selected growers who farmed 139,697 acres of cotton in 1995 (out of a statewide total of 412,100 acres). Grower responses provided a description of weed control practices used in the 1995 Arizona cotton crop. The average statewide cost for hand weeding was reported as \$27.87 per acre in addition to other weed control costs. Statewide, most growers used preemergence herbicides before or at planting and pre- and post-emergence herbicides later in the season. Most of these applications were broadcast applications. The practice of banding postemergence herbicides will probably increase with increasing use of Staple, Roundup Ultra, and Buctril. Statewide, few growers band preemergence herbicides or use electro-hydraulic quick-hitch guidance systems and in-row weeding tools with their cultivators. In summary, the three surveys provided a description of weed species distribution, herbicide use, and cultural practices for weed

control prior to the widespread adoption and use of new herbicide technologies including, Staple herbicide, transgenic cotton varieties resistant to Buctril and Roundup Ultra, and precision guided cultivation with in-row weeding. These baseline data will allow the documentation of changes in Arizona cotton production practices in the future.

Table 1. Common weeds in a 1995 Arizona weed survey.

Common name/Species name	F	FU	MFD	RA
	%	%	m ²	
Purple nutsedge/ <i>Cyperus rotundus</i>	26	10	13	71
Bermudagrass/ <i>Cynodon dactylon</i>	45	10	3.6	44
Annual morningglory/ <i>Ipomoea</i> species	41	8	2.5	37
Yellow nutsedge/ <i>Cyperus esculentus</i>	11	4	3.5	23
Wright groundcherry/ <i>Physalis wrightii</i>	27	5	0.7	20
Johnsongrass/ <i>Sorghum halepense</i>	24	4	0.9	18
Common purslane/ <i>Portulaca oleracea</i>	22	3	0.6	15
Sprangletop/ <i>Leptochloa</i> species	17	2	1.6	15
Barnyardgrass/ <i>Echinochloa crus-galli</i>	16	3	0.8	13
Palmer amaranth/ <i>Amaranthus palmeri</i>	11	2	0.4	9
Silverleaf nightshade/ <i>Solanum elaeagnifolium</i>	6	2	0.56	7.1
Desert thornapple/ <i>Datura discolor</i>	5	2	0.42	6.5
Junglerice	4	1	0.12	2.9
Southwestern cupgrass/ <i>Erichloa gracilis</i>	2	0	0.31	2.5
Field bindweed/ <i>Convolvulus arvensis</i>	4	0	0.06	2.2

Table 2. Arizona cotton herbicide use in 1995 as reported on the Arizona Department of Agriculture form 1080.

Product	Reports	Acres treated	a.i. (lbs)	Acres %
prometryn	749	100,614	63,591	31.5
pendimethalin	507	69,564	42,983	21.8
trifluralin	624	69,276	31,012	21.7
cyanazine	256	25,294	26,110	7.9
diuron	127	11,391	11,007	3.6
MSMA	142	9,995	11,494	3.1
metolachlor	56	9,842	35	3.1
norflurazon	63	6,524	2,997	2
fluazifop-p-butyl	71	3,686	1,003	1.2
clethodim	54	3,044	495	1
oxyfluorfen	43	2,540	969	0.8
EPTC	25	2,175	2,226	0.7
sethoxydim	49	2,102	432	0.7
glyphosate	54	2,101	1,444	0.7
fluometuron	11	548	222	0.2
metham-sodium	9	506	11,264	0.2
TOTAL	2,840	319,205	207,282	100