Where We Stand After 4 Years. . .

D D T Moratorium

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The moratorium on agricultural use of DDT in Arizona, which began January 1969, has completed its fourth year. Since then a Federal ban on its use was established by the Environmental Protection Agency on January 1, 1973. DDT can no longer be used on agricultural crops.

This is the second and final report to appear in *Progressive Agriculture in Arizona* on the status of DDT residues and related degradation products (DDTR) following 18 years of unrestricted use and 4 years of restricted use under the guidance of the Arizona Board of Pesticide Control.

DDT sales information provided to our Community Pesticide Studies Project by the agricultural chemical industry shows that for 1965, 545,000 lbs. were used; 1966, 1,072,000 lbs; 1967, 2,520,000 lbs.; and in the final year, 1968, 528,000 lbs. were used.

The Arizona Board of Pesticide Control, after making the DDT moratorium decision in 1969, asked the Entomology Pesticide Residue Laboratory to monitor the general change in residues while DDT was not being used. We began sampling immediately, and have continued to yearly monitor green alfalfa and soil from the same fields, and desert soils adjacent to agricultural areas. These appear to be the best indicators of DDT residue changes.

Table 1. Average DDTR residues (ppm) in green alfalfa.

Sampling Area	*1967 Aug.*	*1969 Jan.*	*1969 Sept.*	*1970 Sept.*	*1971 Sept.*	*1972 Sept.*
Baseline Rd.	.404	.102	.037	.045	.032	.026
Salt River Valley	—	.117	.051	.063	.036	.039
Pinal County	—	.088	.086	.050	.049	.031
Yuma County	—	.046	.210	.058	.162	.123
State average		.088	.096	.054	.069	.055

Soil and alfalfa samples were collected from the same 10 fields in each of three major irrigated areas — the Salt River Valley near Phoenix, Pinal County and the Yuma mesa and valley. Desert soil samples adjacent to these areas were also collected from 4 locations each.

In addition, a green alfalfa residue study which was begun in 1967, was continued on the 60-mile Baseline Road, an eastwest transect in Maricopa County. This provided a reference standard for the moratorium monitoring.

Results

The analytical results of alfalfa, soil, and desert soils sampling during the past 4 years are shown in Tables 1-3. These actually represent the residues at the termination of five growing seasons, 1968 through 1972. The residues are expressed as total DDTR, that is, DDT and related metabolic or breakdown products, e.g., p, p′, o, p′-DDT and DDE.

Table 2. Average DDTR residues (ppm) in soils from alfalfa fields taken at 2-year intervals.

Sampling Area	*1969 Jan.*	*1970 Sept.*	*Sept. 1972*
Salt River Valley	1.58	1.82	1.64
Pinal County	169	1.62	1.55
Yuma County	0.82	0.75	0.78
State average	1.36	1.39	1.32

Table 3. Average DDTR residues (ppm) in desert soils adjacent to agricultural areas taken at 2-year intervals.

Sampling Area	*1969 Jan.*	*1970 Sept.*	*1972 Sept.*
Salt River Valley	0.89	0.86	0.60
Pinal County	0.40	0.57	0.44
Yuma County	0.13	0.13	0.13
State Average	0.48	0.52	0.39

Historically cotton has been the heavy-use crop, and during the years of maximum acreage it is estimated that 4,000,000 pounds of actual DDT were being used per year in dusts and sprays.

The alfalfa residues from all four areas shown in Table 1 appear to have leveled off at about 0.03 ppm, except for Yuma County, which had September residues some three-fold of the

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a 250-ft. length of run, providing a potential for high water application, distribution, and storage efficiency. Although water application was not measured into individual furrows, estimated water applied, based on time of irrigations and pump discharge rate plus rainfall, was no more than 45.0 inches for the entire growing season. Therefore, distinct difference in yield or water application did not result between the furrow and trickle irrigation methods in this field situation. Where conditions are such that the furrow method would not give a high irrigation efficiency, the water requirement certainly could be reduced by using the trickle irrigation method.

Summary and Conclusions

Quantity and frequency of trickle irrigation were varied to develop management criteria for maximum cotton production and increased water-use efficiency. Trickle irrigations consisted of 1.06, 0.90, and 0.72 times the present consumptive-use estimate for furrow irrigation applied at three frequencies of 3, 6, and 12 days. Lint production for the full season was nearly the same when water was applied at 1.06 and 0.90 times and decreased 18% for the 0.72 treatment. Frequency of trickle irrigation showed no significant effect on lint production between 3, 6, and 12 days for all irrigation quantities. The mean lint production for the 1.06 and 0.90 consumptive-use quantities was 3 bales/acre, with late-season production accounting for 25% to 30% of this yield. Results suggest that the amount of soil moisture needed by the cotton plant for high production with trickle irrigation is approximately equal to the present consumptive-use estimate for furrow irrigation, and that increased frequency of trickle irrigation may not necessarily increase yields on a fine-textured soil.

Furrow irrigation of cotton on an adjoining field yielded essentially the same as the trickle irrigation and required application of about the same quantity of water. In this particular field situation, both furrow and trickle irrigation methods were efficient. However, under many field conditions where furrow irrigation would not result in a high irrigation efficiency, trickle irrigation assuredly has the potential to decrease water requirements. This, of course, will be dependent upon a properly designed, managed, and maintained, non-clogging trickle system which would give a high water application, distribution, and storage efficiency. In either case, the consumptive-use requirement by the cotton plant has not changed, regardless of the irrigation method.

To further investigate the merits and feasibility of trickle irrigation, a 3-year study using trickle irrigation for table grape producton is now underway in Central Arizona. Different quantities and frequencies of irrigation, to include daily trickle irrigations, are being tested. Advantages may be greater on a vinyard, where the spacing between plants is larger.

References

1. *Cole, T. E.* 1971. *Subsurface and trickle irrigation; a survey of potentials and problems. Oak Ridge National Laboratory, Nuclear Desalination Information Center, ORNL-NDIC-9.* 65 *pp.*

2. *Erie, L. J., D. A. Bucks and O. F. French.* 1972. *Irrigation and water management for economical cotton production. Proc., Western Cotton Production Conference, March* 1-3, *Bakersfield, California.*

3. *Erie, L. J., O. F. French, and K. Harris.* 1968. *Consumptive use of water by crops in Arizona. Tech. Bul. No.* 169, *University of Arizona Agricultural Experiment Station, Tucson.* 46 *pp.*

4. *Goldberg, S. D., and M. Shmueli.* 1970. *Drip irrigation — a method used under arid and desert conditions of high water and soil salinity.Trans., Amer. Soc. Agric. Engin.* 13:38-41.

5. *McNamara, J. B.* 1970. *Subirrigation; the basis of tomorrow's agriculture. Proc., Natl. Irrigation Symp., Nov.* 10-13, 1970. *Univ. of Nebraska, Lincoln.*

6. *U. S. Salinity Laboratory Staff (L. A. Richards, Editor).* 1954. *Diagnosis and improvement of saline and alkali soils. Agric-Handbook No.* 60, *U. S. Department of Agriculture.* 160 *pp.*

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other areas. Sampling in January, indicated that the Yuma residues had declined to levels of the other areas (0.035 ppm). The high September values for Yuma were also seen in 1969, and 1971. These phenominally high residues are apparently the result of climatological conditions not found in the other sampling areas.

Residues in the alfalfa soils have declined negligibly (Table 2) or not at all since the 1968 growing season. One change that has been noted is that the DDT levels are declining while DDE levels are increasing — a residue "tradeoff." Since the decline is imperceptible the suggested time required for these residues to reach one-half their present level is now estimated to be greater than 20 years, with the desert soils changing the least. The desert soils, however, are sampled only from the top 0.25 inch, and are most subject to change by wind-borne deposits, and may change rapidly in value.

The DDTR residues now found in Arizona alfalfa and soil are primarily DDE, the DDT portion slowly being converted to DDE which is declining negligibly. As suggested from past studies, problems arising from DDT in the future will be attributable to DDE, the very persistent and chemically stable metabolite of DDT.

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