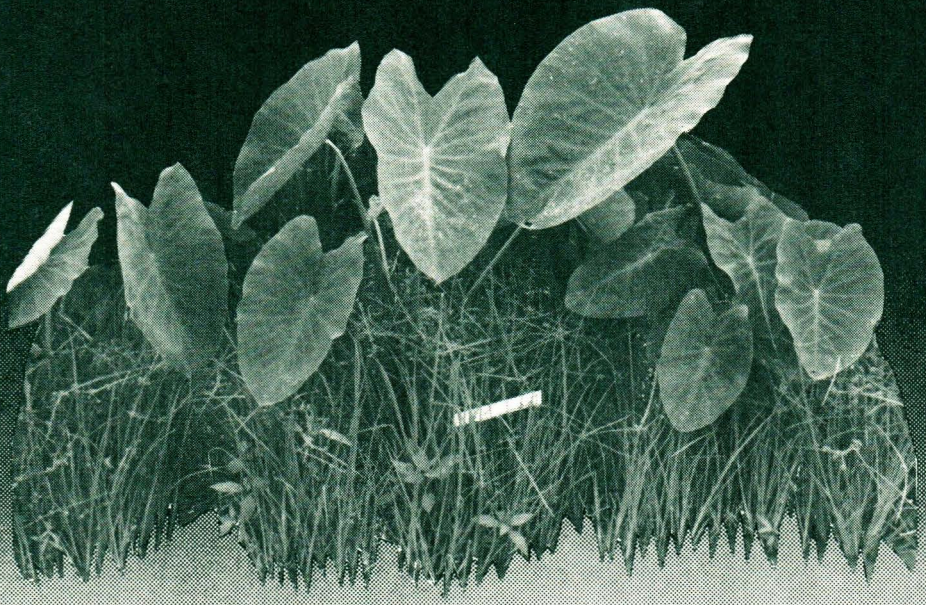
Cooperative Extension Service
University of Hawaii
Circular 488



NITROFEN
for Taro Weed Control

Ramon S. de la Peña

7/2/85

SAM

Barry Brennan called to request that we take Circular 48T (Nitrofen for Taro Weed Control) out of circulation. (Nitrofen has been banned by the EPA)

Barry's thought is that we should destroy our inventory as Nitrofen will probably not be allowed again.

CD

Nitrofen for Taro Weed Control

By

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Assistant Specialist in Agronomy

Taro, an old staple food crop grown in Hawaii for the manufacture of poi, is cultivated under lowland and dryland conditions. Virtually all of the taro presently grown in Hawaii is cultivated under lowland conditions and the limited acreage in dryland taro is confined to elevated areas with adequate rainfall for irrigation.

Once a widely cultivated crop in Hawaii, taro production has decreased considerably in the last ten years, averaging slightly over 400 acres per year (2). Requiring several hours of hand labor in knee-deep water, the steadily increasing cost of labor needed in the field operations resulted in the decrease in number of taro farmers (2). Except for the introduction of small machine for land preparation, the farmer still must depend on hired labor for all of the farm operations including planting, weeding, harvesting, etc.(5).

Weed control has always been an expensive operation requiring many hours of hand labor. To obtain high yields and maintain high quality, weed control in both upland and lowland taro is essential. Not only do weeds compete with the taro crop for nutrients, water and sunlight, but weeds also make field operations especially harvesting more difficult and expensive. Weed control in lowland taro has been easier than in upland taro because of the weed control afforded by continuous flooding. Intermittent drying or draining of taro fields, however, allows weeds to germinate in lowland paddies. Semi-aquatic and aquatic weeds are also a nuisance in lowland taro patches (6).

As in lowland rice all over the world, barnyard grass and junglerice (*Echinochloa crusgalli* and *E. colonum*) are the most serious weeds in Hawaiian taro patches (Fig. 2). Control of these and other weed species up to now has been done by hand and by thorough land preparation as well as irrigation management.

The use of chemicals for weed control in both upland and lowland taro has been the subject of years of research work at the H.A.E.S. (Hawaii Agricultural Experiment Station, College of Tropical Agriculture, University of Hawaii). Among several herbicides tested, nitrofen has shown excellent weed control in both upland and lowland taro without causing injury Fig. 1, 2 to the taro plants (4, 6). A petition was submitted for the registration of nitrofen for taro weed control, using residue analysis and field data obtained by the H.A.E.S.

The clearance of nitrofen for chemical weed control in taro was approved for Hawaii September 26, 1974, Reg. No. 4376-13.

The availability of a material for taro weed control also offers another advantage for growers who want to drain the field right after planting to induce rapid and

Fig. 1. Taro plot, three months after planting, treated with nitrofen (TOK E-25) at 3 kg a.i./ha. immediately after planting.

Fig. 2. Control plot, three months after planting. Note tarweed cuphea (*Cuphea carthagenensis*) in the foreground and seeding barnyard grass (*Echinochloa crusgalli*) in the middle of the plot.

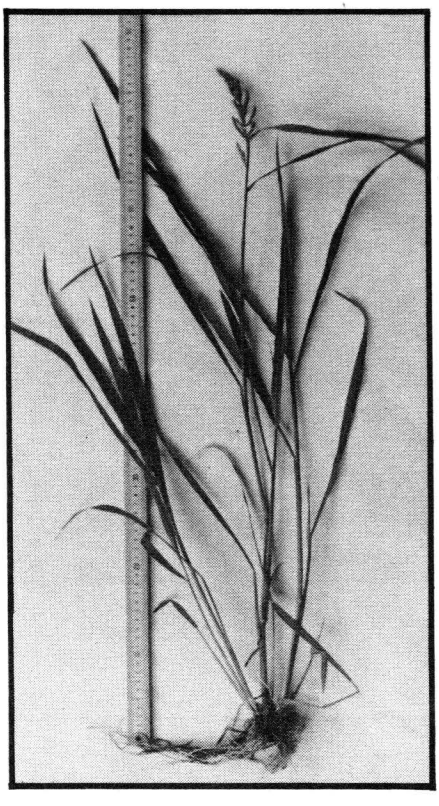

Fig. 3. Barnyard grass, *Echinochloa crus-galli.*

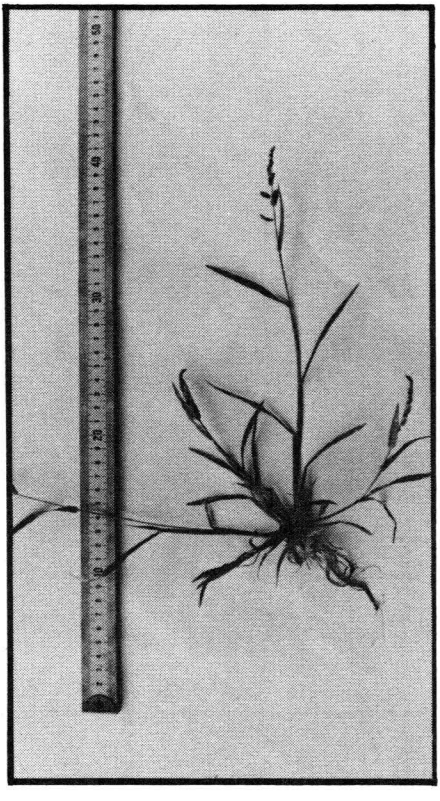

Fig. 4. Junglerice, *Echinochloa colonum.*

early plant development without serious weed outbreak. During applications of fertilizers when the crop is three to six months old, the field can also be drained and fertilized in the usual manner and an application of nitrofen will prevent growth of germinating weeds during the period when the paddy is drained.

Weed Species Controlled

Nitrofen, when used for weed control in certain vegetable crops, controls several weed species. Under the conditions where it was tested for lowland taro weed control, nitrofen controlled barnyard grass (*Echinochloa crusgalli*), junglerice (*Echinochloa colonum*), small flower umbrella plant (*Cyperus difformis*), tarweed cuphea (*Cuphea carthagenensis*), primrose willow (*Jussiaea suffruticosa*), and *Dopatrium junceum,* (Fig. 2, 3, 4, 5, 6).

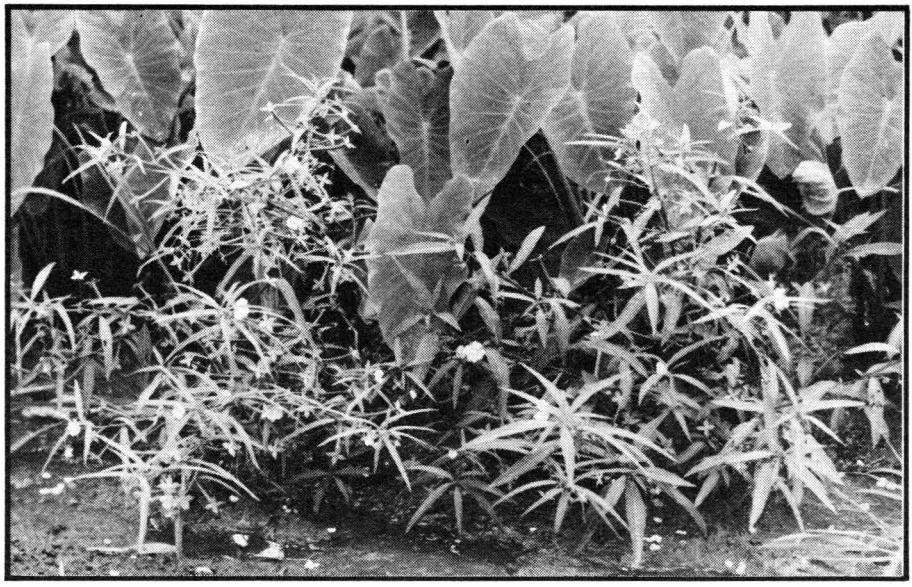

Fig. 5. Tarweed cuphea, *Cuphea carthagenensis,* in a taro patch.

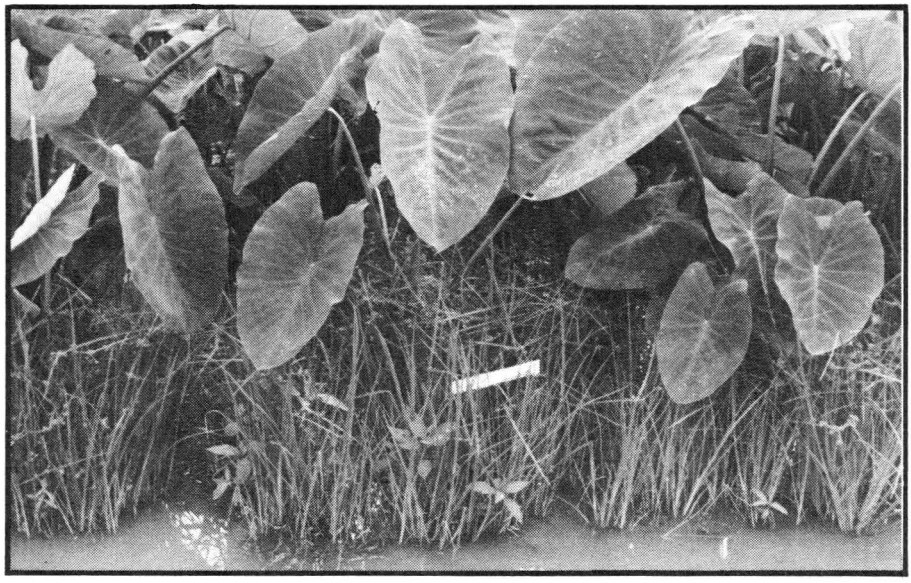

Fig. 6. Small flower umbrella plant, *Cyperus difformis,* in a taro patch. Note a few seedlings of tarweed cuphea starting to come up.

Methods of Application

Nitrofen can be used at rates of 3 kg a.i./ha (active ingredient/hectare) or 2.67 lbs. a.i./acre to 6 kg a.i./ha or 5.34 lbs. a.i./acre. It should be applied within three days after planting or before the new leaves have emerged. Drain the field before application to allow chemical to come in contact with the soil surface. Do not flood within three days after application of herbicide. A second application may be done at two to three months after planting if necessary.

Nitrofen can be applied in several ways in the taro paddies. It can be sprayed, using a knapsack sprayer or suitable spraying equipment or watered-in with the irrigation water, (Fig. 7, 8, 9).

Application of the chemical through irrigation water has been shown to be convenient especially when the crop is already developed by using an injector pump which sucks the chemical and mixes it with the water coming into the patch (4), (Fig. 7). Another simple and almost labor free method of applying nitrofen is by using a constant flow device[1] for metering the chemical into the irrigation system (Fig. 9, 10) or simply dripping the chemical into the water inlet (Fig. 8). These methods have the advantage of being able to apply the herbicide without causing leaf injury. They also allow applicators to stay outside of the field thereby reducing root injuries and soil disturbance that can cause disease infestation and outbreak, especially corm rot. It is important that the field is thoroughly prepared and level to assure uniform distribution of the flood water and herbicide over the soil surface.

The water outlet should be closed during the process of application. Water inlets and outlets should be closed after application and the patch be allowed to drain naturally before normal irrigation is resumed.

Calibration

Whether the material is applied as a spray or applied through the irrigation by an injector pump, drip system, or constant flow device, the calibration of the equipment and applicator is important so that the desired rate of application is attained.

In the injection method, the chemical should be diluted with enough water so that the chemical is going into the irrigation stream until water in the patch is approximately one inch deep.

The drip system shown in Fig. 8 is calibrated in the same manner as the injection method and the constant flow device. That is, the chemical solution should last until there is enough water in the patch.

For the constant flow method, the following simple steps may be followed for calculating the amount of material to be applied and the degree of dilution for a given area.

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[1] **Adopted from Stauffer Chemical Co. 1971. Eptam 6-E Label. page 5.**

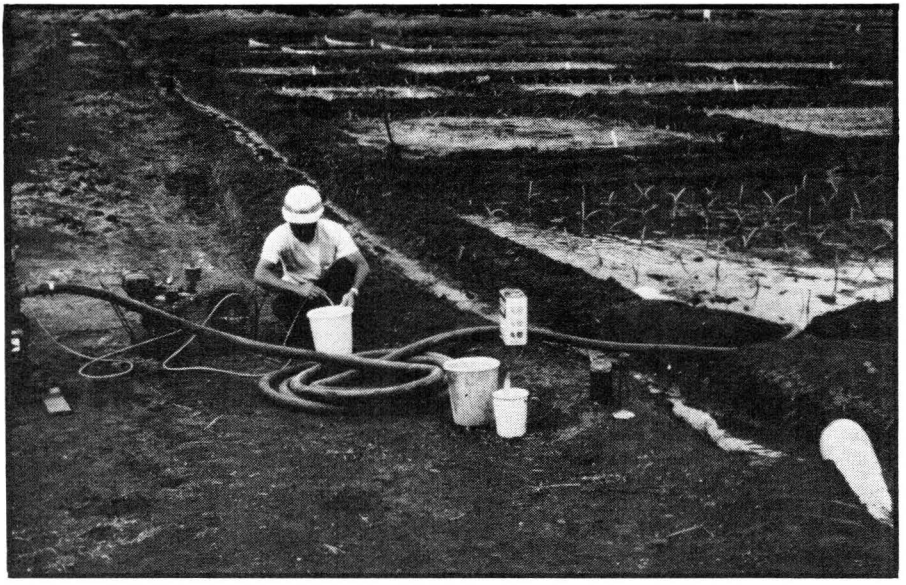

Fig. 7. Pump injection method of applying herbicide into the irrigation water. The solution is sucked by a pump, immediately to the right of the operator, and injected into the irrigation stream.

Fig. 8. The drip method, quite simple but should be calibrated to enable applicator to apply the precise amount into the patch. Note second tubing which reaches to the top of the solution to allow air inside preventing formation of a vacuum.

First, measure the field dimensions to calculate the area and the exact amount of active ingredient and commercial formulation needed for a given taro patch at a given rate of application.

Second, determine under the existing field conditions, the approximate time needed to irrigate the patch to about one inch depth.

Third, select an orifice size that will deliver a convenient volume of chemical solution in the length of time that it takes to flood the patch using table 1 as a guide.

Sample problem A:

Treat a patch with an area of 21,780 sq. ft. or 0.5 acres at 3 lbs. active ingredient per acre with an irrigation time of approximately 12 hours.

Solution to problem A:

By calculation, three fourth (0.75) gallons of TOK E-25 is needed for the 0.5 acre patch. Using table 1 as a guide, Tee Jet Tip No. 800067 delivers 5 gallons of solution in approximately 11 hours and 57 minutes. Diluting the TOK E-25 material with enough water to make a solution of 5 gallons, Tee Jet Tip No. 800067 should be used.

Sample problem B:

The same patch in problem A with an irrigation time of only four hours.

Solution to problem B:

The same patch treated with the same rate of nitrofen, the chemical should be diluted to 5 gallons and Tee Jet Tip No. 8002 should be used.

Sample problem C:

An area of 4,356 sq. ft. (0.1 A) to be treated with TOK E-25 at 3 lbs. a.i. per acre and an irrigation time of approximately 30 minutes.

Solution to problem C:

To treat an area of 4,356 sq. ft. (0.1 acre), 568 cc (19.2 U.S. Fluid oz.) of TOK E-25 is required to give a rate of 3 lbs. a.i./acre. Using table 1, Tee Jet Tip No. 0003 which delivers 1 gallon of solution in approximately 31 minutes should be used and the chemical diluted to a volume of one gallon. (Note: One acre at 3 lbs. a.i./acre needs 1.5 gallons of TOK E-25, therefore 0.1 acres need .15 gallons or 568 cc).

Commercial Formulations

Nitrofen is available as a 25% emulsifiable concentrate (E.C.) as TOK E-25, as a 50% wettable powder (WP) as TOK WP-50, and as a 7.7% granular material. TOK E-25 contains 2 lbs. a.i. per gallon (7).

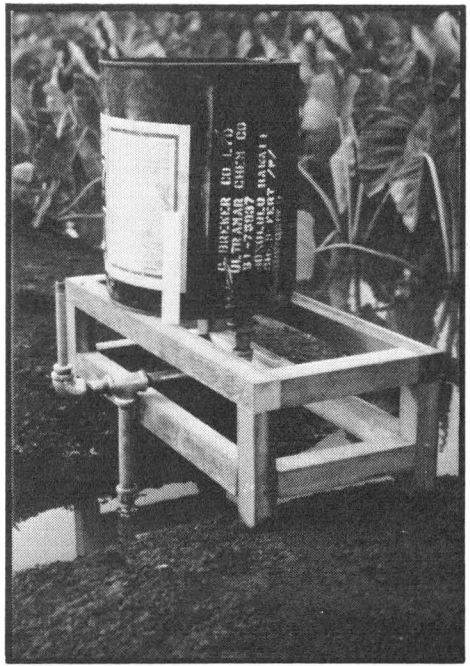

Fig. 9. Constant-flow device for metering herbicide into the irrigation water. Container can be any five-gallon container with a bung which will fit a ¾" bushing. With slight modification, a bigger container can also be used.

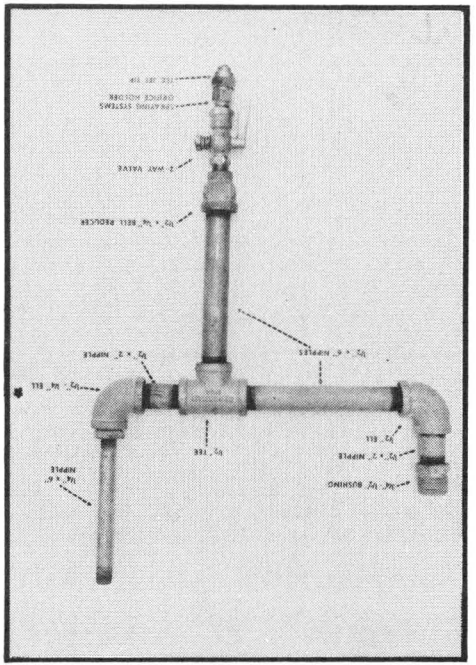

Fig. 10. The constant-flow device, an easy to make metering device. *Or ½" Ell with a ½"–¼" bushing as shown in the picture.

Table 1. Flow rates for some Tee Jet® orifices for the constant flow device.

Tee Jet Type and Tip No.	Equiv. Orifice Diameter	Screen Mesh	Approximate delivery[1]			Approximate time (hours:min)[1]	
			ml/min.	ml/hour	gal/hour	1 gallon	5 gallons
Solid Stream Tips							
000009	.008"	200	3.0	180	0.05	20:00	100:00
000012	.010"	200	5.2	312	0.08	12:30	62:30
000019	.012"	200	8.5	510	0.13	7:41	38:28
000021	.0135"	200	10.0	600	0.16	6:15	31:15
000050	.020"	200	21.75	1305	0.34	2:56	14:43
0001	.028"	100	40.5	2430	0.64	1:34	7:49
00015	.033"	100	57.5	3450	0.91	1:06	5:29
0002	.039"	50	85.0	5100	1.35	0:44	3:42
0003	.047"	50	125.0	7500	1.98	0:31	2:32
0004	.055"	50	158.0	9480	2.50	0:24	2:00
0005	.061"	50	194.0	11640	3.08	0:19	1:37
0006	.067"	50	205.0	12300	3.25	0:18	1:32
0008	.078"	*	320.0	19200	5.07	0:12	0:59
0010	.086"	*	365.0	21900	5.79	0:10	0:52
0015	.107"	*	520.0	31200	8.24	0:07	0:37
0020	.125"	*	735.0	44100	11.65	0:05	0:26
Flat Spray Tips							
800050	.018"	200	16.6	998	0.26	3:51	19:14
800067	.021"	100	26.4	1584	0.42	2.23	11:54
8001	.026"	100	40.8	2448	0.65	1.32	7:41
80015	.031"	100	60.0	3600	0.95	1:03	5:16
8002	.036"	50	78.0	4680	1.24	0:49	4:02
8003	.043"	50	112.5	6750	1.78	0:34	2:49
8004	.052"	50	145.0	8700	2.30	0:26	2:10
8005	.057"	50	178.0	10680	2.82	0:21	1:46
8006	.062"	50	206.0	12360	3.27	0:19	1:32
8008	.072"	50	287.0	17220	4.55	0:13	1:06
8015	3/32"	50	490.0	29400	7.77	0:08	0:38

® Registered trade mark of Spraying Systems Company.

[1] Values taken at 72–74°F. Actual flow in the field should be measured as rate of delivery varies with material and temperature. Other types and Tee Jet Tips may be used but rate of flow should be measured before actual use.

* Screen not required.

Nitrofen, 2,4-dichlorophenyl-p-nitrophenyl ether, is a free flowing solid, dark brown with a distinct odor. It is essentially insoluble in water and soluble in acetone, methyl alcohol, and xylene to the extent of 25% at room temperature (7).

Under conditions of use, it has been determined to be nontoxic to wild birds and toxic to fish (7).

Use Precautions

Nitrofen is flammable, do not smoke while using and keep the emulsifiable concentrate away from fire and sparks. Clean spray equipment after using by washing thoroughly with detergent and water. Do not allow chemical to come in contact with the skin or eyes to prevent possible irritation. Contaminated skin areas should be washed immediately with soap and water.

Keep all materials out of the reach of children and away from pets and foodstuffs. Exercise extreme caution in handling spray materials and wear protective clothing and equipment when spraying. Read the label and follow the manufacturer's recommendations.

NOTE:

The use of trade names is for convenience only and is not an endorsement of the product exclusive of other products or companies.

References

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7. Weed Science Society of America. 1974. Herbicide Handbook of the Weed Science Society of America. Third Edition.

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