blood dyscrasias is conditioned by the degree of loss of ability on the part of the erythropoietic tissues to elaborate cholinesterase. Though other cholinergics besides acetylcholine are undoubtedly involved in the production of cholinergic episodes and the maintenance of cholinergic states in the human, the concomitance of blood cholinesterase level depression with morbidity degree in these dyscrasias may indicate a rational approach to control through substitutive enzyme therapy. Such therapy appears to have been successful in an estrapenic condition, experimental surgical shock in dogs (*5*).

The presence in human plasma (which has not had its cholinesterase activity vitiated) of a factor which permits maturation of leucemic myeloblasts (*2, 6*) and of a factor (diminished in the estrapenic plasma of relapsing Addisonian anemia) which causes reticulocyte "ripening" (*4*) would appear to warrant the attempt at isolation and the therapeutic trial of these fractions.

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Sulfaquinoxaline in the Control of *Eimeria tenella* and *Eimeria necatrix* in Chickens on a Commercial Broiler Farm[1]

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Delaplane, Batchelder, and Higgins (*1*) first reported the use of sulfaquinoxaline in the prevention of *Eimeria tenella* infection in chickens under laboratory and field conditions. Grumbles, *et al.* (*2*) continued these studies and made more extensive observations on sulfaquinoxaline in preventing and treating both cecal and intestinal coccidiosis (*E. tenella* and *E. necatrix*) under field and laboratory conditions.

Sulfaquinoxaline was fed at the rate of 0.05% to chickens subjected to severe exposure of coccidia on a commercial broiler farm. The drug was given 2 days out of 5 (2–3 schedule), 1 day out of 4 (1–3 schedule), 1 day out of 5 (1–4 schedule), 2 days out of 6 (2–4 schedule), 4 days out of 8 (4–4 schedule), and at the rate of 0.0125% fed continuously.

Results of studies on 43,309 sulfaquinoxaline-treated birds and 3,085 untreated controls are shown in **Table 1.** The deaths from coccidiosis among the medicated birds were 1.75, 2.17, 1.80, 0.86, 1.13, and 1.20% as compared to 17.43% in the controls. The birds which died from coccidiosis showing *E. necatrix* infection were 0.63, 0.26, 0.28, 0, 0.13, and 0.12%, respectively, as compared to 7.45% in the controls.

Thus, sulfaquinoxaline used at the rate of 0.05% intermittently and 0.0125% continuously in the feed is effective in the control of *E. tenella* and *E. necatrix* infection in chickens. No symptoms of toxicity were observed in the birds after the use of the drug at the levels cited.

TABLE 1

Schedule	No. of birds	Coccidiosis mortality (%)			
		Cecal	*E. necatrix*	Both*	Total
Control pens "2–3"	3,085	9.98	3.53	3.92	17.43
.05% S.Q.† "1–3"	17,699	1.12	0.51	0.12	1.75
.05% S.Q. "1–4"	7,348	1.91	0.18	0.08	2.17
.05% S.Q. "2–4"	5,459	1.52	0.02	0.26	1.80
.05% S.Q. "4–4"	1,043	.86	0	0	0.86
.05% S.Q.	1,575	1.00	.13	0	1.13
0.0125% continuous	10,181	1.08	0.1	0.02	1.20

* Both *E. tenella* and *E. necatrix* infections.
† Sulfaquinoxaline.

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Weed Control in the Tropics

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The use of cheap labor for hoeing weeds is traditional in the tropics. Only recently have chemicals been given serious consideration. The low cost and great effectiveness of the 2,4-D herbicides have created new opportunities for improvement of cultural methods and conservation of labor. Van Overbeek and Vélez (*4*) and White and Villafañe (*6*) have pointed out the unique value of 2,4-D as a selective weed killer in cane and other tropical crops.

The selective nature of 2,4-D is at once a virtue and a fault. Being relatively nontoxic to cane and coffee (*4*), this herbicide can be used with little or no injury in these crops. On the other hand, being nontoxic to grasses, one of the large and important groups of weeds is im-

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mune to its action. Grasses are known to exist in cane, coffee, pineapples, and other important crops of Puerto Rico and Hawaii. They undoubtedly thrive in many other regions of the tropics. Species of such genera as *Cenchrus, Cynodon, Echinochloa, Eleusine, Panicum, Paspalum, Setaria, Trichachne,* and others are common in and around the cane fields of Puerto Rico. Not only do they grow in the cane rows, where hand-hoeing is required to remove them, but they abound along roads, drainage and irrigation ditches, fence lines, and railway ballast; in fact, they make up an important part of the plant population of every nontilled area.

Recognizing the ineffectiveness of 2,4-D against grasses, Van Overbeek and Vélez (*5*) recommended that they be controlled by mechanical cultivation; 2,4-D, therefore, was only a supplementary treatment to correct the shortcomings of mechanical methods. It has proved particularly useful in the humid regions, where *Commelina* (day lily) species are very difficult to control by mechanical means.

In view of the experiences of many growers in Puerto Rico, the early statements of Van Overbeek and Vélez (*5*), *i.e.* "completely effective against nutgrass," "a concentration between .05 and .075 per cent is sufficient to exterminate commelina completely," and ".3 per cent gave complete eradication (of nutgrass)," seem somewhat optimistic. Although under the ideal conditions of experimental spraying such results could be obtained, actually neither of these weeds is responding so favorably. Many factors are responsible such as the unpredictable tropical rains, inefficiency of the workers, spreading by tillage and irrigation water, etc. If chemical weed control is satisfactorily to supplement hoe labor in controlling tropical weeds, a systematic program of periodic treatments will be required; and if it is completely to replace mechanical methods, a contact spray capable of controlling grasses is needed.

Recent studies based on several years of research (*1, 2, 3*) indicate that the following formula will provide a satisfactory oil emulsion contact spray, low in cost, and convenient to handle: medium gravity highly aromatic oil, 30 lbs; pentachlorophenol, 2 lbs; Oronite wetting agent, 2 lbs; and water, 95 gals.

The oil used in the experimental work was a bottoms or residue left after the recovery of gasoline from the fraction produced by catalytic cracking of petroleum. Much of this oil is being produced, but it is employed as furnace fuel for want of a better use. Two weed-killing oils, Shell #20 and Standard (of California) #2 are of this type. In making up the spray emulsion, the pentachlorophenol and Oronite are dissolved in the oil. Gentle heating speeds this process. When this concentrate is ready, it is emulsified in the water, using violent agitation. After it is mixed, gentle agitation will keep it stable.

This spray emulsion will kill all green vegetation, but it will not kill cane, coffee, pineapple, or banana plants if used only around the bases and kept off the leaves. It can be used as a pre-emergence spray before planting and as a general contact spray against all weeds as soon as the shoots are a foot or more in height. It should be kept off the young leaves of cane and out of the crowns of pineapple plants.

Even this spray, though toxic to all green vegetation, will not control all weeds. In fact, the above formula is designed to kill young grass seedlings in cane with a minimum of damage to the latter.[2] At this concentration, bejucos (*Ipomoea* sp.) are killed only to the ground line, from whence they resprout. *Commelina* and coqui (nutgrass) are only slightly injured, and the injury is slow in developing. Herein lies the key to a very significant discovery.

Ordinarily in the use of 2,4-D, toxic materials as solvents or coupling agents are avoided, the reason being that immediate injury to the leaves will prevent satisfactory translocation of the herbicide to the stems and roots. This is basically sound, but it does not apply to the combination of 2,4-D with the contact emulsion described above when used in Puerto Rico, because *Commelina,* bejucos, and coqui are not rapidly injured and are extremely sensitive to 2,4-D. Therefore, it has been found that 1 lb of 2,4-D or its equivalent of an ester can be added to the concentrate consisting of the three first items of the formula given above, and that the resulting emulsion spray will kill grasses, *Commelina,* coqui, bejucos, morivivi (*Mimosa pudica*) and many other weeds. In other words, it combines the virtues of a general contact herbicide with those of 2,4-D to give a spray that kills most of the weeds of tropical crops.

One additional problem is acute in the tropics—the control of coarse, vigorous grasses such as malojillo (*Panicum purpurascens* Raddi) and zorra (*Trichachne insularis* (L.) Nees.) in drainage and irrigation ditches, in fences, along roadsides, and in every nontilled area.

If 2 lbs of pentachlorophenol are dissolved in 1 gal of the highly aromatic oil described, and this is mixed in 100 gals of diesel fuel, waste crankcase oil, or any other oil of light enough viscosity to flow through the nozzle, this fortified oil will be found to give excellent results, especially if it is used in sufficient quantity to cover the grass thoroughly and soak down into the crowns. Where the highly aromatic oil is available in quantity it may be used directly without fortification.

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[2] This formula may be modified to meet almost any condition. The pentachlorophenol concentration may be increased to 3 lbs for use in cane over 2½′ in height. For roadside weeds 4 lbs or more may be used. For coarse, mature grasses the oil concentration may be increased to 45 lbs or more, or the killing power may be increased by simply emulsifying the stock solution in less than 95 gals of water.