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RESEARCH ON A HERBICIDE BASED ON 2,4,5-T

/Following is a translation of an article by I. Bakuniak, M.A. and J. Ostrowski, M.A., Institute of Organic Industry, Warsaw, in the Polish-language periodical Ochrona Roslin (Plant Protection), No 1, 1964, pages 24-29./

Every new herbicide in the initial stages of its biological appraisal is tested in the laboratory using various bioindicators (test plants).

Fults and Payne (2) /references are to bibliography at end/ showed in a microtest of the Went pea curvature, a similar biological activity of 2,4,5-T and 2,4-D. Wain and Wightman (5) composed the biological activity of the acid 2,4,5-T with other phenoxy acids using the wheat grain fragments, the pea test of Went and the tomato bending test. The wheat fragments for the acid 2,4,5-T behaved similarly as for 2,4-D. The Went test for a concentration of the active ingredient to 0.1 ppm (parts per million), more active proved to be acid 2,4-D than acid 2,4,5-T; when, for concentrations of 1 and 10 ppm, no differences in activity were detected. The tomato bending test showed that both herbicides were active.

In our experiments, conducted in 1961, the butyl ester of 2,4,5-T acid synthesized in the Institute of Organic Industry was compared with a similar product of the firm Cela, called Tormona 80%, by the test of coleoptile of wheat grains, the test of first interknot of oat grains, and the test of inhibiting the growth of cucumber roots, and their volatility was tested by a laboratory method.

In the coleoptile wheat germinating grain test sprouts were used about 20 mm long which were produced in darkness at 25° C, and in order to induce the elongation, coleoptiles of germs of soaked seeds and the sprouts were irradiated with red light. From these shoots, a special device selected from each, one segment of 4 mm length from the coleoptile, at a distance of 3 mm from the top. These segments were mixed in doubly distilled water and transferred to Petri dishes with test solutions of investigated compounds at concentrations 10^{-4} - 10^{-8} by weight. The proposed solutions were at pH=5 by the action of buffers, i.e., 1.794 g/l of potassium phosphate and 1.019 g/l of the citric acid monohydrate and of 2% of sacharase. In order to obviate a possible interaction of pairs of tested solutions, the Petri dishes were sealed with plasticine and placed at 25° C for 20 hours. Then the segments were measured with accuracy down to 0.1 mm using a Brinell lens.

We see from the results that both compounds in the coleoptile test of the wheat germs for concentrations of 10^{-8}, 10^{-7}, 10^{-6}, 10^{-4} showed similar results, only for the 10^{-5} concentration the butyl ester of 2,4,5-T showed a longer elongation than Tormona 80, as seen in Fig. 1.

The first interknot of oat germs test conducted by the Nitsch method (3) on oat germs of length about 25 mm grown in darkness at 25° C, the coleoptiles were cut off by a big razor at the coleoptile knot and subsequently from the first interknot were cut out, using a special instrument, one test fragment each of length 4 mm at 2 mm from the coleoptile knot. The segments were rinsed in doubly distilled water and transferred to Petri dishes with solutions of tested compounds in concentrations from 10^{-4} to 10^{-9} at pH=5 (using similar buffers as before) and 2% sacharase. The Petri dishes were sealed as before and placed in a thermostat at 25° C for 20 hours.

The results are tabulated in Table 2 and show that the action of both compounds whose active ingredient was the butyl ester of acid 2,4,5-T at all concentrations was for the test of the first interknot of oat germs equal, as is seen in Fig. 2.

The test based on inhibiting the growth of cucumber roots was carried out by the method of Ready and Grant (4), ten cucumber seeds were placed in Petri dishes on filter paper saturated with test solutions at concentrations from 10^{-4} to 10^{-8} Three repeats of experiments were made. The dishes were sealed with plasticine, and placed at 25° C for three days, after which time the cucumber roots were measured with an accuracy of 1 mm.

Variance analysis was performed for the obtained results. The confidence limit with a probability of 95% was 2.7 mm, so we may infer that both esters act similarly as all differences for equal concentrations are not meaningful. (Fig. 2).

The volatility testing of the esters of the acid 2,4,5-T was performed by means of the described method. In the biotesting of volatility of the mentioned herbicides we used tomatoes grown on lots in the laboratory under artificial light similar to daylight. The families of tomatoes grew in pots made of waxed paper which were placed in Petri dishes larger than the bottoms of the pots, to which previously were inserted filter paper rings saturated on one side with 1 milliliter of 0.25% test solution of investigated esters (solution similar to those used in practice). The plants, together with the dishes were placed into plastic bags which were sealed using a soldering gun. (Fig. 4).

The prepared bags were suspended by means of pressure hangers for 24 hours in darkness (Fig. 5).

During that time the bioindicators (tomato families) were under the influence of the tested herbicide vapors. Many were subsequently taken out of the bags and placed under artificial light, and observed for a few days. The tomato plants which as a rule are sensitive to herbicides of this type, showed no changes under the action of the butyl ester of the 2,4,5-T acid produced by the Institute of Organic Industry (I.P.O.) nor under Tormona 80.

The experiment was repeated twice more; in one set, a 0.5% solution was used, while in another a 1% solution. In both cases, the tomato plants, were not affected, which points to the relatively low volatility of the pair of tested herbicides.

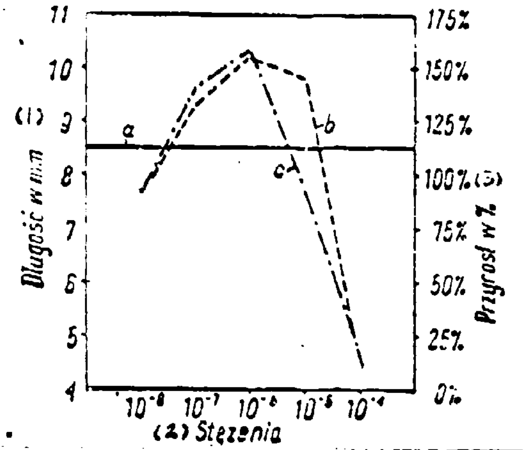
The conducted experiments enabled ~~us~~ to infer that the butyl ester of the 2,4,5-T acid produced by the I.P.O has a similar biological activity as the butyl ester of the 2,4,5-T acid produced by the firm Cela and called Tormona 80.

The good action of a herbicide based on the acid 2,4,5-T in fighting superfluous flora was described in "Ochrona Roslin" No 11/1963 r.

Table 1. The influence of esters of acid 2,4,5-T on the elongation of coleoptile sections of wheat germs.

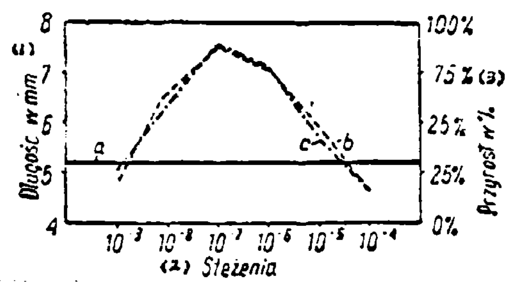
Compound	Concentration 10^{-8}	10^{-7}	10^{-6}	10^{-5}	10^{-4}
	Mean length of section in mm.				
Butyl ester of 2,4,5-T	7.6	9.3	10.2	9.8	4.5
Tormona 80	7.7	9.6	10.3	7.7	4.6
Control	8.5				

Fig. 1. The influence of ester of acid 2,4,5-T on the elongation of coleoptile of wheat germs: (a) control, (b) butyl ester of 2,4,5-T produced by I.P.O., (c) Tormona 80.



/Legend/: 1) Length in mm; 2) Concentration; 3) Increment %.

Fig. 2. Influence of esters of acid 2,4,5-T butylate on the elongation of sections of the first interknot of oat germs: (a) control, (b) 2,4,5-T butylate I.P.O. production, (c) Tormona 80.



/Legend/: 1) Length in mm; 2) Concentration; 3) Increment %.

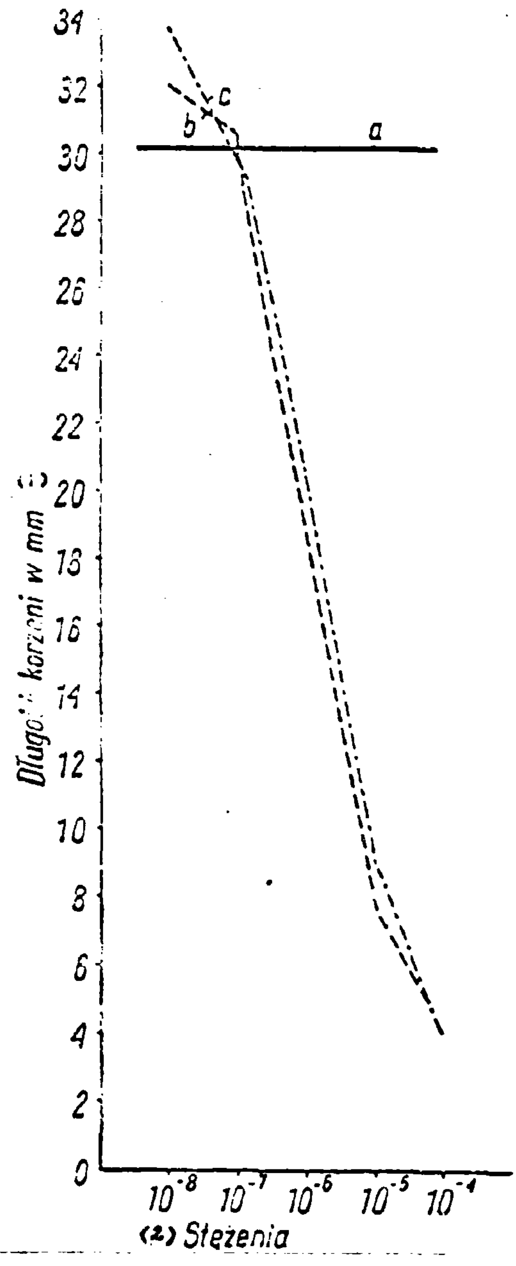
Table 2. The influence of 2,4,5-T butylate on the elongation of the first interknot of oat germs.

Compound	Concentration 10^{-9}	10^{-8}	10^{-7}	10^{-6}	10^{-5}	10^{-4}
	Mean length of sections in mm.					
2,4,5-T butylate I.P.O.	5.0	6.4	7.6	7.1	5.7	4.6
Tormona 80	4.8	6.6	7.5	7.1	5.9	4.6
Control	5.2					

Table 3. Effect of the esters of the acid 2,4,5-T on retarding the growth of cucumber roots.

Compound	Concentration 10^{-8}	10^{-7}	10^{-6}	10^{-5}	10^{-4}
	Mean root length in mm.				
2,4,5-T butylate I.P.O.	32.0	30.4	18.8	7.7	4.1
Tormona 80	33.7	29.9	20.3	9.1	4.0
Control	30.2				

Fig. 3. Influence of esters of acid 2,4,5-T on inhibiting the growth of cucumber roots: (a) control, (b) 2,4,5-T butylate I.P.O., (c) Tormona 80.



/Legend/: 1) Root length in mm; 2) Concentration.

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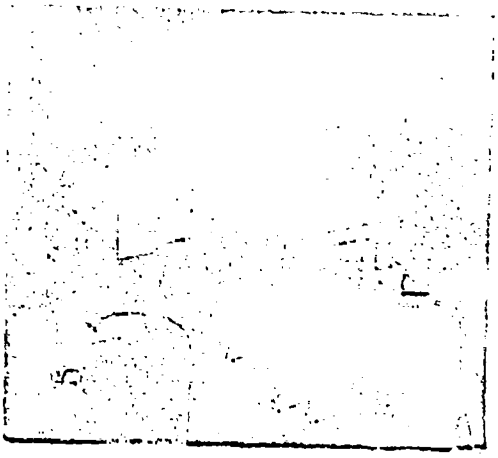
Fig. 4. Tomato plant in a plastic bag prepared to be tested by vapors of 2,4,5-T acid esters.

Fig. 5. Experiment to test action of vapors of esters of the 2,4,5-T acid on tomato plants.



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