WEED CONTROL IN TEA WITH PARAQUAT AND DIURON *)

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S u m m a r y

An experiment with paraquat and djuron and a mixture of the two chemical was conducted in a tea plantation at Pagilaran, Pekalongan, Central Java in 1972/73 which was predominantly infested with *Eupatorium riparium*.

The result showed that weed regrowth 8 weeks after spraying with paraquat and paraquat + djuron, were almost the same, but paraquat ($P < .01$) and paraquat + diuron ($P > .01$) also reduced the dry weight of weeds biomass.

Introduction.

Paraquat is widely used in tea-plantations in Java, Sumatra as well as in other countries (Agarwata 1971; Arvier 1971; Kiswito and Lubis 1971; Venkataramani, 1971). It is now also used in Pagilaran Tea-estate, which is managed by the Faculty of Agriculture of the Gajah Mada University. It is an effective contact herbicide which acts through photosynthesis (P system I). There is indirect evidence that the salt themselves are not biologically active but its bipyridylium ion is. The proces involves the addition of one electron to bipryridylium ion to form a free radical, which upon oxidation by molecular oxygen produces peroxyde radicals or hydrogen peroxyde by a series of chain reactions.

Diuron acts also via photosynthesis, but in a different way from paraquat. It is believed that diuron blocks the electron flow from water to chlorophyl. Because of this inhibition of electrons to the chlorophyil, it will also inhibit the electron flow through P system I so that the presence of diuron or monuron will inhibit the herbicidal action of paraquat (Audus, 1964). This may be beneficial because of the greater possibility to transport the paraquat salt molecules further in the plant, which cause a more intensive effect on the plants.

This experiment which was also inspired by the work of Seth 1971 was to try to prolong the suppressing effect of paraquat by diuron under local conditions, with the expectation that similar effects will be obtained as shown by Seth (1971) in Malaysia and Pritchard (1971) in New Guinea.

Materials and methods.

The experiment was conducted at the Pagilaran tea-plantation located at an altitude of about 1200 m above sea level with a uniform cover of weeds, primarily **Eupetorium riparium.** The tea-bushes were at 1.00 X 1.50 m spacing and were about seven months after deep pruning so that the canopy was not completely closed yet. Other weeds present were **Paspalum conjugatum, Panicum repens, Boreria latifolia, Drymaria cordata, Oxalis cerymbosa, Polygonum spp.** and also **Imperata cylindrica.**

The last weeding, by slashing, was carried out about 8 weeks before the spray. At that time the weeds were about 35 cm high.

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The treatments were as follows :

A. paraquat at 0.3 kg a.i. per Ha.
B. diuron at 2.4 kg a.i. per Ha.
C. paraguat + diuron (0.3 kg a.i./Ha + 1.2 kg a.i./Ha).
D. paraquat + diuron (0.6 kg a.i./Ha).
E. Manual weeding.
F. Unweeded.

The chemicals were applied as direct post-emergence sprays. Plot-size was 50 square meters with 3 replications.

Observations on the effect of the chemicals were done at two weeks interval beginning at four weeks after spraying and continued until eight weeks. Percentage of kill was assesed visually and scorings were given from 0, for no kill, -5, for 100% kill of the covering weed vegetation. The last observation at 8 weeks after spraying included also a biomass analysis for randomlytaken sample quadrats of one square meter for each treatment plot.

3. Result.

The average rating values at each observation and the average dry-weight of weeds present in one square meter is summarized in table 1.

Table 1 : Rating of treatment performance and dry-weight of biomass.

Treatment	Average actual rating values			Angular transformed rating values			Dry wight of biomass per sq. m. at 8 was in grams.
	4 was *	6 was	8 was	4 was	6 was	8 was	
A. paraquat	3.7	3.3	2.7	59.21	54.99	46.92	71.7
B. diuron	0.7	0.3	0.0	18.31	10.06	1.81	235.0
C. paraquat + diuron (high)	4.0	3.7	3.0	63.43	59.21	50.77	84.0
D. paraquat + diuron (low)	3.3	3.3	2.7	54.99	54.99	46.92	127.0
E. manual weeding	5.0	4.0	2.7	88.19	63.43	46.92	300.0
F. unweeded	0.0	0.0	0.0	1.81	1.81	1.81	520.0
LSD 5%				13.42	14.98	7.24	135.8
LSD 1%				19.98	21.30	10.30	193.2

*) was = weeks after spraying.

Statistical analysis after angular transformation of the rating values showed the following result. Manual weeding (E) at 4 weeks after spraying was significantly better than all other treatments, while treatments with paraquat, and paraquat + diuron mixtures (A, C, D) were significant better than the diuron treatment (B). There was no significant difference among the treatments with paraquat alone, high dose of paraquat + diuron mixture and low dose of

paraquat + diuron and there was only a slight significant difference between the diuron treated plots compared to the unweeded.
The second observation at 6 weeks after spraying revealed that there was no significant difference between manual weeding and all other treatments except the diuron treatment.
The result of the biomass analysis from sample quadrats in the treated plots gave a rather different picture of the effectiveness of the effectivenes of the treatments. Treatments with paraquat (A) and paraquat + diuron (C) were much better ($P<.01$) than manual weeding; while treatment D (commercial paraquat + diuron mixture) was only slightly better ($P<.05$) than manual weeding. Treatment B, diuron alone was better than manual weeding although the difference was not significant.

4. Discussions and conclusion.

Based on the rating values obtained at four weeks after spraying it may be concluded that manual weeding was better than other treatments, while spray with paraquat alone and paraquat + diuron mixtures were significantly better than treatment with diuron alone. In this case, diuron was applied as a postemergent herbicide no killing effect was observed, although some suppressing effect was noted. Better results with diuron were expected if it is applied as a pre-emergent spray. For this reason this experiment should not be abandoned yet, but continued by applying this herbicide at various time, because an alteration of the time of application for this particular herbicide might give satisfactory results.

At six weeks after spraying the rating values for all treatments, except with diuron, were still significantly better than the control, but there was no significant difference among those treatments themselves. It seems that a quicker recovery occured on the manual weeded plots which reduced the rating value of that treatment. This situation remained quite the same up to the last observation at eight weeks after spraying. The average rating value for treatment C, with selfmixed paraquat and diuron was slightly higher than treatments with paraquat alone, commercial paraquat + diuron and manual weeding, but this difference was not significant.

Looking at the results based on the dry weight of biomass, a different situation came up, indicating that treatments with paraquat (A) and paraquat + diuron (C) were much better ($P<.01$) than manual weeding. Treatment D with the commercial paraquat + diuron mixture was slightly better ($P<.05$) than manual weeding at eight weeks after spraying. The rating values were based on visual assesments of the percentage of kill or percentage of cover in the plots, so that a quick regrowth of tiny shoots after a certain period will markedly reduce the rating value, due to the relative larger coverage precentage that will show. Those tiny young shoots have a very high water content so that their weight is relatively low compared to shoots which developed earlier in the manual weeded plots. The possible higher reserve-food content of the stubble remaining after manual weeding, may be responsible for the sturdier texture of shoots that developed, especially for **Eupatorium riparium** which was the dominant weed in this particular area.

Another point worth to be discussed here is that the addition of diuron to paraquat, which was expected to be synergistic in prolonging the effect of the spray did not quite show up. One of the factors which may affect this phenomena is the light intensity as mentioned by Headford (1970). Poor light conditions that occur during the application of the spray or directly aftor spraying may be the main cause of the above mentioned results obtained in this experiment as shown in table 2. The absence of sufficient light will keep the paraquat breakdown to its free radicals to a low level, so that some of the salt molecules were also transported to other parts of the plants without the presence of diuron. But anyhow there was little evidence that paraquat + diuron mixtures gave better results than paraquat alone, which confirms the need of more experiments to be done and relating to different weather conditions.

Table : 2 : Rainfall, sunlight temperature during the experimental period.

Month	Total rainfal in mm	Sunlight av. hours/day	Av. temperature (daily) °C Max.	Min.
May	1025	3 hrs. 8 min.	22.2	16.4
June	41	5 hrs. 9 min.	22.8	14.0
July	0	6 hrs. 21 min.	23.0	13.7
August	30	6 hrs. 22 min.	22.8	13.3

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