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EFFECT OF DIFFERENT SOURCES OF WATER ON THE EFFICACY OF COMMONLY USED HERBICIDES IN TEA PLANTATION

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ABSTRACT

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An experiment was initiated at main farm of Bangladesh Tea Research Institute during May, 2006 with three commonly used herbicides in tea plantation. Pond, rain, stream and supplied tap water were used as treatment to determine the effect of different sources of water on herbicidal activities and to co-relate the herbicidal activities along with the properties of water. Calcium (Ca), Magnesium (Mg) and Iron (Fe) content and P^H of each water sample were determined. Glyphosate, Paraquat and 2, 4 –D were diluted separately in each water sample @ 3.70 L/ ha in 750 L water, 2.80 L/ ha in 750 L water and 2.24 L/ ha in 750 L water respectively. The highest significant response of Glyphosate was observed in pond and rain water which were identical with paraquat. In case of 2, 4-D, highest significant performance was found in tap, stream and pond water while lowest was observed in rain water. Significantly difference of paraquat with other herbicides was noticed in tap water. Efficacy of Glyphosate, paraquat and 2, 4-D was found to be positive co-related with the increasing of Mg and Fe concentration, while significantly negative co-relation of paraquate was observed with the increase of Ca concentration.

Key words: Effect of water, herbicidal activities, tea plantation

INTRODUCTION

Weed control is one of the arduous arts of agriculture, practiced through countless ages, has within the past three decades been developed into science of increasing complexicity. Whereas, at the turn of the country, control of weed pests was accomplished almost entirely by cultural and mechanical means, and arsenic was sole “weed killer” (Alden *etal*, 1962) now as evidenced in chemicals in their various forms and formulations used for controlling weeds.

Of the four groups’ agricultural pests- (1) animal diseases, (2) plant diseases. (3) insects, rodents & predatory animals and (4) weeds- the latter may well causes the greatest losses. In tea cultivation weed causes 9-12% (Sana, 1989) in Bangladesh. Chemicals have been used for centuries to control weeds. Different types of formulations of herbicides are available aimed to bring the herbicide into a form convenient to apply usually with water. Concentrates for dilution in water is common practiced and first considered. In the spray as applied in the field, the active ingredient must be dissolved in the diluents especially in water.

Water is very common and usual diluents compound, combining the electropositive element hydrogen (H) and the high electronegative element oxygen (O). It has a very low molecular weight 18, at ordinary temperature. Ca, Mg, Fe etc present in water in ionic form. These ionic forms may combine with active ingredients and influence the uniform solution or fixation may occur as well as the efficacy of herbicides in field condition. If the active ingredient is freely soluble in water, it will be sprayed uniformly and action will be better. Such kind of study was under taken to determine the effect of different sources of water on herbicidal activities and to co-relate the herbicidal activities along with the properties of water.

MATERIALS AND METHODS

Water from four different sources like T_1= pond, T_2= rain, T_3= stream and T_4= supplied tap water was collected. Ca, Mg and Fe content of each water sample were determined by acid method in ppm basis. P^H of each sample was also assessed with the help of P^H meter. Herbicides like H_1= Glyphosate, H_2= Paraquat and H_3= 2, 4 –D were diluted separately in each water sample @ 3.70 L/ ha in 750 L water, 2.80 L/ ha in 750 L water and 2.24 L/ ha in 750 L water respectively. The spray solutions were sprayed with the help of CP 148 knapsack sprayer having flat nozzle. The experiment was laid out in a Randomized Block Design (RCBD) with having 6 replications of each. Data were recorded in terms of percent weed control at seven days interval. All recorded data were analyzed statistically and correlation coefficient was computed by using MSTAT program.

RESULTS AND DISCUSSION

From the analytical assessment of water it was shown that, stream and tap water content highest concentration of Mg (1.44 ppm). Tap water contains highest concentration of Ca (22.55 ppm) followed by stream water (2.48 ppm). In case of iron concentration all sources of water contains below 1 ppm (Table 1).

Table 1: Properties of different sources of water

Water sources	Mg (ppm)	Ca (ppm)	Fe (ppm)	P^H
T_1	0.53	1.46	0.28	6.9
T_2	0.57	1.69	0.18	6.6
T_3	1.44	2.48	0.48	7.0
T_4	1.44	22.55	0.38	7.2

The highest significant response of Glyphosate was observed in pond and rain water which were statistically (0.05) identical with paraquat. In case of 2, 4-D, highest significant performance was found in tap, stream and pond water while lowest was observed in rain water. Significantly difference of paraquat with other herbicides was noticed in tap water (Table 2).

Table 2: Effect of different water on the efficacy of herbicides

	T_1	T_2	T_3	T_4
	Mean of 6 replications	Mean of 6 replications	Mean of 6 replications	Mean of 6 replications
H_0	00	00	00	00
H_1	95.33	92.50	96.50	95.00
H_2	92.83	90.00	98.33	87.50
H_3	85.83	62.50	90.83	96.00
	LSD= 3.048 at 5 % level	LSD= 2.51 at 5 % level	LSD= 1.83 at 5 % level	LSD= 2.15 at 5 % level

H_0= Control, H_1= Glyphosate, H_2= Paraquat and H_3= 2, 4 –D

Efficacy of Glyphosate, paraquat and 2, 4-D was found to be positive co-related with the increasing of Mg and Fe concentration (Table 3 and Table 5), while significantly negative co-relation of paraquate was observed with the increase of Ca concentration (Table 4).

Table 3: Efficacy of Glyphosate, Paraquat and 2, 4-D varies on different PPM of Mg

Water sources	Mg (PPM)	Efficacy (%)		
		Glyphosate	Paraquat	2,4-D
T_1	0.53	95.33	92.83	85.83
T_2	0.57	92.50	90.00	62.50
T_3	1.44	96.50	98.33	90.83
T_4	1.44	95.00	87.50	96.00
Correlation coefficient		r = 0.607	r = 0.178	r = 0.731

Table 4: Efficacy of Glyphosate, Paraquat and 2, 4-D varies on different PPM of Ca

Water sources	Ca (PPM)	Efficacy (%)		
		Glyphosate	Paraquat	2,4-D
T_1	1.46	95.33	92.83	85.83
T_2	1.69	92.50	90.00	62.50
T_3	2.48	96.50	98.33	90.83
T_4	22.55	95.00	87.50	96.00
Correlation coefficient		r = 0.09	r = - 0.641	r = 0.566

Table 5: Efficacy of Glyphosate, Paraquat and 2, 4-D varies on different PPM of Fe

Water sources	Fe (PPM)	Efficacy (%)		
		Glyphosate	Paraquat	2,4-D
T_1	0.28	95.33	92.83	85.83
T_2	0.18	92.50	90.00	62.50
T_3	0.48	96.50	98.33	90.83
T_4	0.38	95.00	87.50	96.00
Correlation coefficient		r = 0.895	r = 0.546	r = 0.831

Glyphosate is a general herbicide active only by foliar application. It is strongly absorbed onto soil and thus rendered biologically inert but, whereas the paraquat is inactivated by absorption onto the clay mineral in soil. Paraquat is believed to be inactivated by chelation with calcium ion (Green *eta*, 1979). The ions of Al, H, Ca, Mg etc. are not all held with equal tightness by the colloids. Ca has high order of strength of absorption than Mg (Alden *etal*, 1959). Such kind of ionic behavior may influence regarding the homogenous mixing of active ingredient in water as well as absorption of herbicidal spray solution. Craft & Emmanuelli (1948) showed that 2, 4-D salt was best when rainfall was sparse. In Table 2 it is found that, the significant response of 2, 4-D is lowest in rain water. Alden *etal* (1959) reports that paraquat combines with calcium ion and form insoluble substances. This may support the present finding of negative co-relation of paraquat with increasing the calcium. Further research work regarding this with more herbicides should be initiated to confirm the present findings with more details.

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