THE USE OF HERBICIDES IN TEA IN SRI LANKA

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INTRODUCTION

Weeds in tea plantations were chiefly controlled until recently by the use of manual labour. Two types of weeding were practiced. The first was 'clean weeding' wherein all plants other than tea and shade trees were scraped from fields and banks. The second method was selective weeding, wherein after an initial clean weeding, only the larger weeds were removed. The small weeds like *Oxalis* spp., *Drymaria cordata*, *Centella asiatica* were allowed to remain as ground cover.

Selective weeding, even though desirable was more difficult to establish as a practice. Most estates resorted to clean weeding, monthly. The idea prevalent was that when a field was kept scrupulously clean a high degree of weed control had been achieved. This was done on a contract basis and from a managerial point of view it was an easy operation to manage. However, the practice of clean weeding was most detrimental. The most damaging effect of this practice was its effect on soil physical properties. As most of the tea is planted up and down in slopy terrain in high rainfall areas, the disturbed top layers of soil get easily washed away in the run-off water. The routine scraping also brought dormant weed seeds to the surface and created an ideal environment for seed germination and thereby increased the problem of weed control. This practice was more psychologically induced than what was required

from a cultural stand point. Most estate managements desired the Visiting Agents report to read "The estate is very clean and free from weeds".

PREVIOUS RECOMMENDATIONS

The monthly weeding programmes became a costly operation with the rise in labour cost and plantations looked for alternate methods of weed control. The use of herbicides in tea was seen first as a means of labour saving. The first reference to any herbicide trial in tea appears in the TRI Annual Report for the year 1949. Fernoxone (2-4D) at 2 oz per gallon was reported to cause phytotoxic effect on tea. Tea had failed to recover more than two months after application. During the later years, in the fifties trials had been carried out with 2-4 D, MCPA, 2, 4, 5-T, Dalapon, Sodium chlorite, Penta chlorophenol, Simazine and Casoron. Dalapon was tried out for the control of rhizomatous grasses such as couch and illuk, in non-tea areas at concentrations ranging from 10 to 100 lb/ac. In the late fifties and early sixties a 2% solution of Dalapon and 1% teepol was recommended on an experimental basis for the control of couch and illuk in tea while 40 to 60 lbs/ac in 50 - 60 gallons water per acre was used in non-tea areas. In the fifties and early sixties several commercial firms carried out about 50 estate trials with Simazine 50 w at 2, 4, 6 and 8 lbs/ac. Even though the TRI had no firm recommendation, several chemical firms were recommending their brand of products for use in tea estates e.g. in 1961 the amount of Karmex sold to tea estates by one firm amounted to 10,255 lb. In 1964 the following herbicides were recommended for tea plantations by the commercial firms.

Fisons (Cey) Ltd - Simazine 50 w

(a) Mature Tea - 4 lbs/ac applied prior to the on set of monsoon. Thereafter 2 lb/ac as a re-treatment applied after 6-12 weeks from the first application.

(b) Young tea - 1-2 lbs/ac, 6 months from planting, followed by a second application of 1-2 lb/ac, 4-6 weeks later.

Shell (Cey) Ltd - Dalapon

5 lb/ac in 10 gallons water up to 4 applications/year.

Photo Cinex Ltd - Diuron (Karmex)

2-6 lbs/ac in 45-100 gallons per acre depending on location, soil type and rainfall.

ICI (Export) Ltd - Paraquat (Gramaxone)

(a) Tea immediately after pruning and before bud break. - 2-3 pints/ac in 80-100 gallons water/ac.

(b) Tea in leaf - 1 1/2 - 2 pints/ac in 80 gallons water/ac.

(c) Ravines - 3 pints/ac in 80 gallons water.

From about mid sixties TRI commenced conducting continuous field trials with several herbicides. Herbicide screening trials were conducted at St. Coombs Estate, Talawakele and St. Joachim Estate, Ratnapura.

For the first time firm recommendations were made by the TRI in 1971. Paraquat, Diuron, Simazine, Dalapon, 2-4 D and MCPA were first recommended followed by Glyphosate (Roundup) for the control of rhizomatous grasses in 1980 and Oxyfluorfen (Goal) for general weed control in 1985.

CURRENT RECOMMENDATIONS

The application rates of the herbicides that are currently recommended for use in tea plantations by the TRI are as follows:

Paraquat: 20% w/v Paraquat concentrate for routine weed control at a dilution rate of 300-450 ml in 225 litres water

Diuron: Wettable powders containing 80% active ingredient at the rate of 840-1120 g in 562-674 litres water/ha

Simazine: Wettable powders containing 50% active ingredient at the rate of 2 1/4 - 3 1/4 kg/ha in 562-674 litres water/ha

2,4-D and MCPA: Only for the control of broad leaf weeds not controlled by Gramoxone *e.g. Commelina sp., Erigeron sumatrensis, Borreria* sp. Rate of application: 1-2 kg of commercial product in 562-674 litres water/ha

Dalapon: Wettable powder containing 80% of active ingredient used for the control of grass weeds not controlled by Gramoxone. Used sequentially with Gramoxone i.e. 6 3/4 kg/ha Dalapon in 562-674 litres/ha followed by Paraquat at recommended rates three weeks later

Glyphosate: Recommended for the control of rhizomatous grass weeds. Rate of application 1 litre of commercial product in 50 litres water.

Glyphosate is not recommended for use in tea in plucking. However, under extreme conditions of dense growth of Couch grass in tea, Glyphosate is recommended provided the sprayed patches are left unharvested for a period of at least three months after spraying.

Oxyfluorfen: Recommended for the control of weeds in tea either alone or with Paraquat 1.2 l of trade product (Goal 2E) in 500 l water per hectare

TOTAL CONSUMPTION OF HERBICIDES AND COST

Paraquat is the most commonly used herbicide in tea followed by Diuron. Glyphosate is used largely in non-tea areas for the control of rhizomatous grasses like *Panicum repens* and *Imperata cylindrica*. 2-4 D is used in tea areas for the control of creeping weeds such as *Cyanotis vilosa*, *Commelina* spp., *Mikania scandens* or any broad leaved weed not controlled by Paraquat or Diuron. Dalapon is again used specifically for the control of grass weeds in tea. Currently 400,000 litres of Paraquat, 3 metric tons of Diuron, 10 metric tons of 2-4 D, 20,000 litres of Round up and 10,000 litres of Goal 2E are being marketed to tea estates annually. At the present market price this would work out to Rupees 51 million a year.

HERBICIDES IN THE ENVIRONMENT

With increasing use of herbicides in tea plantations some users have begun to question the possibility of serious environmental contamination arising from their use.

Most herbicides when compared to insecticides are safe as they have very low mammalian toxicity. This is indicated by the LD 50 figures.

Herbicide	The acute oral LD 50 for rats - mg/Kg
Dalapon	7570 - 9330
Simazine	7500
Glyphosate	4320
Diuron	3400
2 - 4 D Sodium	700
Paraquat	150

Some herbicides cause serious damage if contacted direct. e.g. Paraquat being a strong alkali, is highly toxic to the eye. It is reported to ulcerate the mouth and sometimes even the skin. It has been reported for the first time from case studies in Sri Lanka that it causes damage to the suprarenal glands. But if used as recommended with basic protective measures it causes no harm to the user.

As herbicides are mostly applied in solution form whether applied to the foliage or soil most of it would ultimately come into contact with soil. Hence it is not surprising that questions also arise regarding the effect of herbicides on the soil microbes.

The hormone type herbicides e.g. 2-4 D and MCPA are not very persistent and breakdown in the soil within a few weeks of its application. It has been reported that these are harmless to micro-organisms even at very high doses. Urea and triazine herbicides e.g. Karmex and Simazine too, do not have any adverse effects on microbial populations in the soil, and also they do not build up along food chains. Paraquat is base exchanged as soon as it comes into contact with soil particles. Glyphosate is completely inactive as a herbicide in the soil and is said to be a totally bio-degradable herbicide. Dalapon has been reported to be having a stimulatory effect on soil microbial populations. Work carried out at the TRI has shown that Paraquat, Glyphosate and Diuron at concentrations up to 10 times the recommended doses does not have any adverse effect on soil enzyme activity. There have been no reports that the herbicides currently being recommended have any mutagenic or tetratogenic effects. The behaviour of these herbicides in the soil also indicate that there is no risk that they will be leached into the underground water and contaminate irrigation or drinking water. Therefore one could safely state that at the current level of use, herbicides recommended for tea would not cause any environmental damage.

CONCLUSION

The earlier practice of clean weeding and total weed control has resulted in the loss of valuable top soil and caused severe soil erosion problems in tea estates. The complete control of weeds is not desirable and the current concept is to think in terms of weed management rather than weed control. The weeds have to be tolerated to a level that they do not compete with tea for food and nutrients and interfere with other cultural operations such as plucking. Weed management has to be done with least disturbance to the top soil. The most economic

way of achieving this is through the judicious use of herbicides.

One has also to note the detrimental effects that would arise as a result of over-dependence on one herbicide continuously over a long period of time. It is common knowledge that the repeated application of insecticides and systemic fungicides have led to the appearance of resistant strains. It has been reported that in some countries where 2-4 D was used continuously for the control of weeds in sugar plantations, common weed, *Erechtipes hieracifolia*, had become resistant to it. Continuous use of one herbicide for a long time could result in some weeds becoming resistant and may cause serious ecological effects.

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