

**FINANCIAL IMPLICATIONS OF FOLIAR APPLICATION
OF POTASSIUM TO MINIMISE DROUGHT EFFECTS
IN YOUNG TEA**

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INTRODUCTION

Among plantation crops, tea is affected by the vagaries of dry periods frequently as its economic value depends on its vegetative parts which are harvested at regular intervals. The death of young tea plants (from time of field planting to the fourth year), has been increasingly frequent in recent times due to the recurrent and prolonged droughts in the country. Replanting programmes are reported to be unsuccessful wherever this casualty toll is substantial thereby rendering new clearings as an uncertain investment (Ekanayake, 1992).

Loss of young tea plants results in enhanced costs to the growers. Added expenditure on infilling of vacancies, delay in establishment and harvesting and increased soil erosion as a consequence of exposed vacant patches are some of the important cost components. It was estimated

that in 18 state owned plantations in the mid-country 53 per cent (56 ha) of replanted hectarage had succumbed to drought in 1992 (Yatawatte, 1992). The cost of this damage was enormous and amounted to Rs 13 million, according to an estimate of the value of young plants.

There are a number of cultural practices recommended by the Tea Research Institute to mitigate drought effects. Measures to be adopted prior to and following a prolonged drought have been outlined (Anon. 1980, 1992). These recommendations cover most of the aspects of drought mitigation along with the time and the method of field establishment and the recommended clones for drought prone areas. Among the commonly used practices to mitigate drought hazards mulching , cover cropping , selection of clones and potassium fertiliser application are important (Ekanayake, 1992).

THE PROBLEM

The recommended practices to mitigate drought effects on young tea have their own advantages and disadvantages. One of the problems is that most of the practices cannot be adopted as an immediate relief measure against a looming drought spell. To obtain the desired results, some of them have to be commenced well ahead of a drought spell. For example, mulching should be initiated at the stage of establishment and maintained until the tea bush grows sufficiently well to get an adequate soil cover to achieve the desirable level of soil moisture conservation.

However, a foliar application of potassium (2 kg of potassium sulphate with 4 kg of urea in 100 litres of water per application per hectare) could be practised successfully as an immediate relief measure just before the commencement of a drought spell. As recommended by the Tea Research Institute, it is adequate to commence the foliar application just one month prior to the onset of drought. The role of potassium in cutting down the stomatal as well as cuticular transpiration is well established (Krishnapillai, Jayamaha and Lakshmie, 1986). Increased levels of potassium up to a certain limit will greatly reduce the evapo-transpiration, thereby leaving more water in the soil.

Therefore, in the absence of adopting pre-emptive cultural practises to mitigate an emerging drought situation or due to their inadequacy foliar application of potassium becomes most advantageous.

Although the effectiveness of foliar application of potassium for drought has been demonstrated experimentally (Anon. 1993) it is seldom practised among tea growers. One reason for this may be the lack of a proper understanding of its financial implications. This study was undertaken to demonstrate the financial viability of this practice in order to promote its adoption among the producers.

OBJECTIVE

It is arguable that the rate of adoption of a given agricultural practice depends on its financial feasibility. On

this basis, this study attempts to evaluate the cost and the benefit from the foliar application of potassium as a measure to prevent drought damage in young tea.

MATERIALS AND METHODS

An observation trial carried out by the Physiology Division of the Tea Research Institute, furnished the experimental data. The trial was conducted in Lamiliere Division, St.Coombs Estate, Talawakele on 2-year-old field plants of clone TRI 2025. There were 50 plants per plot. The plots were not subjected to any moisture conservation methods. The treatment was 2 per cent potassium sulphate solution (2 kg potassium sulphate and 4 kg urea in 100 litres of water per hectare). The control plots received 100 litres of water per hectare. The treatments were commenced in December 1991 and continued for 6 months at fortnightly intervals. The death of young plants were recorded during this period.

Cost data of the materials and application (labour and machinery) are given in Table 1 while the casualty rates are given in Table 2.

TABLE 1- Cost of foliar application of potassium (Rs/round)

Item	Unit cost (Rs)	No. of units	Total cost (Rs)
K ₂ SO ₄ (kg)	16	2	32
Urea (kg)	10	4	40
Sprayer	50/day	1	50
Labour	83.5	2.5	209
Total cost			331

TABLE 2 - Casualty rates of treated and control plots

Treatment	% casualty	% recovery
Treated with K ₂ SO ₄	32	65
Control	75	20

It was noted that certain plants which survived the drought were not casualties *per se*, but they did not recover satisfactorily. This percentage was less in treated plots (3 %) but higher in control plots (5 %).

The cost of a casualty is a multifaceted phenomenon. Its impact lies not only in filling the vacancy but also in the deferment of yield as well as the other

associated intangible costs such as increased soil erosion, higher weed control cost, etc. However, for the purpose of this analysis the value of casualties were calculated using the cost of replanting. The detailed break down of the cost of replanting is given in Table 3.

It must be noted that when a casualty occurs, it imposes a cost which equals the sum of all the expenses a grower has incurred in bringing up the plant to the stage at which the death took place. If a casualty occurs in the 2nd year of field planting, the cost incurred would be the sum total of all the cost in the 1st and the 2nd year. It is on this basis that the value of a casualty has been calculated in this study.

TABLE 3- *Cumulative cost of upkeep from field planting to the 4th year (Rs/plant)*

<i>Type of cost</i>	<i>Unit</i>	<i>Yr 1</i>	<i>Yr 2</i>	<i>Yr 3</i>	<i>Yr 4</i>
Labour	Rs 000	70	26	17	21
Material	Rs 000	46	15	12	11
Total cost	Rs 000	116	41	19	32
Annual cost	Rs/plant	9	3	2	3
Cumulative cost	Rs/plant	9	12	14	17

The break even analysis was used to ascertain the profitability of potassium foliar application. In the analysis, the objective was to find out a level of a variable, which usually brings financial

returns, or prevents extra cost (in this instance, the amount of casualties that were prevented by potassium foliar application), at which the associate cost is balanced or breaks even. Therefore, in the analysis an attempt was made to calculate the percentage of casualties that need to be prevented in order to cover the cost of the foliar application.

In the sensitivity analysis, the number of foliar applications were varied and break even percentage of casualties calculated.

The following equation was used to calculate the percentage of casualties that has to be prevented to cover the cost of the application.

$$C\% = \frac{R_{(Rs)} \times N_{(No)}}{V_{(Rs)} \times S_{(No)}} \times 100$$

Variables are as follows:

C% = Percentage of casualties that ought to be prevented to break even the total application cost.

R = Application cost per round (Rs)

N = No. of applications

V = Value of a plant at the time of casualty (Rs)

S = No. of plants per hectare (12,500 assumed)

RESULTS AND DISCUSSION

When the foliar application is given up to the minimum level of the recommendation (3 rounds of application at fortnightly intervals), the percentage of casualties required to be saved to break even the application cost is shown in Table 4. This calculation uses the above formula along with the information from Tables 1, 2 and 3.

TABLE 4 - *Percentage of casualties required to be saved to break even the cost of 3 rounds of foliar application of potassium (100=12500)*

<i>Year of the upkeep</i>	<i>Break even % (to be saved)</i>
1st year	0.882
2nd year	0.662
3rd year	0.567
4th year	0.467

Table 5 shows the other possible scenarios of the foliar application and their respective percentages of casualties to be saved in order to cover the relevant application cost. However, it is relevant to note here that the maximum number of 10 rounds of application and at the lowest plant value (3rd year upkeep) corresponds to the highest amount of casualty to be prevented in order to break even the application cost. This works out to barely 3 per cent.

TABLE 5 - *Percentage of casualties required to be saved to break even the cost of different rounds of application (100 =12500)*

<i>Year of upkeep</i>	<i>No. of applications</i>			
	3	5	8	10
<i>Break even percentages of casualties</i>				
1st year	0.882	1.47	2.35	2.94
2nd year	0.662	1.10	1.76	2.20
3rd year	0.567	0.945	1.51	1.89
4th year	0.467	0.778	1.25	1.55

During a normal dry spell in the up-country, about 10 per cent of casualties are expected from a replanted young tea field (Ekanayake, 1992). However, during a severe drought as seen in 1991/92, the observed casualty rates were very high. As indicated in Table 2, a casualty rate as high as 75 per cent was observed in the untreated plots of the above observation trial against a casualty rate of 32 per cent in the treated plots. The potassium application prevented 43 per cent casualties *vis-a-vis* untreated plots and this is well above the required saving of casualties to break even the cost of application of potassium, as indicated in Table 4.

The highest cost of application is with 10 rounds and break even saving of casualty is only 3 per cent in this instance. This shows the profitability of foliar application of potassium which is worth adopting as a practice.

Assuming that 10 per cent is the rate of casualty in a normal dry spell and that foliar application of potassium could prevent all the casualties, it could be shown that a maximum of 10 rounds of foliar application would save 7 per cent casualties over and above the break even level. Seven per cent or 875 plants which is saved by the application would involve a saving of cost, or indirect gain of Rs 7,900 in the 1st year of upkeep, Rs 10,500 in the 2nd year of upkeep, Rs 12,250 in the 3rd year of upkeep and Rs 15,000 in the 4th year of upkeep. Furthermore, early establishment of crop and quicker harvest together with control of soil erosion would be added benefits from the prevention of casualties.

Thus, foliar application of potassium is an economically promising practice to minimise drought hazards in young tea. In comparison with the other drought preventive measures in young tea, foliar application of potassium is effective in a relatively shorter period.

SUMMARY

The economic feasibility of foliar application of potassium as a measure to minimise the casualties of young tea during periods of drought has been evaluated based

on the findings of an investigation conducted by the Physiology Division. The cost of the foliar application was calculated by the cost of chemicals (potassium sulphate and urea) and that of labour used. The value of young tea plant was calculated by using the cost of labour and material from time of field establishment up to the 4th year. Break even analysis was used to calculate the percentage of casualties that need to be prevented by the foliar applications in order to meet the application cost. Results of the analysis show that the above was merely 3 per cent ($100\% = 12500$) with the maximum number of applications (10). The field study showed that with 3 applications only 32 per cent of casualties were observed whereas in the unsprayed control plots 75 per cent of casualties were observed. The results show that foliar application of potassium in young tea with the onset of drought is an economically viable proposition.

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