

CHEMICAL WEED CONTROL IN CARROTS IN THE UPCOUNTRY WET ZONE

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SUMMARY

Nine weedicides were initially screened in Maha 1978/79 for weed control in vegetable crops in the Upcountry Wet Zone at the Agricultural Research Station, Sita Eliya.

Three of the nine weedicides viz, Afalon (Linuron), 1.75 kg/ha (0.875 kg ai), Sencor (Metribuzin) 0.5 kg/ha (0.35 kg ai) and Planavin (Nitriline) 1.0 kg/ha (0.75 kg ai) which were found suitable for weed control in carrots were further tested in a replicated experiment in Yala 1979 season.

All weedicides gave good control of weeds when used as pre-emergent sprays, without significant reduction of yield of carrots, when compared with the hand weeded plots. Afalon (Linuron) was the only chemical found suitable for post emergent control of weeds.

The use of these weedicides effected a reduction in the total cost of cultivation and an increase in the benefit/cost ratio as compared to hand weeding.

The effect of weeds on the plant population and yield of carrots and the feasibility of the use of chemical weed control are discussed.

INTRODUCTION

The cultivation of carrot in Sri Lanka is generally confined to the cooler region of the upcountry. Large extents under this crop are found in the Nuwara-Eliya and Badulla districts. However test plantings of carrots on a very small scale is now known to be undertaken in some of the districts in the Dry and Intermediate Zones. Although the total area under this crop tends to fluctuate annually depending on weather conditions, the estimated extent in the Nuwara Eliya and Badulla districts is generally in the region of 480 ha. Carrot may be grown as a monocrop or mixed with other crops such as beetroot, knolkhol and leeks. The control of weeds in carrots and other vegetables in these regions is one of the main problems in the successful cultivation of these crops. Weed control is important particularly in carrots as it is direct seeded and the weed competition starts at a very early stage. In comparison to the other vegetable crops weed control in carrot is more cumbersome as carrot is mostly broadcast sown and the seedlings therefore tend to get damaged while weeds are pulled out manually.

The labour requirement for weeding a hectare of carrot is estimated to be around 111 units for 2 weedings. The non-availability of labour at the required times and the heavy cost involved for the hand weeding appears to be a disincentive for the cultivation of carrots.

The use of chemicals to control weeds in most cereal and vegetable crops has become an accepted practice. Many workers have reported success in controlling weeds using weedicides in many vegetable crops. In a total of 12 field trials Kampe (1972)^a showed that Sencor (Metribuzin) controlled broad leaved weeds and grasses in tomato and carrots when applied as a pre emergence application. However he found differential varietal response to Sencor application as post emergence spray. While Sencor was tolerated by carrot as post emergence spray at 2 leaf stage, earlier post emergence application caused thinning and reduction in yields. The effect of Sencor was also subsequently reported by Kampe (1972)^b on the results of 22 field trials carried out from 1970–1972. Kampe (1973) again showed that a pre emergence application of Linuron 1–1.5 kg/ha or Metoxuron 3–4 kg/ha and Sencor 1–1.5 kg/ha as post emergence application gave efficient control of weeds in carrots. Papsolmontas (1967) Lode (1962–1965) Vurbanov (1968) and Gartner Tidende (1973) also demonstrated the superiority of Linuron as a weedicide in carrots.

Investigation on the use of weedicides in field crops grown in the upcountry has not been attempted by any worker hitherto. Since use of chemicals for weed control in the upcountry appears to be useful in some of the vegetable crops, an initial attempt was made at the Agricultural Research Station, Sita Eliya to select suitable weedicides for some of these crops.

The aim of the present experiment was to investigate whether chemical weedicides could be profitably substituted for hand weeding in carrots thus offsetting peak labour demands for weeding and reduction of input cost.

MATERIAL AND METHODS

Preliminary Observation

An observational experiment was carried out in Maha 1978/79 at the Agricultural Research Station, Sita Eliya, in the upcountry wet zone to screen nine weedicides in different vegetable crops in a strip plot design without replications. Visual observations on the weed control and phytotoxicity were recorded. The weedicides which showed promise in different vegetable crops were selected for further testing in replicated experiments.

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Weed Control in Carrots

In Yala 1979 a factorial combination of three weedicides Afalon (Linuron) 1.75 kg/ha (0,875 kg ai) Sencor (Metribuzin) 0.5 kg/ha (0.35 kg ai) and Planavin (Nitriline) 1.0 kg/ha 0.75 kg ai) as pre and post emergent applications were tested with additional hand weeded and unweeded control plots in a randomized complete block lay out. The treatments were replicated three times.

The size of the test plots was 1 m × 3 m. The test plots were separated by a spacing of 30 cm between plots and replicates. All plots received basal application of farmyard manure at 12 tons per hectare and inorganic fertilizer mixture containing 75 kg N, 285 kg P₂ O₅, 70 kg K₂ O/ha as Urea, Concentrated Super Phosphate and Muriate of Potash respectively. A top dressing of 40 kg Nitrogen/ha was given at two months after sowing.

Two grams of carrot seeds of the variety "Cape Market" were broadcast sown, and hand watering was done immediately after sowing. The pre emergence component of the weedicide treatments was applied soon after hand watering using a high volume knapsack sprayer. The volume of water used per plot was equivalent to 450 litres/ha. The post emergence application was done at the same dosage at 30 days after sowing. The hand weeded control plots were manually weeded every 7 days from the 39th day upto 78th day after sowing. The unweeded control plots were not weeded till harvest. No weeding was done at any stage in the weedicides treated plots.

Sampling of weeds in an area of 30 cm × 30 cm was done in all plots at the 29th day, 48th day and 88th day after sowing. The weeds thus sampled were dried in an oven maintained at 50°C for 72 hours and the dry weight was recorded.

Harvesting of carrots was done on the 88th day after sowing. The yield of carrots in each plot with and without leaves was recorded. The carrot yields and the dry weights of weeds at the three observation dates were subjected to statistical analysis.

RESULTS AND DISCUSSION

Preliminary Observation

The results of the preliminary observation of nine weedicides applied as pre and post emergence application in five crops are shown in table 1. Weedicides Afalon (Linuron) Sencor (Metribuzine) and Planavin (Nitriline) when applied either as pre emergent or post emergent applications were effective in controlling weeds in carrots without showing phytotoxic symptoms. Basfapon (Dalapon) as post emergence spray gave good control of grasses only,

without phytotoxic symptoms in carrot. Simazine and Tribunil as post emergent sprays were effective in controlling weeds but showed phytotoxic symptoms in carrots. Lasso, MCPA and 3,4 DPA did not either control weeds or were phytotoxic to the carrot seedlings. Afalon (Linuron) Sencor (Metribuzin) and Planavin (Nitriline) were therefore selected for further replicated trials with carrots due to their suitability as pre and post emergence weedicides in this crop. Although Basfapon did not show any phytotoxic symptoms it was omitted as it is known to be only a selective grass killer and the types of weeds normally present in a carrot crop are composed of a mixture of grasses and broad leaved weeds.

Weed Control in Carrots

The results of the replicated experiment with Afalon (Linuron), Sencor (Metribuzin) and Planavin (Nitriline) for weed control in carrots are shown in table II. At the 29th day the pre emergence application of Afalon, Sencor and Planavin showed good control of weeds without showing signs of phytotoxicity to carrots. Weed growth in the other plots except the hand weeded control was high, ranging from 0.16–0.23 tonnes per hectare. At the 48th day a reduction of weed population was observed in the plots treated with post emergence application of Afalon and Sencor. The weedicide Planavin was not effective as a post emergence treatment due to the poor control of weeds. While Planavin was not phytotoxic to either the carrots or weeds, Sencor as post emergent application was phytotoxic to both the crop and the weeds thus causing a reduction in the stand of carrot seedlings. The weed control effect of the chemicals persisted upto harvest.

The hand weeded plots gave the highest yield in this experiment. The yields of Afalon, Sencor and Planavin pre emergent treatments were not significantly inferior to the hand weeded plots. Of the post emergence treatments Afalon (Linuron) was superior to the other chemicals. The yields of the control, Sencor post emergence and Planavin post emergence plots were similar and gave very low yields.

The yield reduction in the Sencor post emergence treatment could be explained by the phytotoxicity caused by this chemical to the plants although a very good control of weeds was obtained. In the post emergence Planavin treatment and the control the yield reduction is due to the heavy weed stand.

Fig. 1 shows a negative linear relationship between the weed weights and the plant population of carrots at harvest. The Sencor (Metribuzin) post emergence treatment was omitted for this calculation due to the phytotoxicity caused. It appears that a weed stand amounting to every one ton dry weight per hectare can reduce the plant population of carrot by approximately 7%. This reduction in the stand of the crop can affect the final yield.

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The relationship between weed weight and final yield is negatively linear (Fig. II) showing a reduction of 3.05 tons for each ton dry weight of weeds present in a hectare. The control of weeds obtainable with pre emergence application of Sencor (Metribuzin) and Afalon (Linuron) without significant reduction in yield in this experiment is a confirmation of the work of Kampe (1972)^a, (1972)^b, Papsolmontas (1967) Lode (1962-65) Vurbanov (1968) and Gartner Tidende (1973). The success of Afalon as a post emergent application and Nitralin as pre emergent application in carrots obtained in this experiment was also demonstrated by Noll (1968).

The cost of cultivation of a hectare of carrot excluding weeding costs is estimated to be Rs. 11,800/- (Table IIIa). In this experiment 7 hand weedings were done at weekly intervals from the 29th day upto 78 days in order to keep the plots completely weed free. The cost of labour for this operation in this experiment is estimated at Rs. 2649/- (173 mandays per hectare). However it is known that the cultivators do not indulge in more than 2 hand weedings in their carrot crop during the entire growth period. They therefore incur only an expense of Rs. 1699/- (111 mandays) per hectare. While the experimental results show a yield of 29.99 tonnes, when the plots were kept completely weed free, due to the less number of hand weeding done by the cultivators, the yields of their carrot crop will not attain the high level as obtained in this experiment as a certain amount of weeds are apt to be present in the crop at the time of harvesting. Presence of even a small quantity of weeds can reduce yields, therefore weed control is essential for high yields in carrots (Table II). The use of weedicides is less labour consuming and is accompanied with low input costs. (Table IIIB). The yields obtainable with the use of weedicides although appear to be lower than the hand weeded control, the low input costs and the high benefit/cost ratio obtained with the use of weedicides as compared to hand weeding will be an advantage to the farmers in the cultivation of carrots. The weedicides Afalon (Linuron), Sencor (Metribuzin) and Planavin (Nitralin) have to be sprayed only once during the life of the crop as pre emergent sprays. Post emergent application of Afalon (Linuron) is feasible even after the crops and weeds have emerged, if a pre emergent application has not been possible for any reason, thus offsetting weeding costs. The availability of labour at the critical times, the high labour demand for hand weeding and the high prevailing labour charges are some of the problems that accompany hand weeding in carrots.

The use of one of the weedicides Afalon (Linuron) Sencor (Metribuzin) or Planavin (Nitralin) at the early stage of the crop can save input costs, at the same time giving good control of weeds and high yields of carrot.

CONCLUSION

Weedicides Afalon (Linuron) Sencor (Metribuzin) or Planavin (Nitriline) are highly suited for control of weeds in carrots as pre emergent applications. Afalon is also suited for post emergent application upto one month after sowing of carrots.

The use of these weedicides results in controlling weeds from a very early stage of the crop at the same time causing a reduction in input costs and increase in the benefit/cost ratio.

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Table 1—Effect of Pre and Post Emergence Weedicides in Different Crops

Weedicide	Lasso	Afalon	Planavin	MCPA	Simazine	3,4 DPA	Tribunil	Sencor	Basfapon
Cabbage (var. A.S. Cross) ...	Pre	X	Pre & Post	X	*Pre	Post	X	X	Post
Carrot (var. Cape Market) ...	X	Pre & Post	Pre	X	*Post	X	*Post	Pre & *Post	Post
Barley (var. Clipper) ...	X	Pre & Post	Pre	Post	*Pre	Post	Pre & Post	*Pre	X
Leek (var. Large long summer) ...	X	Pre	Pre	X	X	X	Pre & Post	Pre	X
Peas (var. Fill basket) ...	X	Pre	Pre	X	*Pre	X	Pre & Post	Pre	Pre

Pre: Pre emergence application effective for control of weeds without phytotoxicity to crops.

Post: Post emergence application effective for control of weeds without phytotoxicity to crops.

X: No control of weeds and or/phytotoxicity to crops.

* Mild phytotoxicity to crops.

Table 2—Effect of Weedicides in Carrot

Treatment	Yield of Carrot (t/ha 88 DAS)			% root weight	Weed Weights (t/ha)		
	With leaves	Without leaves	Weight of leaves		29 D.A.S.	48 D.A.S.	88DAS
Control	10.99	7.33	3.66	67	0.16	4.28	6.85
Hand weeded control	54.26	29.99	24.08	55	0.07	0.16	0.00
Afalon-Pre-emergent	44.76	24.33	20.41	54	0.01	0.19	1.34
Afalon-Post emergent	36.90	20.49	16.38	55	0.23	0.18	0.03
Sencor-Pre emergent	46.56	25.59	20.91	55	0.00	0.24	1.03
Sencor-Post emergent	9.23	5.33	3.90	58	0.17	0.17	0.04
Planavin-Pre emergent	45.96	24.85	17.22	54	0.02	0.95	2.22
Planavin-Post emergent	14.40	7.09	7.26	49	0.17	3.38	5.65
MEAN	32.88	18.13	14.23	55.88	0.10	1.19	2.15
L.S.D. (0.05)	21.18	7.27	6.83		0.10	0.48	2.54
C.V.	21	23	27		55	68	68

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Table 3a—Cost of Cultivation of Carrots

Treatment	Dosage of weedicides (kg/ha)	Cost of weedicides (Rs/ha)	Labour Requirements for weeding and spraying (Man days)	Wages (Rs/day)	Cost of weed control (Rs/ha)	Other cost (Rs/ha)	Total cost of cultivation (Rs/ha)
No weeding	—	—	—	—	—	11,880.00	11,880.00
Hand weeding	—	—	173*	15/31**	2649.00	11,880.00	14,529.00
Afalon Pre (Linuron)	1.75	581.00	5	18/91	676.00	11,880.00	12,556.00
Afalon Post (Linuron)	1.75	581.00	5	18/91	676.00	11,880.00	12,556.00
Sencor Pre (Metribuzin)	0.5	677.00	5	18/91	671.00	11,880.00	12,651.00
Planavin Pre (Nitriline)	1.0	333.00	5	18/91	428.00	11,880.00	12,308.00

* Labour requirement for hand weeding, every week for 7 weeks.

** Wages calculated at Rs. 15/31 for hand weeding and Rs. 18/91 for spraying per man-day.

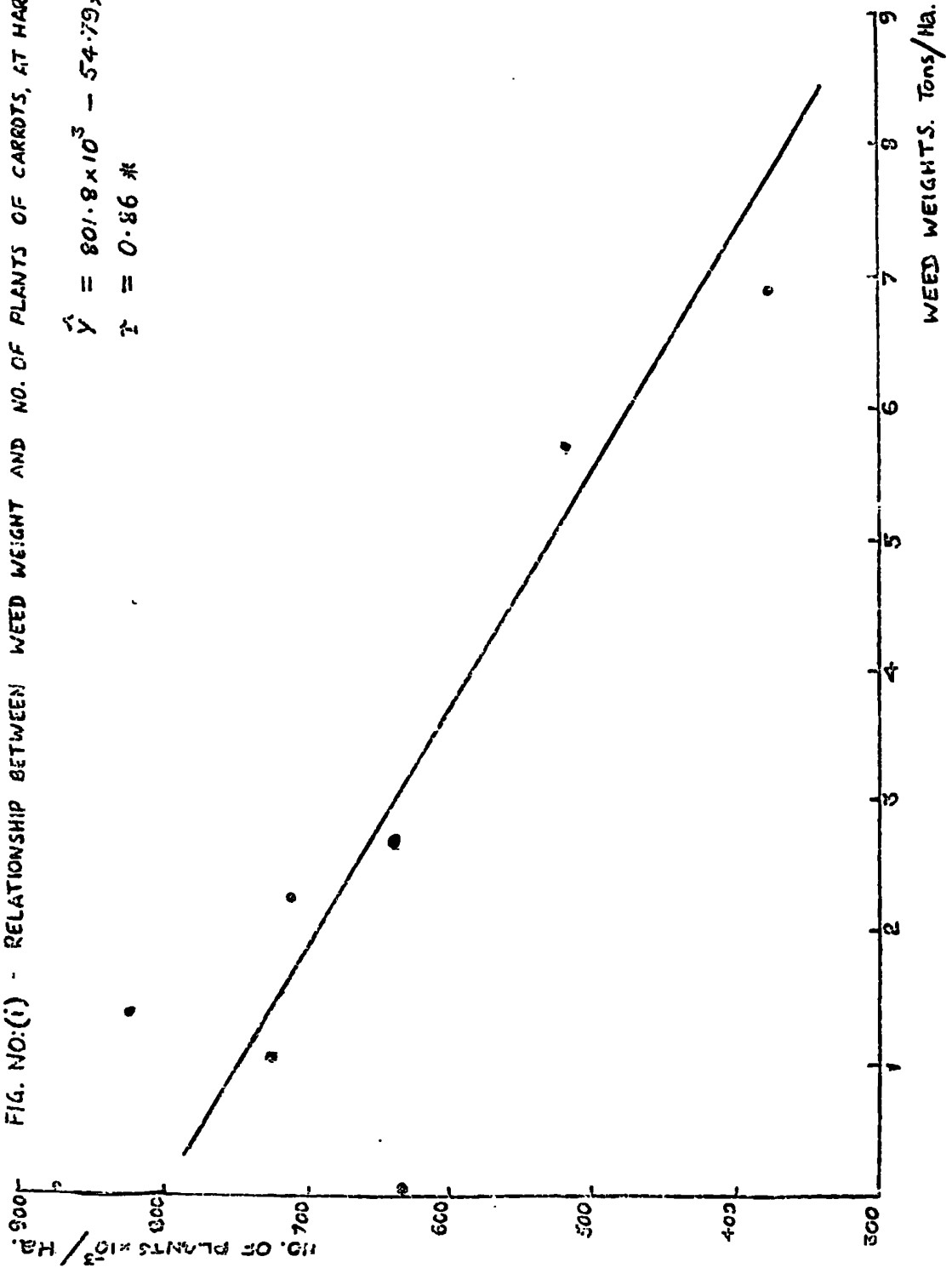
Table 3b—Returns and Benefit/Cost

Treatment	Yield (t/ha)	Return (at Rs. 1750/t)	Total cost of cultivation (Rs./ha)	Profit (Rs./ha.)	Profit due to weed control (Rs./ha)	Cost of weed control (Rs./ha)	Benefit/ Cost due to weed control
No weeding	7.33	12,827	11,880	947	—	—	—
Hand weeding	29.99	52,482	14,529	37953	37006	2649.00	13.96
Afalon (Pre) (Linuron)	24.33	42,577	12,556	30021	29074	676.00	43.00
Afalon (Post) (Linuron)	20.49	35,857	12,556	23301	22354	676.00	33.07
Sencor (Pre) (Metribuzin)	25.59	44,782	12,651	32131	31184	771.00	40.44
Planavin (Pre) (Nitriline)	24.86	43,505	12,308	31197	30250	428.00	70.67

FIG. NO:(i) - RELATIONSHIP BETWEEN WEED WEIGHT AND NO. OF PLANTS OF CARROTS, AT HARVEST.

$$\hat{Y} = 801.8 \times 10^3 - 54.79 \times 10^3 X$$

$$r = 0.86$$



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FIG. 110.(ii) RELATIONSHIP BETWEEN WEED WEIGHTS AND YIELD OF CARROTS WITHOUT LEAVES.

$$\hat{Y} = 27.42 - 3.05 X$$
$$r = 0.91 *$$

