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Short Communication

Weed management indices as affected by different weed control treatments in tea [*Camellia sinensis* (L.) Kuntze]

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Abstract

An experiment was conducted on farmer's field, at village Tanda, Palampur to study the efficacy of glyphosate formulations i.e., glyphosate IPA salt 41% SL and glyphosate potassium salt 46% SL for managing weeds in tea through different weed management indices during 2020. Ten weed control treatments *viz*., glyphosate IPA salt 41% SL 2000, 4000 and 8000 ml/ha, glyphosate potassium salt 46% SL 1440, 2880 and 5760 ml/ha, paraquat dichloride 24% SL 2000 ml/ha, glyphosate 41% 4000 ml/ha, glufosinate ammonium 13.5% 3333 ml/ha and weedy check were evaluated in randomized block design with three replications. Weed indices were calculated which revealed that all chemical treatments significantly reduced weed infestation when compared to weedy check. Glyphosate potassium salt 5760 ml/ha and glyphosate IPA salt 8000 ml/ha, behaving statistically alike with their lower doses i.e., 2880 and 4000 ml/ha, resulted in significantly higher bush height and girth of tea which may be due to effective control of weeds through these herbicides which ultimately helped in better growth of shoots.

Key words: Glyphosate IPA salt, glyphosate potassium salt, weed control index, weed persistence index, herbicide efficiency index, weed management index

Tea [*Camellia sinensis* (L.) Kuntze], the oldest evergreen bush in the Theaceae family, is grown in the Kangra district of Himachal Pradesh. Because of its unique flavour and health benefits, it has its own niche market and consumers. In general, tea is grown in more than 36 nations across all continents, with the exception of North America. China is the largest producer of tea followed by India, Sri Lanka and Kenya and these countries alone produce 75 per cent of the world's tea. Tea prefers temperature range of 13 to 35 degrees Celsius and altitude range from 900 to 1800 metres above sea level with acidic soil pH. The plant requires an annual precipitation of 2500-3300 mm, which should be evenly distributed. Due to these specific meteorological and soil conditions, tea cultivation in Himachal Pradesh is only confined to parts of Kangra, Mandi and Chamba. In 2018-19, the state had a total area of 2311 ha and a production of 877 thousand kg made tea (Anonymous, 2020). Among many constraints limiting tea productivity in Himachal Pradesh, weed infestation is major factor. Weeds compete with tea crop for nutrients and other resources (Ghosh and Das, 2004). Weeds have a variety of detrimental consequences on tea, including reduced branching, frame formation in young tea, plucking capability, and the ability to harbour and act as an alternate host for a variety of important insect pests and diseases. Being labour intensive crop, herbicides are preferred for effective and timely weed control. Most commonly used herbicide is Glyphosate, which is a broad-spectrum, post emergent, systemic and non-selective in nature (Tu *et al*., 2001). Manual and mechanical methods are not a superior option due to the time, season, and cost involved. However, considering the variety of weed species and their intensity of use, different formulations of glyphosate salt *i.e*., glyphosate IPA salt 41% SL and glyphosate potassium salt 46% SL (which is particularly effective on many annual and

perennial grasses and broad-leaf weeds) were investigated for efficient and effective weed control.

A field experiment was carried out at the farmer's field, at village Tanda, Palampur ($32^0$6' N, $76^0$3' E) during 2020. The soil of experimental site was silty clay loam in texture, acidic in reaction (pH 5.4) and medium in available nitrogen (325 kg/ha), phosphorus (21.9 kg/ha) and potassium (201.6 kg/ha). Ten weed control treatments consisting of three doses of glyphosate IPA salt 41% SL 2000, 4000 and 8000 ml/ha, three doses of glyphosate potassium salt 46% SL 1440, 2880 and 5760 ml/ha, paraquat di chloride 24% SL 2000 ml/ha, glyphosate 41% 4000 ml/ha, glufosinate ammonium 13.5% 3333 ml/ha and weedy check were tested in Randomized Block Design with three replications. The herbicides were sprayed using a backpack knapsack sprayer with 600 liters of water per hectare. Different weed management indices were calculated to advocate the results as per following formulas:

Weed Control Index (WCI): WCI was worked out taking into consideration the reduction in weed population in treated plot over weed population in unweeded check. It is expressed in %.

$$WCI = \frac{WPC - WPT}{WPC} \times 100$$

Where, WPC = Weed population in control (unweeded) plot.
WPT= Weed population in treated plot.

Weed Persistence Index (WPI): This index indicates the resistance in weeds against the tested treatments and confirms the effectiveness of the selected herbicides.

$$WPI = \frac{DWT}{DWC} \times \frac{WPC}{WPT}$$

Where, DWC= Weed dry weight in control (unweeded) plot.
DWT= Weed dry weight in treated plot.
WPC = Weed population in control (unweeded) plot.
WPT= Weed dry weight in treated plot.

Herbicide Efficiency Index (HEI): This index indicates the weed killing potential of a herbicide treatment and its phytotoxicity on the crop.

$$HEI = \frac{Y_T - Y_C}{Y_C} \Big/ \frac{DWT}{DWC}$$

Where, Y_T = Yield of treated plot
Y_C= Yield of control (unweeded) plot
DWC = Weed dry weight in control (unweeded) plot
DWT= Weed dry weight in treated plot

Weed Management Index (WMI): This index is the ratio of yield increase over the control because of weed management and per cent control of weeds by the respective treatment.

$$WMI = \frac{Y_T - Y_C}{Y_C} \Big/ \frac{DWC - DWT}{DWC}$$

Where, Y_T = Yield of treated plot
Y_C= Yield of control (unweeded) plot
DWC = Weed dry weight in control (unweeded) plot
DWT= Weed dry weight in treated plot

The dominant weed flora in the experimental area consisted of *Cyodon dactylon, Bidens pilosa, Imperata cylindrica, Ageratum* sp., *Commelina benghalensis, Cyperus* sp. and *Paspalum* sp. Devi *et al*. (2019) have also reported similar type of weed flora in tea. The value of weed indices like weed control index (WCI), weed persistence index (WPI), herbicide efficiency index (HEI) and weed management index (WMI) were inferior in plot receiving no weed control throughout the growing season i.e., weedy check plot (Table 1). Glyphosate potassium salt 5760 ml/ha and glyphosate IPA salt 8000 ml/ha recorded superior values of WCI, WPI, HEI and WMI followed by their lower doses i.e., glyphosate potassium salt 2880 ml/ha and glyphosate IPA salt 4000 ml/ha indicating effective control of weeds with these chemicals. Better control of weeds under these treatments could be assigned the reason for superior weed indices.

Plant/bush height and girth are critical growth parameters that impact a crop's capacity to compete. Maximum plant height was recorded in glyphosate potassium salt 5760 ml/ha (58.8 cm) and glyphosate IPA salt 8000 ml/ha (58.0 cm) which were statistically at par with the lower dose of glyphosate potassium salt *i.e.*, 2880 ml/ha (55.7 cm), paraquat 2000 ml/ha (57.0 cm) and glyphosate 4000 ml/ha (55.9 cm). Glyphosate potassium salt 1440 ml/ha were the next best treatment in this regard. Maximum girth of bush was recorded in glyphosate potassium salt 5760 ml/ha (179.4 cm) and glyphosate IPA salt 8000 ml/ha (179.2 cm) which were at par with their lower doses *i.e*., 2880 (175.2 cm) and 4000 ml/ha (173.3cm), respectively due to effective

Table 1. Effect of weed control treatments on different weed management indices in tea at 90 days after spray (DAS)

Treatment	Dose (ml/ha)	WCI	WPI	HEI	WMI
Glyphosate IPA salt 41% SL	2000	85.20	1.45	1.43	0.39
Glyphosate IPA salt 41% SL	4000	90.24	1.93	3.32	0.77
Glyphosate IPA salt 41% SL	8000	94.30	2.42	4.63	0.74
Glyphosate potassium salt 46% SL	1440	84.69	1.42	1.48	0.41
Glyphosate potassium salt 46% SL	2880	90.06	1.91	3.31	0.78
Glyphosate potassium salt 46% SL	5760	94.02	2.40	4.59	0.77
Paraquat di chloride 24% SL	2000	67.97	1.24	0.53	0.35
Glyphosate 41%	4000	81.75	1.73	1.17	0.54
Glufosinate ammonium 13.5%	3333	82.77	1.32	1.50	0.44
Weedy check	—	0.00	1.00	0.00	0.00

Table 2. Effect of weed control treatments on bush height (cm) and girth of tea bush (cm)

Treatment	Dose (ml/ha)	Bush height (cm)	Girth of bush (cm)
Glyphosate IPA salt 41% SL	2000	53.5	171.1
Glyphosate IPA salt 41% SL	4000	54.8	173.3
Glyphosate IPA salt 41% SL	8000	58.0	179.2
Glyphosate potassium salt 46% SL	1440	54.6	168.0
Glyphosate potassium salt 46% SL	2880	55.7	175.2
Glyphosate potassium salt 46% SL	5760	58.8	179.4
Paraquat di chloride 24% SL	2000	57.0	159.7
Glyphosate 41%	4000	55.9	162.1
Glufosinate ammonium 13.5%	3333	53.2	165.2
Weedy check	—	50.2	158.2
SEm ±	—	1.2	2.0
CD (P=0.05)	—	3.5	6.1

early weed control by these treatments. These results are in close conformity with the findings of Magamboo and Kilavuka (1982).

Conclusion

Application of glyphosate potassium salt 5760 and 2880 ml/ha and glyphosate IPA salt 8000 and 4000 ml/ha gave better results in terms of weed management indices and also resulted in maximum height and girth of tea bush.

Conflict of interest: There is no conflict of interest among the authors.

References

Anonymous. 2020. Economic Survey 2019-20, Economic & Statistics Department, Himachal Pradesh, Shimla. pp 70.

Devi N, Kundu CK, Bera PS, Panda S and Das S. 2019. Evaluation of glyphosate 41% SL to control weeds in tea at Terai region of West Bengal. Journal of Crop and Weed **15** (3): 213-219.

Ghosh C and Das AP. 2004. The materials and method of Jhara preparation by the tribal inhabitants of Tea Gardens in Terai of West Bengal (India). Indian Journal of Traditional Knowledge **3** (4): 373-382.

Tu M, Hurd C, Randall JM. 2001. Weed control methods handbook, The Nature Conservancy 7E.1-7E.10. https://www.invasive.org/gist/products/handbook/methodshandbook.pdf.

Magambo MJS and Kilavuka CL.1982. Effect of glyphosate on shoot growth of tea. Tropical Pest Management **28** (3): 315-316.