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Efficacy of SERU SL Herbicide for Coffee Weed Management in Sidama, Southern Ethiopia

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Abstract: In Ethiopian coffee production, weeds lead to severe yield losses (up to 65%) and significant management expenses. This study evaluated the effectiveness of a newly introduced herbicide, Glyphosate 480g/l SL, for weed control in coffee. A trial was conducted during the 2023 cropping season at Hawassa Agricultural Research Center and Wondo Genet District, comparing Glyphosate 480g/l SL against a standard check (Gly care 480g/l SL) and a weedy check (nil). Results indicated that both herbicides effectively reduced weed density and demonstrated high weed control efficiency relative to the weedy control. A single application of the test herbicide, Glyphosate 480g/l SL, at 3 L/ha during vigorous weed growth, provided season-long weed control comparable to the standard check, with both herbicides controlling weeds within 7-14 days. Therefore, a single seasonal application of Glyphosate 480g/l SL at 3L/ha in 250 L/ha water is recommended for effective weed management in non-organic coffee farms.

Keywords: Coffee, Weed density, Seru 480 SL, Post emergency, Ethiopia.

Research Paper

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1. INTRODUCTION

Coffee (*Coffea arabica* L.) is the backbone of the economy of a country and the second most traded commodity in terms of volume and value, behind oil (Girma, 2011). Therefore, it is essential to maintain a balance in trade between developed and developing countries. It offers over 25% of Ethiopia's population's income and accounts for 70% of foreign exchange profits and 10% of government revenue (Tsegaye *et al.*, 2000). The most consumed type of coffee is arabica, making up for more than 70% of production volume and 90% of worldwide trade value (Tadasse, 2015).

The country's economy and culture are strongly influenced by coffee. Ethiopia's main export crop is arabica coffee, which makes a significant economic contribution to the country. It is the most important product for Ethiopian industry and a major source of foreign exchange that supports the livelihoods of millions of laborers and farmers. Numerous obstacles, including weed control, recurring pests and diseases, depleting soil capacity, and unfavorable weather patterns, have an impact on coffee output. One of the main things preventing the entire country from producing as much coffee is weeds. Depending on the type of weed, the stage at which coffee trees are growing, and nearby growth conditions, weeds in coffee have been shown to reduce yield by 65% and even to result in crop failure (Tadesse E, 1998). Despite, majority of coffee farmers heavily depend on manual slashing and digging which encourage the multiplication and spread of the noxious competitive perennial weeds (Tadesse E, 1994). Weeds infestation is the main bottleneck in crop production in Ethiopia, especially during the rainy season. The climate encourages rapid and abundant growth of weeds and consequently, all crops are heavily infested with weeds. Farmers in the country are aware of a weed problem in their fields but often they cannot cope-up with heavy weed infestation during the peak period of agricultural activities because of labor shortage, hence, most of their fields are weeded late or left un-weeded. Currently, expensiveness of weed management has been a principle issue in economic analysis of coffee production particularly in large scale farm in Ethiopia. This is because of the weed species those are found as dominant and prevalent in the areas where they favorably and quickly re-appear within the season. Hence, uses of effective systemic herbicides for controlling deep seated rhizomes, bulbs and tubers and above ground running stolen of the perennial sedge and grass weeds is vital. Under such circumstance evaluation different herbicides with different groups & mode of action is essential.

Herbicide an essential part of weed management practice in coffee production at Southwest Ethiopia, it also can offer an advantage of taking less time, demanding less labor and avoid potential of diseases spread that causes during manual slashing and digging weed management practices. Previously, several systemic herbicides have been evaluated by Jimma Agricultural Research Center. And recommended Tigist *et al.* (2024). However, since, coffee production becomes expanded yet now there is scarcity of systemic herbicides to reduce losses caused due to weed infestation. Often farmers practice Weeding at one or unwedded left this increases infestation of both broad-leaf and grass weeds (personal comm., Regional Ministry of Agriculture, 1997) resulting in low productivity. Selective herbicides are effective in controlling target weeds but inefficiency may arise in case the weeds develop resistance to certain selective herbicides and due to uncontrolled factors, that may reduce the efficiency of the chemicals. Therefore, the use of non-selective broad-spectrum chemicals becomes important to kill all weeds emerging before they may cause harm to crops. Glyphosate since many years has been used as the most important non-selective herbicide to control all types of weeds before planting.

Glyphosate [N-(phosphonomethyl) glycine] is a broad spectrum, non-selective, post-emergence herbicide that controls weeds by inhibiting their ability to synthesize amino acids. Amino-methyl-phosphonic acid (AMPA) is the major metabolite of glyphosate, found in plants, water and soil. Glyphosate is strongly adsorbed to most soils and thus, does not lead or run off appreciably and soil microorganisms break it down. The estimated half-life of glyphosate in soil is approximately 60 days. After 360 days, residue levels were from 6 to 18% of the initial applied dose. Precipitation, soil composition, presence and absence of a soil constricting layer and drainage type may influence the leaching of glyphosate from soil. Glyphosate is an amino-phosphonic analogue of the natural amino acid glycine.

Having above mentioned points the verification test was conducted following Pesticide Testing guidelines developed by Ethiopian Institute of Agricultural Research (EIAR) to evaluate the efficacy of newly introduced herbicides for verification that verification was done is Glyphosate 480G/L herbicide comparing with already registered herbicide Gly care 48% g/l SL as standard control for control perennial grasses, perennial broad leaves and annual grasses and broad leaves weeds in Coffee at Sidama Regional state, Hawassa agricultural research center on station and Wondo Genet district southern parts of Ethiopia. Such ineffective weed management is considered the main factor for the low average yield of Coffee, resulting in an average annual yield loss of 60-80 % (Esheteu *et al*., 2007).

Glyphosate IPA 480G/L SL is a nonselective herbicide used to control all broads, grass and Sedge weeds of coffee, currently verified at Hawassa Agricultural Research Center. The objective of study was to verify the efficacy of the new formulation Glyphosate 480G/L SL on the control of all weeds in Coffee perennial commercial crops.

2. MATERIALS AND METHODS

2.1. Descriptions of the Study Area

The verification test was conducted at Hawassa Agricultural Research Center (HARC). HARC is found in Sidama regional state in Hawassa city, Ethiopia, 288 km to southern of Addis Ababa. It is located at 07° 03’52’’N latitude and 038° 28’ 52 'E longitude with an elevation of 1700 meter above sea level (masl) and the area receives a total of 1000 to1200 mm rainfall in bimodal raining pattern with short rains (belg rains) coming from April to May and long rains (meher rains) coming from July to October. The mean annul minimum and maximum temperature of areas were 16.5°C and 29.2°C, respectively. Similarly, the study was conducted at Wondo Genet district of northern Sidama zone in southern Ethiopia farm 36 km and 6°36′-6° 39′N latitude and 38°18′–38° 28′E longitude. The area receives an annual rainfall in the range of 1480 to 2150 mm, with the main rainy season between June and September. Mean annual minimum and maximum temperatures are 18.8°C and 28.8°C, respectively with altitude of range 1770-1824 masl.

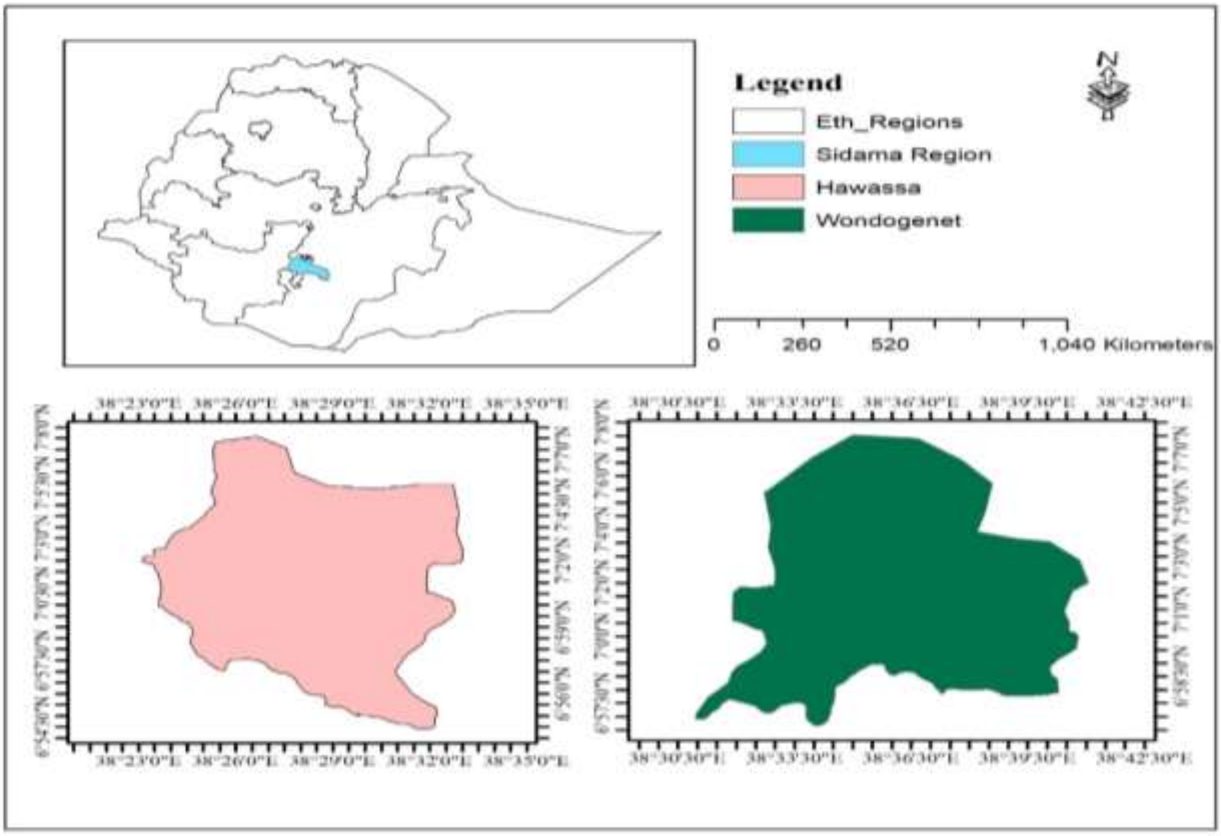

Figure 1: Map of study area

2.2. Material and Procedure

The herbicide test was conducted at Hawassa The herbicide test was conducted by the Hawassa Agricultural Research Center. The trial was conducted at two locations via the on-station of Hawassa Agricultural Research Center and Awada Coffee Research Sub-Center. The study was laid out on already established coffee experimental plots with a naturally infested field where the noxious perennial grasses, perennial broad-leaf weeds, perennial sedges, and annual broad-leaf weeds were abundantly growingTwo (2) treatments were used at the experimental site, including test herbicide SERU 480% SL (Glyphosate 480g/l SL) and standard checks (Glycare 48%g/l SL and weedy check were evaluated. The plots were 10m x 10m in size, both on the Hawassa agricultural research center sub-center stationsand Wondo genet district. The testing trial was laid out in non-replicated plots, where locations were considered as replications. SERU 480% SL (Glyphosate 480g/l SL) was applied with a rate of 3 liters/ha manually using a knapsack sprayer delivering 250 liters of water/ha following the harvesting time of cherry. The herbicides were sprayed one time within the season at the actively growing stage of the weeds. Weeds were counted by randomly throwing the quadrant as a pre-treatment weed count. After the 7th and 14th, days of herbicide application, the weed was counted as post-treatment by throwing a quadrant (0.25 m2) randomly to the plots. Finally, pre- and post-spray weed counts were subjected to efficacy calculation using the formula of Fleming and Retnakaran (1985) as follows:

$$\text{Efficacy } \% = \frac{1 - (\text{Ta} * \text{Cb})}{(\text{Tb} * \text{Ca})} * 100$$

Where, Ta=post-treatment population in treatment, Cb= Pre-treatment population in check, Tb= Pre-treatment population in treatment, Ca= post-treatment population in check, similarly, the herbicide weed control efficiency (WCE) can be calculated by using the following formula as suggested by (Mani, et al., 1973). Percentage of Weed inhibition (PWI) was calculated using the following formula.

$$\text{Percentage of weed inhiition (PWI)} = \left(\text{NWC} - \frac{\text{NWT}}{\text{NWC}}\right) * 100$$

Where, NWC &NWT are number of weeds ($0.25m^2$) in the weedy check and any particular treatment, respectively. Individual and general weed control evaluations (1-9 scale score), 1= no control and 9= (100% control) were determined through visual observation at 7^{th} and 14th days' after treatment application by considering growth reduction, foliar chlorosis, wilting and stunting during the time of assessment. Weed Control Efficiency (WCE) was calculated based on the following formula (Surinder, 2016). The plot (weedy check) was used as for comparison and all other management practices were applied as per their agronomic recommendations uniformly.

$$\mathrm{WCE} = \frac{\text{Weed count in weedy plot} - \text{weed count in treated plot}}{\text{Weed count in weedy plot}} * 100$$

Table 1: Description of tested herbicide and standard check

Trade Name	Common Name (active ingredient)	Application Rate (Liter ha-1)	
		Herbicide	Water Volume
SERU 480 %SL	Glyphosate 480G/L SL	3	250
Gylycare 48% SL	Glyphosate IPA	3	250
Weedy check	-	-	-

Note: *SERU 480 %SL and Gylycare 48% SL are broad spectrum non selective* **herbicides.**

3. RESULTS AND DISCUSSIONS

3.1. Weed Infestation in Terms of Taxonomy

In the verification test was conducted under coffee orchards pre-established in different weed species belonging to the annual broad leaf, grasses and sedge and perennial broad leaf, sedge, and grass categories were identified. Twenty-seven (27) weed species belonging to fifteen (15) families were recorded within the verification test fields across locations. Among the recorded species, 14.8%, grass and 85.2% were broad leaved weed species, respectively. This result is similar with the report of (Tigist and Tamiru. 2023) done in southern west Ethiopia of Jimma Zone. As study result showed number of broad leaved was more prevalent than grass species across sites (Table 2).

Table 2: Taxonomy of weed species observed in the verification test site across locations

S/no	Scientific Name	Family	Common Name	Morphology
1.	*Achyranthes aspera* L.	*Amaranthaceae*	Devils horsewhip	BL
2.	*Alternantherria caracasana*	*Amaranthaceae*	Khakiweed	BL
3.	*Amaranthus greecizens* L.	*Amaranthaceae*	Pig weed	BL
4.	*Antigonon leptopus Hook. & Arn.*	*Polygonaceae*	Coral vine	BL
5.	*Bidens Pilosa*	*Compositae*	Black Jack	BL
6.	*Bracheria mutica*	*Poaceae*	Para grass	G
7.	*Chamaecrista pumila*	*Fabaceae*	Dwarf cassia	BL
8.	*Commelina benghalensis* L.	*Commelinaceae*	Tropical spiderwort	BL
9.	*Convolvulus arvensis* L**.**	*Convolvulaceae*	Field bindweed	BL
10.	*Conyza albida*	*Asteraceae*	Tall fleabane	BL
11.	*Cyathula prostrat* (L.) *Blume.*	*Amaranthaceae*	Pasture weed	BL
12.	*Desmodium intorutum*	*Fabaceae*	Green leaf desmodium	BL
13.	*Digitaria abysinica*	*Poaceae*	Couch grass	G
14.	*Euphorbia hirta* L.	*Euphorbiaceae*	AsthmaWeed	BL
15.	*Galinsoga parviflora*	*Compositae*	Gallant Solder	BL
16.	*Galiumm aparinae*	*Rubiaceae*	Madder family	BL
17.	*Ipomoea obscura (L.) Ker Gawl.*	*Convolvulaceae*	Obscure morning glory	BL
18.	*Lantana camara*	*Verbenaceae*	Common lantana	BL
19.	*Leucas martinicensis (jacg) Airt.g*	*Labiatae*	Bobbin weed	BL
20.	*Oplismenus hirtellus*(L.) *P.Beauv.*	*Poaceae*	Basket grass,	G
21.	*Oxalis cognuculata* L.	*Oxalidaceae*	Yeloow sorrel	BL
22.	*Paspalum conjugatum*	*Poaceae*	Buffalo grass	G
23.	*Phyllanthusniruri* L.	*Euphorbiaceae*	Store breaker	BL
24.	*Polygonun convolvulus*	*Polygonaceae*	Smartweed	BL
25.	*Portulaca oleraceae*	*Portulacaceae*	Moss rose	BL
26.	*Ruellia Prostrate poir*	*Acanthoceae*	Prostrate wild petunia	BL
27.	*Tribulus terrestris*	*Zygophyllaceae*	Puncture vine	BL

Note: Bl= broad leaf and G=grass

3.2. Effect of Herbicides on Weed Density and Percentage of Weed Reduction

Weed density and percentage reduction data following herbicide application are presented in Table 3. The current verification trial results indicate that herbicide application significantly affected weed density. Glyphosate 480 g/l SL effectively reduced weed density compared to the untreated control. Both Glyphosate 480 g/l SL and the standard check Gly Care 48% g/l SL are non-selective systemic herbicides that began killing weeds within 7 to 9 days after application. Most weeds were eliminated by the 9th and 10th days, with over 98% killed by the 14th day post-application. Approximately 14 weed species were identified on-site at the Hawassa Agricultural Research coffee farms, with the major species noted. In total, about twenty weed species were observed. At the 14-day evaluation, the treated plots with Glyphosate 480 g/l SL and Gly Care 480 g/l SL recorded lower mean weed densities of 6, 8, 12, and 15 per 100 m², respectively, compared to the weedy control. The highest mean weed population (5701 per 100 m²) was found in the untreated control plots (Table 3).

Table 3: Effect of herbicide on weed population and percentage of weed reduction

Location	Herbicide evaluation time per locations of 100m^2 area								
	Glyphosate 480g/l SL			Glyph care 480g/l SL			Weedy check (untreated)		
	BA	at7th DAA	at14th DAA	BA	at7th DAA	at14th DAA	BA	at7th DAA	at14th DAA
Hawassa on site	4553	1540	12	4780	1715	15	4620	5510	5510
Wondo Genet	4590	1340	8	5210	1625	06	4580	5610	5701
Mean	**4572**	**1440**	**10.0**	**4995**	**1670**	**10.5**	**4600**	**5560**	**5606**

Where, BA=Before Application and DAA=Days after application,

Different results on percentage of weed inhibition (PWI) or percentage of weed reduction (PWR) was also recorded in the present verification trials. As a result indicated weed reduction percentage mean value ranged from 44.4. % - 72.2%, 55.6% - 72.2%, at seven days after application 72.2 - 100% were obtained from plots treat with Glyphosate and Glycafe480g/l SL herbicides respectively as compared with plot untreated (Table 4). A tested herbicide and standard check performed well on weed density reduction and weed reduction percentage compared with untreated plot.

Table 4: Mean effect of Glyphosate 480g/l SL and Gly care 480g/l SL herbicides on individual weed control over locations

Weed Species	Treatment Evaluation time per Locations							
	Glyphosate 480g/l SL				Gly Care 480g/l SL			
	at7th DAA		at 14th DAA		at 7th DAA		at14th DAA	
	Score (1-9)	% WC	Score (1-9)	% WC	Score (1-9)	% WCE	Score (1-9)	% WC
Achyranthes aspera L.	6.5	72.2	9	100	6.5	72.2	9	100
Alternantherria caracasana	6.5	72.2	9	100	6.5	72.2	9	100
Amaranthus greecizens L.	6.5	72.2	9	100	6.5	72.2	9	100
Antigonon leptopus Hook. & Arn.	6.5	72.2	9	100	6.5	72.2	9	100
Bidens Pilosa	6.5	72.2	9	100	6.5	72.2	9	100
Bracheria mutica	6	66.7	9	100	6.5	72.2	9	100
Chamaecrista pumila	6	66.7	9	100	7	77.8	9	100
Commelina benghalensis L.	4	44.4	8.5	94.4	4.5	50	8.5	94.4
Convolvulus arvensis L**.**	5.5	61.1	9	100	5.5	61.1	9	100
Conyza albida	5	55.6	9	100	5.5	61.1	9	100
Cyathula prostrat (L.) *Blume.*	5.5	55.6	9	100	5.5	61.1	9	100
Desmodium intorutum	4	44.4	6.5	72.2	5	55.6	6.5	72.2
Digitaria abysinica	5.5	55.6	9	100	5.5	55.6	9	100
Euphorbia hirta L.	6.5	72.2	9	100	6.5	72.2	9	100
Galinsoga parviflora	6.5	72.2	9	100	6.5	72.2	9	100
Galiumm aparinae	6	66.7	9	100	6.5	72.2	9	100
Ipomoea obscura (L.) *Ker Gawl.*	4	44.4	9	100	5	55.6	9	100
Lantana camara	4.5	50	9	100	5.5	61.1	9	100
Leucas martinicensis (jacg) Airt.g	5.5	55.6	9	100	5.5	61.1	9	100
Oplismenus hirtellus(L.) *P.Beauv.*	6.5	72.2	9	100	6.5	72.2	9	100
Oxalis cognuculata L.	6	66.7	9	100	6.5	72.2	9	100
Paspalum conjugatum	6.5	72.2	9	100	6.5	72.2	9	100
Phyllanthusniruri L.	6	66.7	9	100	6.5	72.2	9	100

Polygonun convolvulus	6.5	72.2	9	100	6.5	72.2	9	100
Portulaca oleraceae	4	44.4	7.5	83.3	5	55.6	8	88.9
Ruellia Prostrate poir	6.5	72.2	9	100	6.5	72.2	9	100
Mean	5.7	63.0	8.8	98.1	6.0	66.9	8.8	98.3

DAA= days after application

3.4. Effect of Herbicide on General Weed Control

General weed control was evaluated via visual observation based on 1-9 scale and percent weed control after 7and 14days of herbicides application. Accordingly all testes herbicide effectively controlled the annual and perennial broad leaves, grasses and sedge weeds which predominantly infested the experimental plots across locations. As present herbicide verification observation result showed that a herbicide showed good performance on general weed control compared with standard control herbicide. The weed control percentage range mean value (63% to 98.2%) obtained from the plots treated with Glyphosate 480% g/l SL herbicide at 7th and 14th day evaluation time after herbicide application across locations which were to some extent similar with the weed control percentage mean value (66.7% to 98.3%) obtained from the plots treated with Gly care 48% g/l SL standard check herbicide at seven and fourteen days after herbicide application, respectively (Table 5). The present verification trial result suggested that it has the same efficacy level with standard check. The current work is in line with the finding of Tigist and Tamiru (2023) done in Southern west Ethiopia.

Table 5: Mean Effect of Herbicides on General Weed Control.

Location	**Treatment Evaluation time per Locations**							
	Glyphosate 480g/l SL				**Glyph care 480g/l SL**			
	at7th		**at 14th**		**at 7th**		**at14th**	
	Score (1-9)	**WC %**	**Score (1-9)**	**WC %**	**Score (1-9)**	**WC%**	**Score (1-9)**	**WC%**
Hawassa on site	5.4	60	8.65	96.1	5.5	61.1	8.7	96.7
Wondo Genet	6.0	66.7	9	100	6.5	72.2	9	100
Mean	5.7	63	8.8	98.1	6.0	66.7	8.9	98.35

Note: WC %= weed control percentage

3.5. Effect of Herbicide on Weed Control Efficiency

The highest weed control value 98.2% followed by 98.3%, obtained from Glyphosate 480g/l, SL and Gly care480g/l SL herbicides respectively (Table 6). This result indicates that the test herbicide have the same weed control efficacy with standard check which the farmers can use either one of them depending the availability of the herbicides.

Table 6: Herbicides weed control efficiency (WCE %)

Location	**Treatment Evaluation time per Locations of 1m^2 area at 14 days after application**					
	Glyphosate 480g/l SL		**Glyph care 480g/l SL**		**Weedy check (untreated)**	
	Weed density / m2	**WCE (%)**	**Weed density / m2**	**WCE (%)**	**Weed density / m2**	**WCE (%)**
Hawassa on site	0.12	98.1	0.15	98	5510	
Wondo Genet	0.08	98.4	0.06	98.6	5701	
Mean	**0.1**	**98.2**	**0.11**	**98.3**	**5606**	

Note: WCE= weed control efficiency

4. CONCLUSION AND RECOMMENDATION

The verification trials of Glyphosate 480% g/l SL, a new herbicide, have shown promising results against various weed species in coffee. The herbicide effectively reduced weed density and started weed killing after a week, compared to the standard control herbicide Gly Care 48% g/l SL, which starts on seven days after application. This indicates that Glyphosate can reduce weed population equivalent to a standard check. Repeated application after a month is not required for full control throughout the season, as it can control weeds in one season. If economically affordable and available to farmers, Glyphosate 480 G/L SL is recommended for use as a broadleaf and grassy weed and sedge management option for coffee, where weeds are aggressive due to continuous use of selective herbicides and buildup of resistance. Implementing glyphosate in provinces and similar coffee-producing areas could lead to improved efficiency and sustainability in coffee production, benefiting farmers and the local economy. Therefore, it is wise to recommend Glyphosate 480 g/l SL for use against major post-emergency broadleaved, grass, and sedge weeds in the current study of coffee-growing areas and similar agro-ecologies as an alternative to herbicides on non-organic coffee farms.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCE

- CSA (Central Statistics Agency). 2022. Federal Republic of Ethiopia, Central Statistical Agency, Agricultural Sample Survey Report on Area and Production of Major Crops, 2020/2021, Vol. 1, Statistical Bulletin 578, May 2021, Addis Ababa, 121P.
- Duressa, T.F. 2018. Newly Emerging Insect Pests and Diseases as a Challenge for Growth and Development of Ethiopia: The Case of Western Oromiya.Journal of Agricultural Science and FAOSTAT, 2008. Potato world: Production and consumption. International year of the potato 2008.
- Fleming, R. and Retnakaran, A. 1985. Evaluating single treatment data using Abbott´s formula with modification. J. Econ. Entomol.78:1179-1181
- Girma, N. K. 2011. Marketing information operation in Ethiopia with special reference to the Ethiopia Commodity Exchange (ECX) Coffee Trading. MSc. thesis. Swedish University of Agricultural Sciences, Uppsala, Sweden. Department of Urban and Rural Development pp. 75.
- Mani, V. S., Malla, M. L., Gautam, K. C.and Bhagwandas. 1973. Weed-killing chemicals in potato cultivation. Indian Farm, VXXII, 17-18.
- Mesfin Amha. 1990. The status of demonstration sites. Ministry of Coffee and Tea Development, Coffee Improvement Project (CIP).
- NPR .2017. Coffee Farmers are on the front lines of climate change, internet source at http://newsok.com/article/555373.
- Rezene, F. and Yohannes, L. 2003. Control of Snowdenia polystachya in large-scale wheat production: herbicide resistance in context. pp. 78-88. In: Bedada Girma. BADE. Bale Agricultural Development Enterprise: Proceedings of the Agronomy Workshop, March 20-21, 2000, Melkassa. Addis Ababa, Ethiopia.
- Surinder,S.R. 2016. Weed indices. Available https://www.researchgate.net/publication/320268615_34 Weed indices. (Accessed: 13.05.2020).
- Tadasse, W. 2015. Coffee: Ethiopia's Gift to The World: The Traditional Production Systems as Living Examples of Crop Domestication, and Sustainable Production and an Assessment of Different Certification Schemes.
- Tadesse, E. 1994. Effect of Clipping Frequency of Couch grass (Digitariaabyssinica) on the Growth of young Coffee. In. Fassil Reda and D. G. Tanner (eds.) Arem Vol. 2 and 3. Proceedings of the 2nd and 3rd Annual Conferences of the Ethiopian Weed Science Society. Addis Ababa, Ethiopia.
- Tadesse, E. 1998. Weed control in the western coffee growing areas of Ethiopia. Pp. 22-27. In: Beyene S and Abera D. (eds) 1998. Agricultural Research and Technology Transfer: Attempts and Achievements in Western Ethiopia. Proceedings of the Third Technology Generation, Transfer and Gap Analysis Workshop. 12-14 November 1996. Nekemt, Ethiopia.
- Tadesse, E. and Tesfu, K. 2015. Effect of Weed Management Methods on Yield and Physical Quality of Coffee at Gera, Jimma Zone, South West Ethiopia. Journal of Resources Development and Management Vol 11.
- Tigist, B, Tamiru, S. and Tekleeyesus, F. 2024. Evaluating Efficacy of Newly Introduced Herbicides Against Coffee Weeds at Jimma, Southwest Ethiopia. Journal of Drug Design and Medicinal Chemistry, 10(1), 1-7. https://doi.org/10.11648/j.jddmc.20241001.11
- Tigist, B. and Tamiru S. 2023. Evaluating Herbicides' Efficacy Against Coffee Weeds in Southwest Ethiopia. Modern Chemistry, 11(4), 70-77.
- Tsegaye, Y., Getachew, O. and Tesfaye, Z. 2000. Some Socio-Economic Issues Related to Fungicide Use against CD in Ethiopia. In: Preceding of workshop on the command (CBI) in Ethiopia, 13-14 August 1999, 72-84 pp. International Journal of Pest Management.