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Physiological Responses Non Selective Post Emergence Herbicides to Various Weeds in Peach Field

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Abstract: *Peach is one of the most important fruit crops in the world with wider ecological adaptation which has been cultivated in sub-tropical to temperate climates. In spite of its economic importance, its production has been affected by various abiotic and biotic factors. Therefore, the objective of this study was to assess the effect of non-selective herbicides against peach weeds. Treatments consisted of three post emergence non selective herbicides; Glynosh @ 1.75kg/ha, Glynosh @1.75 L ha^{-1}, Glyphosate@ 2L ha^{-1} along with weedy check that were laid out in RCBD with three replications. The field was infested with nine weed species in which five species were annual weeds, three species were perennial weeds and one species was under category of biennial. The maximum relative weed density (17.38) was calculated from Cynodon dactylon L. while minimum (3.90) number was observed from Centella asiatica L. The result also showed that application of all herbicides had no statistically significant differences on Bidens pilosa L., Medicago polymorpha L., Palntago lanceoleta L. and Raphanus raphanistrum L. except for weedy check. In addition, application of Glyphosate IPA 480gm. /lit, 48% SL and Glyphosate produced statistically no significant differences on the remaining weed species. Application of all herbicides revealed statistically no significant differences in terms of weed dry weight while better weed control efficiency and fruit yield was obtained from application of Glyphosate IPA 480gm. /lit, 48% SL at all experimental sites. Furthermore, there is no phytotoxicity was observed due to candidate herbicide if applied with great care in between row planted peach. Thus, Glynosh 1.75 L/ha is recommended for control of various annual and perennial weeds in peach.*

Keywords: *difference; effect; Glynosh; herbicides; weed*

1. INTRODUCTION

Peach is one of the most important fruit crops in the world, with wider ecological adaptation, cultivated in sub-tropical to temperate climates. It is cultivated on 1.54 million ha with an annual production of 20.27 million tons in the world (FAOSTAT, 2010). The broad wider use of peach including its importance in a healthy and balanced diet has resulted in increased production of both processed and fresh varieties worldwide in the recent years. Similarly, a marked increase in area of production has also been observed in recent years in Ethiopia. The crop is among grown fruit crops using rain fed both by smallholder and commercial farmers in highlands of Ethiopia. .

According to reports of Majek *et al*. (1993) and Parker and Meyer (1996) revealed that weed interference has been reported to affect tree growth, yield, and fruit quality in peach. However, the magnitude of the effect on fruit yield and size depends on the weed species (Tworkoski and Glenn, 2001). Cultivation or herbicides are most commonly used for the management of weeds in peach orchards. Weed control by cultivation with discs and cultivators is temporary and not cost effective. Further, cultivation with discs and cultivators cannot manage the weeds under the trees in between the tree rows; hence, manual weeding is performed or herbicides are used. High labor costs in developed nations make manual weed in uneconomical. Conventional agricultural practices rely on synthetic herbicides for managing weeds, and these compounds account for more than half of the volume of all agricultural pesticides applied in the developed world (Dayan *et al*., 2011). The increased pressure to reduce herbicide applications and new interests in organic farming underline the importance of alternative approaches for orchard weed suppression (Goh *et al*., 2001).Further, repeated use of the same combination of herbicides can result in a shift in weed population and development of resistance. Rotation of herbicides with a different mode of action avoids the problem of weed resistance and improves weed control.

In spite of the crop's wider ecological adaptation, both biotic and abiotic stresses had limitation on its production and productivity. Weeds control is less noticeable to Peach production in Ethiopia and economic losses resulting from crop damage or weed control measures are less noticeable.

In Ethiopia, weeds are more severe during summer when rainfall is high. Weeds infested quickly in fields and can result in total crop failure if left untreated. Sustainable control of weeds actually requires integration of cultural practices that involves the application of herbicides. However, due to different germination time of the weeds, herbicides with better efficacy should be made available for the growers to reduce the consequential yield loss caused by the weeds. Therefore, the objective of this study was to assess the effect of non-selective herbicides against peach weeds.

2. MATERIALS AND METHODS

Description of the study area

Field experiment was conducted from June, 2020 to December, 2020 main cropping season under rain fed conditions at Holeta Agricultural Research Center and Medegudina locations. Holeta is located 33km west of Addis Ababa at an elevation of 2400 m.a.s.l and within the geographic coordinates of 9^o 00′N and 38^o 30′E. The area receives annual rain fall of 1144 mm with mean minimum and maximum temperatures of 6^{o}C and 22^{o}C respectively (EIAR,2018).The soil of the experimental field is clay loam with p^H of 6.65, organic carbon (2.26%), available Phosphorus (14.17 mgkg^{-1}),total nitrogen (0.12%) and cation exchange capacity of (17Cmol kg^{-1}) (EIAR,2018).The edaphic and climatic conditions observed during the trial period were favorable for the exuberant growth of numerous weed species that competed with the crop plants. The climatic conditions observed during the trial period mean rain fall of 1114.5 mm relative humidity 78.8 % with mean minimum and maximum temperatures of 8^{o}C and 25.2^{o}C, respectively. The remaining area received almost similar weather conditions with that of Holeta.

Treatments and crop management

Field experiment was conducted at Holeta Agricultural Research Center and Medegudina farmer field where fields were infested with many weed species. Treatments were laid out plot sizes of 4m x 4m along with the test herbicides; Glynosh 1.75 kg/ha, Glynosh 1.75 L /ha, Glyphosate 2 L/ha and weedy check. The design was RCBD with three replications. Peaches were already planted at the experimental sites at recommended spacing. All agronomic practices were applied based on recommendation for peach. All herbicides were applied as post emergence with spray volume of 250L/ha.

Data collection

Weed species identification was made by uprooting fresh weeds from experimental field and taken to laboratory. After the weed flora were identified, they were categorized as grasses and broad leaf weeds using reference of manuals, consulting experienced professionals and comparing with existed herbarium as described by Stroud and Parker (1989). Data regarding the kind of weed species and their densities were counted at 25 day after sowing i. e, before the application of herbicides by using four quadrats with sizes of 0.25 m x 0.25 m randomly placed in each plot and their density was calculated m^{-2}. In addition, individual weed species density count was also done at 45 days after herbicides were applied by randomly placing four quadrats of sizes 0.25m x 0.25m converted to m^{-2}.The density of each weed species in the field was counted after treatment by randomly placing of four quadrat of sizes 25 cm x25 cm in each plots and calculated m^{-2} basis. The relative weed density was calculated by the formula (Marwat *et al.*, 2013): RWD (%) $\frac{number\ of\ weeds\ of\ species}{total\ weeds\ of\ species}$ x100. The aboveground dry biomass of grass weeds and dry biomass of broad leaf weeds harvested from each quadrat placed into paper bags separately and oven drying at a 65 ^{0}C for 48 hours and subsequently the dry weights were measured. Weed control efficiency (WCE) was determined by the following formula $\mathrm{WCE}(\%) = \frac{\mathrm{WDC}-\mathrm{DWP}}{\mathrm{WDC}} \mathrm{X}100$, where, WCE=Weed Control Efficiency, WDC=Weed Dry weight in Control Plot and DWP = Weed Dry weight in Particular treatment (Davasenapathy *et al.*, 2008). Grain yield was measured after threshing the sun dried plants harvested from each net plot and the yield was adjusted at 12.5% grain moisture content (Amare *et al*., 2014).

Statistical analysis

The means of each data was checked by the normality test depending on Shapiro test (Pr < W) before analysis of variance using the GLM procedure of SAS (SAS 9.3 version).When the treatment effects were significant, means were compared using Fisher's LSD test at 5% level of significance (Gomez and Gomez, 1984).

Table1. *Trade name, common name, rates and mode of action of herbicides*

Trade name	Common name	Rate /ha	Selectivity
Glynosh	Glyphosate IPA 75.7% WSG	1.75 kg/ha	Non selective
Glynosh	Glyphosate IPA 480gm. /lit, 48% SL	1.75 L/ha	Non selective
Round up	Glyphosate	2 L/ha	Non selective
Weedy check	-	-	-

3. RESULTS AND DISCUSSIONS

Identification of weed flora in the experimental field

The experimental sites were infested with various weed floras that are problematic in perennial crops as well as pastures. Nine weed species were identified from the experimental location in which five species categorized as annual, three species were under category of perennial and only one species under biennial (Table 2). This result showed that the field was highly infested with annual weeds. The maximum relative weed density (17.38%) was calculated from *C. dactylon* L. while minimum (3.90%) number was observed from *C.asiatica* L. which indicated that perennial grasses are more problematic weed in perennial crop (Peach).

Table2. *Weed species, relative density and life form in the experimental field*

Scientific names	Families	Weed density count m^2 before spray	Relative weed density (%)	Life form
Bidens plosa L.	Asteracae	460	15.70	Annual
Ocimum australis.L.	Lamiaceae	336	11.47	Biennial
Medicago polymorpha L.	Fabaceae	420	14.34	Perennial
Cynodon dactylon L.	Poacae	509	17.38	Perennial
Bidens pachyloma L.	Asteraceae	372	12.70	Annual
Plantago lanceoleta L.	Plantaginaceae	132	4.50	Annual
Centella asiatica L.	Apiaceae	116	3.90	Annual
Rumex abyssinicus Jacq	Polygonaceae	204	6.97	Perennial
Raphanusraphanistrum L.	Brasicaceae	380	12.97	Annual

Weed density count at 45 days after herbicides application at Holeta

Individual weed densities were significantly affected by all tested herbicides in peach (Table 3). The result showed that application of all herbicides had no statistically significant differences on *B. pilosa, M. polymorpha, P. lanceoleta and R. raphanistrum* except for weedy check. Similarly, application of Glyphosate IPA 480gm. /lit, 48% SL and Glyphosate produced statistically no significant differences on *Ocimum spp., M. polymorpha, B. pachyloma, P. lanceoleta, C.asiatica* and *R. raphanistrum.* This result revealed that herbicides having the same mode of action had similar performance on targeted weed species. On other hand, broad spectrum herbicides have the ability of controlling of various weed species that could be more preferable for farmers.

Table3. *Effects of Herbicides on individual weed species at 45 days after herbicides application at Holeta*

Treatments	*Bidens pilosa* L.	*Ocimum spp.* L.	*Medicago polymorpha* L.	*Cynodon dactylon* L.	*Bidens pachyloma* L.	*Palntago lanceoleta* L.	*Centella asiatica* L.	*Rumex abyssinica* Jacq	*Raphanus raphanistrum* L.

Glyphosate IPA 75.7% WSG	11.33b	12.00b	16.00b	173.00ab	14.00b	10.00b	14.66b	13.00b	14.00b
Glyphosate IPA 480gm. /lit, 48% SL	3.33b	4.00c	4.00b	148.00ab	4.00c	4.00b	4.00c	4.00c	4.00b
Glyphosate	3.33b	4.00c	4.00b	119.00b	4.00c	4.00b	4.00c	4.00c	4.00b
Weedy check	30.66a	14.66a	45.87a	184.00a	20.67a	16.00a	77.33a	28.00a	18.66a
LSD (5%)	15.35	2.31	24.87	64.52	3.12	4.76	8.29	7.88	7.56
CV (%)	6.3	13	21	20	14.57	23.80	16.59	32.22	33.90

Weed density count at 45 days after herbicides application at Medegudina

Individual weed densities were significantly affected by all tested herbicides in peach (Table 4). The result showed that application of all herbicides had no statistically significant differences on *B. pilosa, M. polymorpha, P. lanceoleta and R. raphanistrum* except for weedy check. Similarly, application of Glyphosate IPA 480gm. /lit, 48% SL and Glyphosate produced statistically no significant differences on *Ocimum spp., M. polymorpha, B. pachyloma, P. lanceoleta, C.asiatica* and *R. raphanistrum.* This result revealed that herbicides having the same mode of action had similar performance on targeted weed species. On other hand, broad spectrum herbicides have the ability of controlling of various weed species that could be more preferable for farmers.

In general, results of both locations produced almost similar results of herbicidal treatment in terms of weed control. Herbicides having the same mode of action may produce similar results that could be better advantages for peach growers.

Table4. *Effects of Herbicides on individual weed species at 45 days after herbicides application at Medegudina*

Treatments	*Bidens pilosa*	*Ocimum spp.*	*Medicago polymorpha*	*Cynodon dactylon*	*Bidens pachyloma*	*Palntago lanceoleta*	*Centella asiatica*	*Rumex abyssinica*	*Raphanus raphanistrum*
Glyphosate IPA 75.7% WSG	13.33b	14.00b	18.00b	175.00ab	14.00b	10.00b	14.66b	13.00b	14.00b
Glyphosate IPA 480gm. /lit, 48% SL	5.33b	6.00c	6.00b	150.33ab	4.00c	4.00b	4.00c	4.00c	4.00b
Glyphosate	5.33b	6.00c	6.00b	121.33b	4.00c	4.00b	4.00c	4.00c	4.00b
Weedy check	32.66a	16.66a	47.33a	186.00a	20.67a	16.00a	77.33a	28.00a	18.66a
LSD (5%)	15.34	2.30	24.87	64.52	3.10	4.75	8.29	7.88	7.56
CV (%)	5.4	10.82	6.4	20.41	12.27	19.83	15.37	27.70	28.75

Weed dry weight

Weed dry weight was significantly affected by application of different nonselective herbicides (Table 5). There was no dry weed biomass was recorded from application of Weed free plots at both locations while the maximum weed dry weight (2633.33 kg/ha) at Holeta and (2433.33kg/ha) at Medegudina were recorded from weedy check plots. There is no statistically significant differences were observed due to application of all herbicides at both locations except for weedy check. Megersa *et al*. (2017) reported in barley that the lowest dry weight recorded was due to removal of most of the weed plants there which suppressed density of weeds and resulting into a lower competition between the crop and weeds for resources.

Weed control efficiency

Weed control efficiency was significantly affected by application of different herbicides (Table 5). The maximum weed control efficiency (95.88 %) at Holeta and (96.75%) at Medegudina was recorded from application of Glyphosate IPA 480gm. /lit, 48% SL while no weed control efficiency at weedy check plots at all tested locations. The maximum weed control efficiency from application of

Weed free plots due to minimum weed dry biomass. Megersa *et al*. (2017) also reported in barley that the reduction in weed dry weight might be due to the inhibition effect of treatments on growth and development of weeds.

Marketable fruit yield

Fruit yield was significantly affected by application of different herbicides (Table 5). The maximum yield (26.3tons/ha) was recorded from application of Glyphosate IPA 480gm. /lit, 48% SL at Holeta while the minimum values (1.0 ton/ha) was recorded from weedy check at Holeta. In addition, there is no statistically significant variation was observed due to application of all herbicides except for weedy check at Medegudina. The maximum fruit yield from application of Glyphosate IPA 480gm. /lit, 48% SL implied that better weed control that enable the plants to utilize more growth resources but the minimum fruit yield at weedy check probably due to severe competions of weeds. Shah *et al*.(2018) reported that the maximum grain yield was obtained where minimum weed crop competition for nutrients and water was existed.

Table5. *Effects of Herbicides application weed dry weight, weed control efficiency and yield at Holeta and Medegudina*

Herbicides	Weed dry weight (kg/ha)		Weed control efficiency (%)		Yield (ton/ha)	
Locations						
	Holeta	Medegudina	Holeta	Medegudina	Holeta	Medegudina
Glyphosate IPA 75.7% WSG	153.33b	123.33b	94.17b	95.54b	23.0b	21.3b
Glyphosate IPA 480gm. /lit, 48% SL	108.33b	90.00b	95.88a	96.75a	26.3a	25.0b
Glyphosate	200.00b	170.00b	92.40c	93.85c	23.6b	22.0b
Weedy check	2633.33a	2433.33a	0.00d	0.00d	1.0c	0.80c
LSD (5%)	135.72	135.30	0.90	1.07	2.20	2.23
CV (%)	8.77	9.61	0.64	0.75	5.32	5.85

4. Conclusion

Peach is one of the most important fruit crops in the world with wider ecological adaptation which has been cultivated in sub-tropical to temperate climates. In spite of its economic importance, its production has been affected by various abiotic and biotic factors. Among biotic factors weeds can share greatest yield reducing factors if left uncontrolled. Hence, the aim of this study was to test the efficacy non selective herbicides against peach weeds. The experimental sites were infested with various weed floras that are problematic in perennial crops as well as pastures. The maximum relative weed density was calculated from *C. dactylon* L. while minimum number was observed from *C.asiatica*. Individual weed densities were significantly affected by all tested herbicides in peach. The result also showed that application of all herbicides had no statistically significant differences on *B. pilosa, M. polymorpha, P. lanceoleta and R. raphanistrum* except for weedy check. Correspondingly, application of Glyphosate IPA 480gm. /lit, 48% SL and Glyphosate produced statistically no significant differences on *Ocimum spp., M. polymorpha, B. pachyloma, P. lanceoleta, C. asiatica* and *R. raphanistrum.* The result revealed that maximum weed control efficacy was recorded from application of Glynosh (Glyphosate IPA 480gm. /lit, 48% SL) than other tested herbicides. Application of all herbicides revealed statistically no significant differences in terms of weed dry weight while better weed control efficiency and fruit yield was obtained from application of Glyphosate IPA 480gm. /lit, 48% SL at all experimental sites. Furthermore, there is no phytotoxicity was observed due to herbicides if applied with great care in between row planted peach. Thus, Glynosh (Glyphosate IPA 480gm. /lit, 48% SL) at the rate of 1.75L/ha in 250 L of water per hectare is recommended as alternative herbicide for control of various annual and perennial weeds in peach.

Declaration of Competing Interest

I am here by declaring that this article is my own original work and it has not been presented and will not be presented to any other University for a similar or any other degree award. Brief quotations from this article are allowable without special permission provided that accurate citation of source is made.

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