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EVALUATION OF HERBICIDES FOR WEED CONTROL IN VINEYARDS OF ENSENADA, BAJA CALIFORNIA

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Abstract: On the coast of Ensenada in Baja California (B.C.), the main wine region of Mexico is located. Due to its benign climatic conditions, fruits can be produced that allow the production of wines of the highest quality, and contribute 70% of Mexican wines. In vineyards, weeds, especially perennials such as grass (*Cynodon dactylon* L.), nutsedge (*Cyperus esculentus* L.) and bindweed (*Convolvulus arvensis* L.), constitute a major problem, which increases production costs. For its control, glyphosate is mainly used, a broad-spectrum systemic herbicide, to which harmful effects on human health and the environment are attributed. The objective of this work was to evaluate synthetic and natural herbicides as possible options for weed control in the vineyards of Baja California. The herbicides were tested: Glufosinate, Paraquat, Herbitec, Secbios, Secnatural and glyphosate plus a control without application. The treatments had a significant effect on weed control on the three sampling dates carried out. The results indicated that the herbicides tested were equally effective as glyphosate, and much superior to the absolute control. The effects of the treatments diminished as time went by.

Keyword: glyphosate, alternative herbicides, grass, grapevine

INTRODUCTION

On the coast of Ensenada in Baja California (B.C.), is the main wine region of Mexico. Due to its benign climatic conditions, fruits can be produced that allow the production of wines of the highest quality, and contribute 70% of Mexican wines. Around 180 producers (SPV 2009) cultivate 4,660 hectares of vineyards from which 30,456 tons of fruits are obtained (SIAP 2021). In vineyards, weeds, especially perennials such as grass (*Cynodon dactylon* L.), nutsedge (*Cyperus esculentus* L.) and bindweed (*Convolvulus arvensis* L.), constitute a major problem, which increases production costs. For its control, glyphosate is mainly

used, a broad-spectrum systemic herbicide, to which harmful effects on human health and the environment are attributed (Bai and Ogbourne 2016; Meftaul et al., 2020). Due to the above, the National Institute of Forestry, Agricultural and Livestock Research started a project focused on finding alternatives to the use of glyphosate in vineyards. The objective of this work was to evaluate synthetic and natural herbicides as possible options for weed control in the vineyards of Baja California.

MATERIALS AND METHODS

The trial was carried out from October to December 2021, in a vineyard in production with a drip irrigation system located in the Guadalupe Valley, B.C. which was infested mainly with grass weed and to a lesser extent with nutsedge. Seven treatments were tested under a randomized block design with four repetitions, which were applied with a manual backpack between October 25 and 30 (Figure 1). The herbicides evaluated were the following: 1) Secbios (2.33 l/ 100 l); 2) SecNatural (1.75 l/100 l); 3) Herbitec (1.75 l/100 l); 4) Glufosinate ammonium (630 ml/100 l); 5) Paraquat (600 ml/100 l); 6) Glyphosate (800 ml/100 l) and 7) Absolute control without product application. In all cases, 233 ml of the non-ionic Break® Thru adjuvant were added. The effect of the treatments on the weed was determined through visual observations where the percentage of damage was counted within a 60 x 60 cm metal box (Figure 2), 12, 24 and 36 days after application of the treatments. A scale from 0 to 100% was used, where 0 corresponded to no control and 100 corresponded to total control of the weed. Analysis of variance and mean separations using the 5% Fisher test were performed on the data collected on each sampling date. In order to know the control percentages of the treatments in relation to the absolute control, the following formula was applied (Dominguez 2021):

$$\% \text{ control} = \frac{\% \text{ control in treatment} - \% \text{ control in absolute control} \times 100}{\% \text{ control in treatment}}$$

RESULTS AND DISCUSSION

The results showed statistically significant effects on weed control among the treatments tested on the three sampling dates (Table 1). On the first sampling date, the greatest control was achieved with the herbicides herbitec, glufosinate and paraquat with percentages that varied between 77 and 87. On the second date, the greatest controls were achieved with glufosinate with 93%. In the last sampling, all treatments had a high percentage of weed control (74 to 85%) with respect to the absolute control. From the results obtained, it is clear that, on the three sampling dates, the herbicides tested were equally effective as glyphosate, and much superior to the absolute control. In Figure 3 you can see the effects of some treatments on grass control.



Figure 1. Herbicide application



Figure 2. Weed sampling

Treatment	Control percentage		
	10/11/2021	22/11/2021	04/12/2021
Secbios	44.38 b*	80.00 ab	85.63 a
Secnatural	41.25 b	64.38 b	66.88 a
Herbitec	86.88 a	81.25 ab	85.63 a
Glufosinate	83.13 a	93.25 a	83.13 a
Paraquat	77.50 a	83.75 ab	76.88 a
Glyphosate	60.00 ab	76.88 ab	73.75 a
Absolute control	10.13 c	28.75 c	40.00 b

Table 1. Effect of treatments on weed control in a vineyard in Valle de Guadalupe, B.C.

* Means with the same letter are not significantly different at $p < 0.05$, Fisher test

Figure 4 shows the control percentages obtained through the sampling dates, taking the absolute control treatment as a reference. It can be seen that weed control percentages were higher on the first sampling date in all treatments. These percentages decreased in the second sampling and were lower in the third. That is, the effects of the treatments tended to decrease as time passed. Since the main weed present in the vineyard was grass, which is a perennial plant, it began to recover



Figure 3. Absolute control on the left side, Secnatural treatment in the center and glufosinate on the right

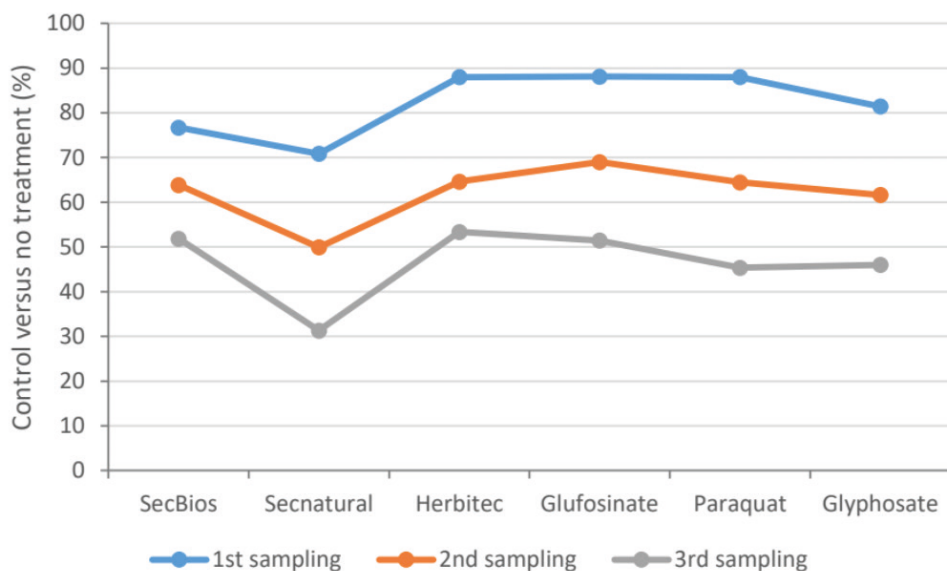


Figure 4. Percentages of weed control of the treatments in contrast to the absolute control

from the damage caused by the herbicides and began to emit new shoots, which reduced the proportion of the damaged area with respect to the healthy one or green. This modified the percentages of the affected area over time. Other authors (Ormenño-Núñez et al., 2007; Siddappa et al., 2015) have reported the decrease in the effectiveness of herbicides in grass control over time. The results of the present study suggest that, to achieve a more precise evaluation of the effect of the treatments on this weed, it would be advisable to continue sampling for a longer period.

CONCLUSIONS

1. The treatments had a significant effect on weed control on the three sampling dates carried out.
2. The results indicated that the herbicides tested were equally effective as glyphosate, and much superior to the absolute control.
3. The effects of the treatments decreased as time passed, being greater in the first sampling and lower in the third, the latter carried out 46 days after the herbicides were applied.

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