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The effect of glyphosate and herbicide combinations on pistachio garden weeds in Kerman

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SUMMARY – In order to study the effect of glyphosate and herbicide combinations on pistachio garden weeds, an experiment was conducted in 1995 at the Pistachio Experimental Station in Kerman. The type of design was randomized complete blocks with 8 treatments and 4 replications per treatment. All treatments received 300 ml/ha of citowett spreader. Glyphosate combinations were applied once (mid July) and twice (mid July and mid September) in half of each plot respectively. The results indicated that in all treatments two herbicide applications were more effective than a single application. Weeds such as bermuda grass, Russian knapweed, field bindweed, Russian thistle and camel thorn were among the most troublesome and highly resistant to herbicides. The annual broad leaved plants and grasses were mostly susceptible to herbicide combinations. Among different treatments: (i) glyphosate (3 kg/ha), and 2,4-D (1.5 kg/ha); (ii) glyphosate (3 kg/ha), and DCPA (0.9 kg/ha); and (iii) glyphosate (3 kg/ha), and Ammonium sulphate (6 kg/ha) respectively, had better control on weeds than other treatments.

Key words: Pistachio, herbicides, resistance, glyphosate.

RESUME – *"L'effet de combinaisons de glyphosate et d'herbicide sur les mauvaises herbes des plantations de pistachiers à Kerman". Afin d'étudier l'effet de combinaisons de glyphosate et d'herbicide sur les mauvaises herbes des plantations de pistachiers, une expérience a été menée en 1995 à la Station Expérimentale sur le Pistachier de Kerman. Les dispositifs étaient des blocs complets aléatoires avec 8 traitements et 4 répétitions par traitement. Tous les traitements recevaient 300 ml/ha de nébulisation avec citowett. Des combinaisons de glyphosate ont été appliquées une fois (mi-juillet) et deux fois (mi-juillet et mi-septembre) sur une moitié de chaque parcelle respectivement. Les résultats ont indiqué que pour tous les traitements une application d'herbicide en deux fois était plus efficace qu'une seule application. Des mauvaises herbes telles que cynodon dactyle, jacée des prés, liseron des champs, soude et* Acacia erioloba*, ont été parmi les plus problématiques et fortement résistantes aux herbicides. Les plantes annuelles à feuilles larges et les graminées ont été les plus sensibles aux combinaisons d'herbicides. Parmi les différents traitements : (i) glyphosate (3 kg/ha), et 2,4-D (1,5 kg/ha); (ii) glyphosate (3 kg/ha), et DCPA (0,9 kg/ha); et (iii) glyphosate (3 kg/ha), et sulphate d'ammonium, respectivement, étaient ceux qui contrôlaient le mieux les mauvaises herbes par rapport aux autres traitements.*

Mots-clés : *Pistachier, herbicides, résistance, glyphosate.*

Introduction

Weeds are the most serious problems in Kerman pistachio orchards, specially during the first years of their growth. Invasion of annuals and mainly perennial weeds such as camel thorn (*Alhagi camelorum*), bermuda grass (*Cynodon dactylon*), field bindweed (*Convolvulus arvensis*) resulted a tremendous damage to pistachio orchards. Keeping the garden free of weeds especially during the first 4 years of pistachio growth resulted in the optimal growth of trees.

Glyphosate which is a broad spectrum and almost non-selective herbicide may control perennial weeds effectively. Since perennial weeds are among the most troublesome weeds in pistachio orchards, an experiment was conducted to study the effect of glyphosate in combination with herbicide and citowett spreader on pistachio garden weeds. Attempts has been done to see the susceptibility and tolerance of pistachio garden weeds to different treatments.

Material and methods

The experiment was conducted in Kerman Pistachio Garden Experimental Station. The type of design was randomized complete blocks with 8 treatments and 4 replications per treatments. The size of the plots were 4 m x 10 m and pistachio trees were 4 m and 2 m apart between and within

rows respectively. The plots were divided in 2 halves. Half of each plot were treated once (mid July), or twice (mid July and mid September) by using a Swiss made Knapsack sprayer.

Evaluation were done following fall and spring by visual rating. Different treatments and the rate of chemical used in each treatments are shown in Table 1.

Table 1. Treatment definitions

Treatment no.	Treatment definitions†
1	PMG + C + 2,4-D (1.5 kg/ha)
2	PMG + C + paraquat (1.5 kg/ha)
3	PMG + C + atrazine (0.9 kg/ha)
4	PMG + C + dichlophop methyl (0.9 kg/ha)
5	PMG + C + metribuzine (0.9 kg/ha)
6	PMG + C + ethalfluralin (0.9 kg/ha)
7	PMG + C + $(NH_4)_2SO_4$ (6 kg/ha)
8	PMG + C + DCPA (0.9 kg/ha)

†PMG = Glyphosate (3 kg/ha). C = Citowett (300 ml/ha).

Results and discussions

The results of different treatments and their efficacy on weed control are shown on Table 2. Although all treatments did work well on weed control in fall evaluation (Fig. 1), but treatments: 1 [glyphosate (3 kg/ha), 2,4-D (1.5 kg/ha), and citowett (300 ml/ha)], 7 [glyphosate (3 kg/ha), ammonium sulphate (6 kg/ha), and citowett (300 ml/ha)], and 2 [glyphosate (3 kg/ha), paraquat (1.5 kg/ha), and citowett (300 ml/ha)] worked better than other treatments. In Table 2 the weeds showed to be totally controlled based on fall evaluation is also listed. Spring evaluation during the following season is also shown in Table 2. It is note worth that the regrown plants are arranged in ranked order and the first weed in each treatment has the higher frequency. Although most of the reappeared perennials did not have enough frequency and size to do serious harm and compete with pistachio trees.

Table 2. The effect of different treatments on different weed species† control

Treatments		
1 – PMG + C + 2,4-D	Pl.la., Av.fa., Xa.st.	Al.ca., Ac.re., Cy.da.
2 – PMG + C + Paraquat	Sa.ka., Pl.la.	Al.ca., Co.ar., Cy.da., Ac.re.
3 – PMG + C + Atrazine	La.sc., Pl.la.	Al.ca., Co.ar., Cy.da., Ac.re., Lo.ri.
4 – PMG + C + Dichlophop methyl	–	Al.ca., Cy.da., Co.ar., Pl.la., Sa.ka., So.ol.
5 – PMG + C + Metribuzine	La.sc., Sa.ka., Ca.dr.	Al.ca., Pl.la., Cy.da., Co.ar., Sa.ka., So.ol.
6 – PMG + C + Ethalfluralin	Cy.da., Av.fa., La.sc.	Al.ca., Co.ar., Sa.ka., Ac.re.
7 – PMG + C + $(NH_4)_2SO_4$	Sa.ka., Ch.al., La.sc., Ac.re.	Al.ca., Co.ar., Cy.da.
8 – PMG + C + DCPA	–	Al.ca., Co.ar., Cy.da.

†Ac.re. = *Acroptilon repense*; Al.ca. = *Alhagi camelerum*; Av.fa. = *Avena fatua*; Ca.dr. = *Cardaria draha*;
Ch.al. = *Chenopodium album*; Ca.ar. = *Con volvulus arvensis*; Cy.da. = *Cynodon dactylon*; Sa.ka. = *Salsa kali*.

Regrowth of weeds resulted some variation between fall evaluation and spring evaluation.

Among all weeds, with no exception camel thorn was ranked #1. It was the most tolerant and the most trouble maker in pistachio orchards. The regrown weeds in spring of the following season are shown in the same table.

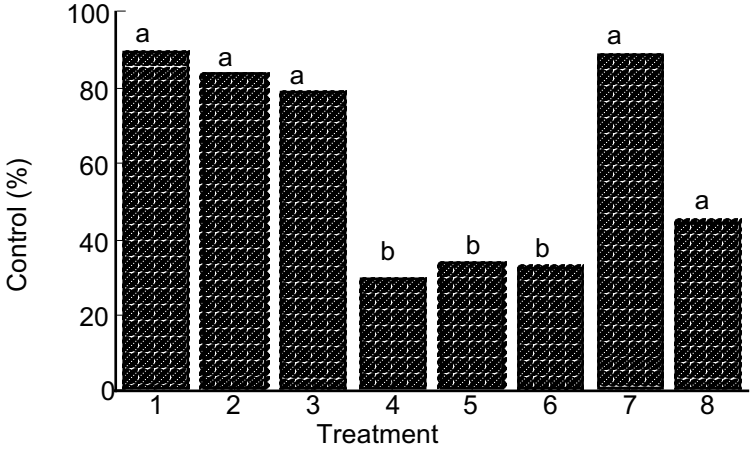

Fig. 1. The effect of 1 time application of herbicide combination on the control of pistachio garden weeds (fall evaluation).

Figure 2 also shows the effect of a single application evaluated during spring of the following year. Figure 3 also shows the effect of 2 times application of herbicides on twice worked better than using a single application but the order of effectiveness were almost the same and treatments 1 [glyphosate (3 kg/ha), 2,4-D (1.5 kg/ha), citowett (300 ml/ha)]; 8 [glyphosate (3 kg/ha), DCPA (0.9 kg/ha), citowett (300 ml/ha)]; 7 [glyphosate (3 kg/ha), ammonium sulphate (6 kg/ha), citowett (300 ml/ha)]; and 5 [glyphosate (3 kg/ha), metribuzine (0.9 kg/ha), citowett (300 ml/ha)], were among the best treatments respectively. However, regrowth of annuals and specially perennial weeds in the above treatments compare to fall evaluation indicates that the latter treatments are more reliable.

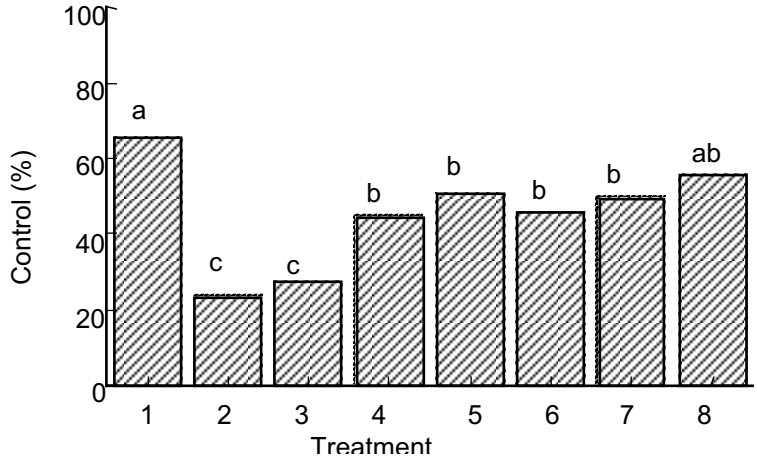

Fig. 2. The effect of 1 time application of herbicides combinations on the control of pistachio garden weeds (spring evaluation).

The over all results of the experiment shows that perennial weeds are the most troublesome in pistachio gardens. Camel thorn is the most difficult weed to control. Other weeds such as field bindweed, diffuse knapweed (*Acroptilon repense*), Russian thistle (*Salsa kali*) and bermuda grass (*Cynodon dactylon*) are hard to control. Annual weeds are not hard to control with the above treatments. Glyphosate plus citowett and 2,4-D performed best among other treatments. However,

one must watch for herbicide injury to pistachio trees.

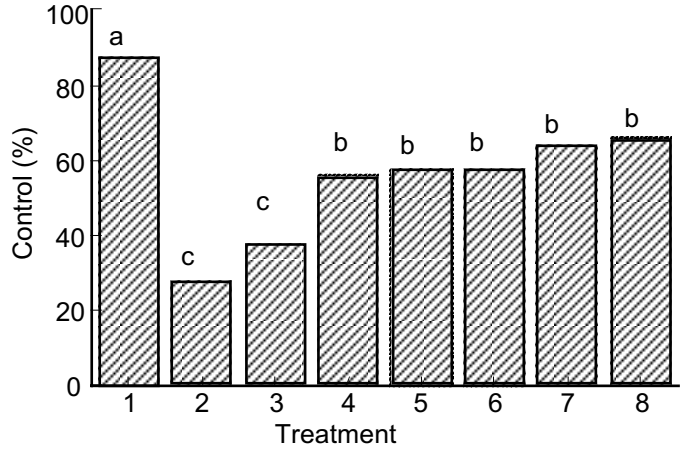

Fig. 3. The effect of 2 times application of herbicides combinations on the control of pistachio garden weeds (spring evaluation).

Further reading

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