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Investigation of the Effect of Burning Plant Debris on Germination and Weed Growth

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ABSTRACT

In this study, the effect of burning plant debris on germination and growth of 7 different weed species was investigated. In general, burning plant residues reduced germination and growth rate of 7 studied weed species, but its effect on some was less than other studied species. The chemical effect of smoke depends on the type of weed, so that the chemical effect of smoke reduced the germination of *portulaca oleracea* and sorrel and increased the germination of wild oats compared to the control, but had no effect on the germination of barley, wild roe deer and leeks. In general, no significant difference was observed between soot and control treatments for germination percentage and germination rate, but fire and fire + soot treatments were significantly different from the control. Therefore, the reason for the reduced germination and germination rate of weeds after burning plant debris is the physical cause (heat) of the fire, not the chemical.

Key words: Germination, *Portulaca oleracea,* Burning plant, Weed Growth

INTRODUCTION

The effect of fire on germination is achieved through two types of heat shock and chemical changes resulting from combustion. Germination stimulation by heat shock has been observed in the families Fabaceae, Rhamnaceae, Convolvulaceae, Malvaceae, Cistaceae and Sterculiaceae (Kelly and Futteringham, 1998). Recent studies on the effect of fire on germination show dormancy of hard seeds with cuticle And the dense layers of hedge (the dormancy of these seeds is to prevent water from penetrating into the seed) is broken by fire.

Temperatures between 80 and 120 ° C are sufficient to remove the hard surface layers of the seed, which in turn eliminates the possibility of water absorption by the seed. Heat treatment alone seems to be sufficient to eliminate seed dormancy in many species, while in some other species heat treatment must be combined with other treatments such as cold or light (Kelly and Fottingham, 1998). In a study, Paul et al. Examined the effects of fire (heat, smoke, and nitrate) on several species of Northeastern Australian legumes. In this study, legumes were exposed to temperatures between 80 and 120 ° C, and Chamaecrista sleep mimosoides, Crotalaria calycina, Crotalaria montana, Indigofera hirsute and Tephrosia juncea, were broken, but in this study, the 4 species with the heaviest seeds did not show a significant difference from the normal state (no use of heat shock). When the seeds were exposed to 120 ° C for 5 minutes, all species experienced seed death (Paul *et al*., 2003). There are numerous plant species that invade lands rapidly after a fire. These species have evolved to occupy uncovered lands without competition from other species, so fire provides a suitable environment for these plants. Provide. Many of these species have a hard seed coat that prevents water from penetrating the seed, breaks the heat of the seed coat fire, and thus allows moisture to enter the seed. The chemical effects of smoke on germination were identified in the late 1970s. Hundreds of species whose germination was affected by smoke were then identified around the world (Malakov, 1997). A well-known trait of most annual weeds is seed dormancy, our knowledge of the factors that cause seed dormancy to break Nitrogen dioxide, a common component of smoke, causes some plants to germinate (Kelly and Fottingham, 1997).

MATERIALS AND METHODS

This experiment was performed in two laboratory and greenhouse sections in 2008. In the laboratory study, the effect of high temperatures on germination and in the greenhouse experiment, the effect of burning crop residues on the emergence and growth of weed seedlings were investigated. Laboratory study: In this study, the effect of fire (1- control 2- weed seeds were burned in straw for 5 minutes 3- weed seeds were burned in straw for 5 minutes 4- grass seeds Weeds were placed in an oven at 70 ° C for 5 minutes. 5- Weed seeds were placed in an oven at 100 ° C for 5 minutes. 6- Weed seeds were placed in an oven at 130 ° C for 5 minutes. 7- 10 grams of ash from burning waste was added to each pot) on weed germination (roe deer, *portulaca oleracea*, leek, barberry, wild oats and sorrel) was studied. To apply heat shocks, the treatments were placed in ovens with the above temperatures and were taken out of the oven at designated times for each treatment. Metal nets were used to apply smoke and fire treatments. Immediately after applying the desired treatments, 25 seeds of each species were placed in petri dishes (9 cm) containing a layer of filter paper. 7 ml of distilled water was added to each petri dish and after culturing the petri dishes were placed in a plastic bag (to prevent moisture loss). The petri dishes were transferred to the germinator at an alternating temperature of 25.15 ° C (night / day). The counting of germinated seeds continued daily for 10 days. The criterion for root germination was considered to be 2 mm in length. 1-1. Statistical analyzes: This factorial experiment was performed in a completely randomized design with 7 replications. Greenhouse study: In this experiment, the effect of

burning wheat residues (straw and straw) on the emergence and seedling growth pattern of 6 weed species (rooster, *portulaca oleracea*, leek, barberry, wild oats and sorrel) was investigated. First, 20 cm diameter earthenware pots were filled with a mixture of clay, sand and rotten manure (1: 1: 1.5 ratio), of course, about 3 cm from the edge of each pot to add wheat straw. It was left empty to treat direct fire on some of the pots. 30 seeds of a specific weed were placed on the soil surface of each pot. Then, for fire treatment, 20 grams of wheat straw was added to each pot, which is equal to 6 tons of residues per hectare. This amount of residue usually remains after harvesting wheat in lands such as Fasa.

All studied weeds were exposed to the following treatments: 1- Witness 2- Weed seeds were placed in burning straw for 5 minutes 3- Weed seeds were burned in straw for 5 minutes 4- Weed seeds were placed in an oven at 70 degrees for 5 minutes 5 ° C 5- Weed seeds were placed in the oven at 100 ° C for 5 minutes 6- Weed seeds were placed in the oven at 130 ° C for 5 minutes 7- 10 g of ash from each pot Burning debris added. Immediately after cultivation, irrigation was started and other irrigations were done as needed. The pots were kept in a greenhouse with a temperature ranging from 22 to 26 ° C under natural light conditions. The number of sprouted seedlings (shoot emergence 1 cm long) and the height of the first three sprouted seedlings (per pot) were recorded at intervals of 2-3 days. Wet weight and dry weight (24 hours in the oven at 72 ° C) of seedlings in each pot were determined at the end of the period and corrected according to the number of green seedlings for that pot. 2-1- Statistical analyzes: This experiment was performed in a completely randomized design with 6 replications.

RESULTS AND DISCUSSION

One of the most important issues in our country is the burning of plant debris, which in addition to the negative impact on the environment, also affects the germination and growth of weeds. It is very important to burn crop residues in areas where two crops are planted per year on each plot of land (such as Fasa). By examining the effect of burning plant debris on germination and weed growth, weed management can be better managed. Greenhouse test results Weed germination percentage: First, the data normality test was performed using minitab software, after the root conversion, the data were normalized and all analyzes were performed using the converted data. The effect of experimental treatments on the percentage of emergence of all studied weeds was significant (Table 1). The comparison results of the mean of the treatments are shown in Figure 1. As can be seen, for most species, the highest percentage of greening is related to the control treatments, smoke and ash, and the two treatments of fire and temperature have the lowest percentage of greening (Figure 1).

For example, in *portulaca oleracea*, the percentage of germination in control, ash and smoke treatments was about 85%, but when their seeds were exposed to fire from burning wheat residues, the percentage of germination was sharply reduced. Smoke and ash treatments increased germination and germination of turmeric and oat seeds. On the other hand, in wild

weed, sorrel and leek weeds, even adding smoke to the soil surface had a severe inhibitory effect on seedling emergence (Figure 1). Overall, the results of this section show that the burning of wheat residues It drastically reduces the germination percentage of the above weed seedlings, but the response of the species to the presence of smoke can be negative (such as sorrel, wild roe deer and leek) or even positive (such as wild oats and deciduous trees). Brown *et al*. (1998) stated that there is a significant interaction between smoke and other environmental factors, in some cases smoke affects germination more than heat. Factors such as seed age, amount of light and temperature can affect the effect of light on germination. Smoke-treated seeds retained their superior germination power even after 1 year of storage. If we divide the effect of burning plant debris into two parts, physical and chemical. In this case, the effect of heat is related to the physical part and the effect of smoke and ash is related to the chemical part of burning waste. The effect of heat on the studied species is almost the same process and has reduced the germination of weed seeds. But there is a strong interaction between the chemical effect of smoke and the type of weed. Weed seeds that are on the surface of the field soil are usually affected by the heat caused by the burning of the residues and their germination is reduced, but the seeds that are below the soil (close to the soil surface) are affected by the chemical effects of smoke.

The effect of smoke and its effect on germination depends on the type of weed. Menorsky (2002) stated that slow burning of dry or green plant debris produces water-soluble compounds that affect the seed germination of many plants. In general, considering the average percentage of weed emergence in all conditions, *portulaca oleracea* had the highest germination percentage and the lowest germination reduction due to fire. Sorghum also had the lowest percentage of germination and emergence and was more affected by fire than other species, thus having the highest rate of reduced germination. In some cases, smoke treatment increases germination compared to the control (such as deciduous trees) and in some cases reduces germination compared to the control (such as sorrel, wild roe deer and leeks). Because the positive and negative effects of smoke neutralize each other, in general, smoke and control treatments are not significantly different. Therefore, the chemical effect of smoke during a fire does not have much effect on weed germination. However, due to the significant interaction between weed type and fire treatment, it is recommended to consider the predominant weed of the field and conduct a case study. Also, in general, high heat treatments (physical effect of burning plant residues) and fire (physical effect + chemical effect) were not significantly different. Hence, the main reason for reduced weed germination due to fire is physical (high heat) effect, not chemical. The effect of smoke on some weed species stimulates and increases germination.

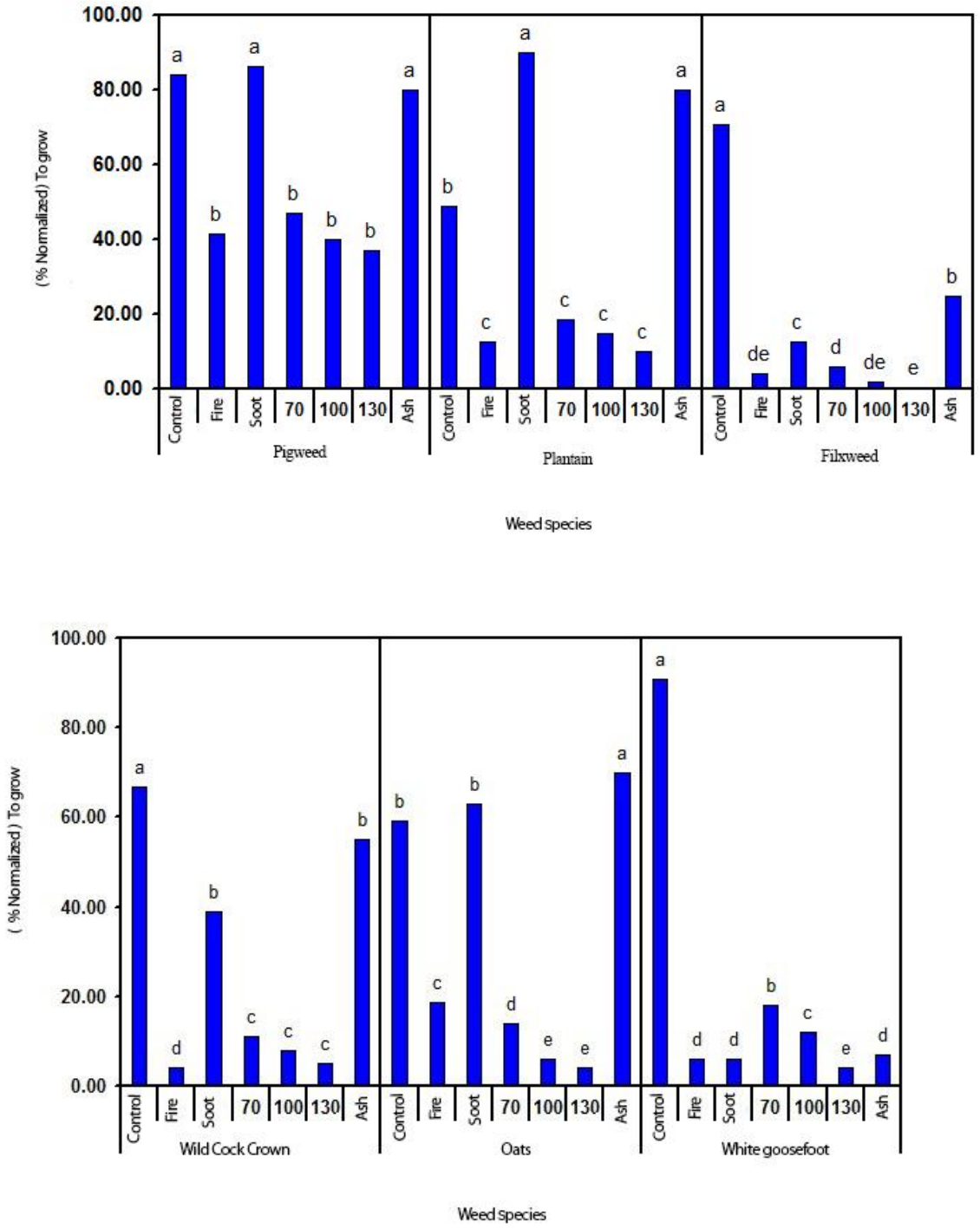

Figure 1- Effect of different treatments on burning wheat residues on seedling germination percentage of 6 weed species. For each weed, different letters indicate a significant difference according to the LSD test at the level of 5%.

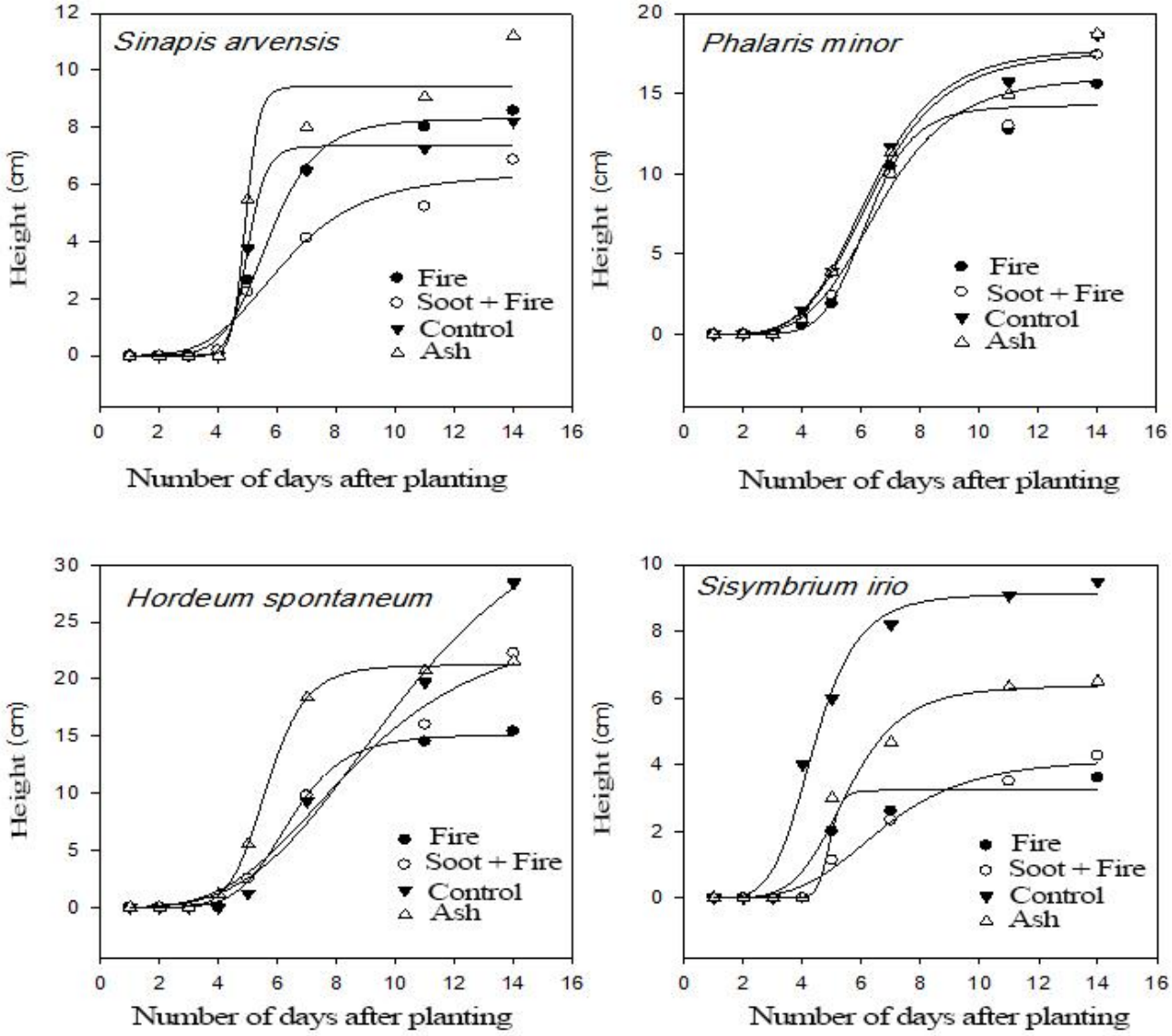

Figure 2 - Seedling height changes of four types of winter weeds over time after application of various treatments to burn wheat residues. The points of the observed values and the lines of the predicted values resulting from the fit of the logistic model show three parameters.

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