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Regulation of Germination in Some Range Plants

By

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With 4 Figures

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Introduction

In a previous investigation by the same authors, the germination of 10 of the important range plants were studied under different conditions of temperature, rainfall, salinity and depth of sowing. Germination in some range plants was improved by alternating temperatures. In the case of *Ononis vaginalis* the percentage germination was still low even in treatments of alternating temperatures.

In the present investigation acid treatment was applied for improvement of germination in *Ononis* as well as other leguminous range plants namely *Crotalaria aegyptiaca* and *Trifolium purpureum*, with low percentage germination. The study is of prime importance from the economic point of view since improvement of germination results in production of dense stands and rich crops.

Improvement of germination by alternating temperatures

In a previous investigation by the same authors (Abd El Rahman & Monayeri 1966) the effectiveness of alternating temperatures was manifested in some of the studied range plants (Fig. 1). In *Panicum antidotale* the percentage germination attained a maximum of 100% at the alternating temperatures 15/25° C (Fig. 1). The optimum germination in *Panicum turgidum* was obtained at a temperature alternation of 25°/30° C at which the percentage germination reached 75% (Fig. 1). Germination in *Panicum maximum* attained the highest percentage (58%) at a temperature alternation of 15°/25° C (Fig. 1). In the case of *Ononis vaginalis* the treatments of alternating temperatures were not considerably effective. The highest percentage germination obtained at a temperature alternation of 10°/20° C did not exceed 30%. For this reason, other treatments must be applied to improve germination.

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Improvement of germination by acid treatment

Materials and methods

Seeds were soaked in concentrated and 65% H_2SO_4 separately for different periods, then washed and germinated in Petri dishes containing moist filter paper. Each treatment includes four replicates of 25 seeds each. The Petri dishes were kept in a dark incubator at a constant temperature of 25° C.

Results and discussion

In the present investigation seeds of the three leguminous plants namely *Ononis vaginalis, Crotalaria aegyptiaca* and *Trifolium purpureum* were treated with concentrated and 65% H_2SO_4 separately.

Ononis vaginalis:

a) Treatment with conc. H_2SO_4: The percentage of germination increases with increase in duration of treatment till it reaches a maximum of 100% at the duration of 25 minutes, above which it shows a progressive decline with increase in duration of treatment. At the treatment durations of 45 minutes and more the seeds fail to germinate.

b) Treatment with 65% H_2SO_4: The percentage of germination also increases with increase in duration of the treatment and the maximum of 100% was reached at a duration of 75 minutes which is much longer than in the case of conc. H_2SO_4. With the increase in duration above 75 minutes the percentage germination diminishes and the seeds fail to germinate for a duration of 150 minutes or more.

It is evident from Fig. 2 that germination in untreated seeds is slow and started on the 4*th* day, whereas in the treated seeds with conc or 65% H_2SO_4 it started on the second day. Acid treatment proved successful since the percentage germination was raised from 20% in the untreated seeds to 100% in the properly treated seeds with conc. or dil. H_2SO_4. The optimum duration of treatment in dil H_2SO_4 is much longer than in the case of conc. H_2SO_4.

Crotalaria aegyptiaca:

a) Treatment with conc. H_2SO_4: The percentage germination rises with the prolongation of the treatment duration. At the duration of treatment of 30 to 50 minutes, all the seeds germinate (Fig. 3). The percentage germination diminishes progressively with the increase in duration of treatment above 50 minutes, and the seeds fail to germinate when they are treated with conc. H_2SO_4 for a period of 90 minutes and more (Fig. 3).

b) Treatment with 65% H_2SO_4: The duration of treatment required for germination of all the seeds was 60 minutes (Fig. 3). Treatments

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which extend for a period of 210 minutes or longer result in failure of germination.

It is evident from Fig. 3 that in the untreated seeds germination started on the third day, whereas in the treated seeds particularly at the duration of 40 minutes 92% of the seeds germinated on the second day. Acid treatment proves successful since the percentage germination

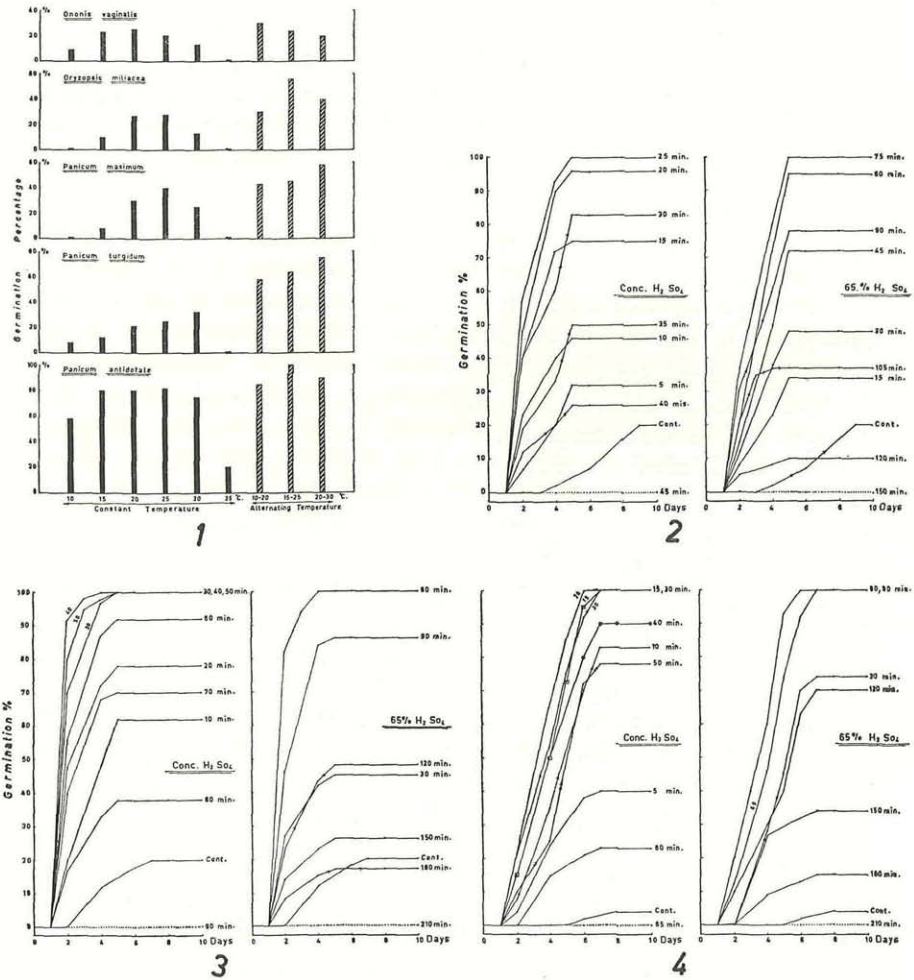


Fig. 1: The effect of different treatments of constant and alternating temperatures on percentage germination of some range plants.

Figs. 2—4: Germination of *Ononis vaginalis* (Fig. 2), *Crotalaria aegyptiaca* (Fig. 3) and *Trifolium purpureum* (Fig. 4) at different treatments of conc. and 65% sulphuric acid.

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rises from 20% in the untreated seeds to 100% in the treated seeds with conc. or 65% H_2SO_4.

Trifolium purpureum:

a) Treatment with conc. H_2SO_4: The highest percentage germination of 100% is reached within the duration of treatment between 15 and 30 minutes (Fig. 4). Shorter and longer duration of acid treatments are associated with fall in the percentage of germination. Seeds soaked in conc. H_2SO_4 for a period of 65 minutes or more are destroyed.

b) Treatment with 65% H_2SO_4: For obtaining complete germination of all the seeds duration of treatment with dil. (65%) H_2SO_4 is longer than in the case of conc. H_2SO_4 and ranges between 60 and 90 minutes (Fig. 4). Soaking the seeds for long periods of 210 minutes and more are detrimental.

It is evident from Fig. 4 that the rate of germination in *Trifolium* is greatly affected by acid treatment. In the untreated seeds germination began on the 6th day, whereas in the acid treated seeds germination started on the second day. Also the percentage germination is greatly influenced by acid treatment. It increases from 4% in the untreated seeds to 100% at certain durations of acid treatment.

A review of the literature concerning the improvement of germination by sulphuric acid treatment (STODDART & WILKINSON 1938, TOOLE 1940, PORTER 1949, LAUDE 1951, CROCKER & BARTON 1953, TAUBMAN 1953, KOLLER 1955, TOOLE & al. 1956, EVENARI & KOLLER 1956, KOLLER & NEGBI 1959 and EL GHONEMY 1960) shows that the improvement may be due either to increase in permeability to water of structures enclosing the embryo or to removal of chemical inhibitors which retard germination.

The duration of acid treatments used by other investigators varies widely. STIER 1937 increased the rate of germination of recently harvested potato seeds through soaking for 30—60 seconds in conc. H_2SO_2. TOOLE 1940 soaked seeds of *Oryzopsis hymenoides* for 46—60 minutes. GARMAN & BARTON 1946 mentioned that for improving germination capacity of *Panicum anceps*, the seeds ought to be soaked in conc. H_2SO_4 for 30 minutes. KOLLER & NEGBI 1959 reported that the optimal duration of treatment of *Oryzopsis miliacea* seeds with 70% H_2SO_4 varied between 20 and 40 minutes.

In the present investigation the duration of treatment that gives optimum germination varies in the different species and in the different concentrations of H_2SO_4.

The above findings of the present investigations have a great value from the economic point of view, and could be applied to reseeding practices in desert regions. Reseeding carried out with untreated seeds

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results in poor crop, but with properly treated seeds will result in a rich stand and rich crop due to successful germination of seeds.

Summary

In a previous investigation by the same authors germination of some of the important range plants was improved by alternating temperatures. Germination in *Ononis vaginalis* was not much improved by alternating temperatures. For this reason acid treatment was applied to improve germination in *Ononis vaginalis* and other leguminous range plants namely *Crotalaria aegyptiaca* and *Trifolium purpureum.*

Treatment of seeds with conc. and 65% H_2SO_4 acid accelerates germination and raises the percentage germination in all the studied plants. In *Ononis* the percentage germination rises from 20% in the untreated seeds to 100% in the seeds soaked for 25 minutes in conc. H_2SO_4 and 75 minutes in dil. H_2SO_4. In *Crotalaria* the percentage germination increases from 20% in the untreated seeds to 100% in the seeds soaked for 30—50 minutes in conc. H_2SO_4 and 60 minutes in dil. H_2SO_4. Germination of *Trifolium* seeds is greatly affected by acid treatment. The percentage germination of the untreated seeds is very low (4%), whereas in the acid treated seeds it reached 100% at a duration of treatment of 15—30 minutes in the case of conc. H_2SO_4 and 60 and 90 minutes in the case of dilute H_2SO_4.

The findings of the present investigation have a great value from the economic point of view and could be applied to reseeding practices and pasture development in desert regions. Reseeding carried out with properly acid treated seeds will result in rich stand and rich crop due to successful germination of seeds.

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