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Effects Of Different Sowing Depths And Growing Media On Germination Of Bladder-Senna (*Coluteaarmena* Boiss & Huet) Seeds.

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ABSTRACT

This study was carried out to determine which sowing depth and growing medium should be preferred to increase germination percentage of *Coluteaarmena* seeds. Treatments applied to the seeds were 3 different sowing depths (0.5 cm, 1 cm and 1.5 cm) and 4 different growing media (forest soil+sand+manure (2:1:1);peat+manure (2:1);peat+perlite+manure (2:1:1) and peat+forestsoil+manure (1:1:1)). The seeds were submersed in concentrated (98%) sulphuric acid for 30 minutes to overcome seed dormancy. The seeds were sown in pot-trays at 24±1°C in the greenhouse. The statistical approach was a randomized complete block design with three replications and 60 seeds were used for each replication. Germinated seeds were observed periodically during 42 days to determine germination percentages and germination rates. Both the highest germination percentage (31.1%) and germination rate (9 days) were obtained in seeds which were sown in the medium of forest soil+sand+manure (2:1:1), in 0.5 cm-sowing depth. On the other hand, the lowest germination percentage (2.8%) was determined from the seeds which were sown in 1 cm-depth in the growing medium of peat+manure (2:1).

Keywords: *Coluteaarmena*, germination, sowing depth, growing media

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INTRODUCTION

Vegetation cover is one of the most important factors in preventing and controlling soil erosion. It gives long-term soil surface protection by providing leaf cover that reduces rain-drop effects. In addition, it helps better soil structure development through establishing a root system, thereby increasing infiltration and soil stability [1]. The genus *Colutea* L. (bladder-senna) includes about 26 species of deciduous shrubs and small trees with a distribution ranging from the Mediterranean region and South-Eastern Europe and North-West Africa [2]. *Colutea armena* (Boiss. & Huet.) is a drought-tolerant plant occurring in rocky and steep landscapes and is known as an important species in preventing soil erosion [3, 4]. *Colutea* species are cultivated in temperate climates primarily for ornamental purposes [4-6]. *C. arborescens*' potential as a forage crop was investigated in Spain [7].

Seeds of many woody plant species cannot germinate even if they are sown under optimal moisture, oxygen and soil conditions [8]. This problem is called dormancy and its causes are a hard and impermeable seed coat, immature or dormant embryo, absence of endosperm, or thick, fleshy seed cover [9]. Poulsen [10] reported that dormancy among and within seed lots of the same species varies with provenance, crop year, and individual trees. In addition to this, seedling growing medium and sowing depth of seeds have very important effect on germination percentage and germination rate of seeds [11-14].

There are various germination obstacles in *Colutea* seeds resulting in propagation difficulties [3, 15, 16]. A few studies have tried to determine different methods and techniques to overcome seed dormancy in *Colutea* species. The methods and techniques, especially cold stratification and submersion in concentrated H_2SO_4 are well-known and used to increase germination percentage of *Colutea* seeds [16-20].

The properties of growing media are becoming more and more important for optimal plant growth. A grower requires well prepared growing media which have constant properties the year round [21]. Horticultural substrates differ from soils because they are removed from their original places or which are produced artificially. Growing media include as well the long-time known horticultural soils which consist out mainly natural organic matter (pine and leaf moulds, all kinds of composts), as the peaty substrates which became more important as artificial substrates (foam plastics, vermiculite, rockwool etc.) [22]. A good growth medium for germination is provided by choosing an appropriate substrate and by appropriate soil preparation and management. For most species sand may be used to improve drainage and aeration. Peat or other material with high organic content improves the water retention capacity. Forest soil is often used as potting media, since it is rich in both organic material and nutrients as well as containing mycorrhiza and other beneficial soil symbionts [23].

The aim of this study was to examine the influence of four different growing media (forest soil+sand+manure (2:1:1); peat+manure (2:1); peat+perlite+manure (2:1:1) and peat+forestsoil+manure (1:1:1)) and three different sowing depths on germination of *C. armena* seeds.

MATERIAL AND METHODS

Ripe fruits were collected in August 2012 from *Colutea armena* individuals (Exposure: South-west, Altitude: 440 m, Latitude: 41° 11' 40" N, Longitude: 41° 50' 65" E) in Artvin located in the North-Eastern part of Turkey. The seeds were separated from the fruit material, rinsed with tap water, dried in the shade, and stored at $4\pm 1^\circ C$ in plastic bags after the ratios of filled seeds to all the collected seeds were determined.

The following pre-treatments were applied to determine their effects on germination percentage and germination rate of *C. armena* seeds;

- Growing media (forest soil+sand+manure (2:1:1); peat+manure (2:1); peat+perlite+manure (2:1:1) and peat+forestsoil+manure (1:1:1)),
- Sowing depths (0.5 cm, 1.0 cm and 1.5 cm).

The seeds were submersed in concentrated (98%) sulphuric acid for 30 minutes (Olmez et al., 2007a) before they were sown in pot-trays.

Seeds were sown into the pot-trays filled with four different growing media, at $24\pm 1^{\circ}\text{C}$ and 65% humidity in the controlled greenhouse conditions. The experimental design was a randomized complete block with three replications (60 seeds in each replication) for each treatment. Numbers of germinated seeds (evaluation done according to ISTA Rules (1993)) were recorded for 4th, 7th, 10th, 14th and 21st days after the sowing, and recording continued weekly after the 21st day for 42 days.

The GP and GR values were determined for each pre-treatment. The formula used in determining GR values is as follows [24];

$$GR = \frac{(n1 \times t1) + (n2 \times t2) + (n3 \times t3) + \dots + (ni \times ti)}{T}$$

Where;

GR: Germination rate

n: Number of days for each counting of germinated seeds

t: Number of germinated seeds at each counting day

T: Total number of germinated seeds

The whole experiment lasted for 42 days when it was observed that the seeds had stopped germinating. Data from the treatments were analyzed using the SPSS statistical software after arc-sinus transformation was applied to GP values to meet ANOVA assumptions. The multifactor ANOVA and Duncan's tests were used to compare treatment groups to find out whether they showed any statistically significant differences with significance level (α) set at 0.05.

RESULTS AND DISCUSSION

The physical structure of the medium in which seeds are germinated is crucial both for germination and early seedling establishment. A good seed-bed should provide a balance between moisture and aeration. In addition to this, the optimal seeding depth varies with species and it depends on the size of the seeds [23]. The main purpose of this study was to examine the influence of different growing media and sowing depth on germination percentage and germination rate of *C. armena*. Four substrate components were mixed at different ratios of peat, manure, perlite, forest soil and sand and used three sowing depth.

According to some researchers, *Colutea* spp. seeds did not germinate easily unless the impermeable seed coat was ruptured by mechanical or chemical scarification [3, 16]. For that reason, the seeds were sown in the pot-trays after sulphuric acid scarification for 30 minutes.

Statistical analyses showed that both the highest germination percentage (31.1%) and the best germination rate values (9 days) were obtained from the growing medium of forest soil+sand+manure (2:1:1) and sown in depth of 0.5 cm. At the opposite, the lowest germination percentage (7.03%) was determined from the seeds which were sown in the substrate of peat+manure(2:1) combination (Table 1, Figure 1). It could be said that the mixture of forest soil, sand and manure (2:1:1), having a water retention and porosity better than peat, gave good results, in particular on *C. armena*. D'Angelo and Titone [25] implied that observations of plants have revealed that a ratio of 30% peat is sufficient to assure good water retention. Best draining components were perlite and argex, used at a percentage not higher than 20%. In our study, the maximum germination percentage value among the growing media including the ratio of 33% peat was 22.8% (Peat+forestsoil+manure (1:1:1)) for the seeds that were sown in 0.5 cm-depth (Table 1). This finding is consistent with the results stated by D'Angelo and Titone [25] and Ayan [13].

While the treatments including forest soil gave better germination percentages ranging from 18.9% to 31.1%, 0.5 cm-sowing depth gave the best germination percentage and germination rate results (Table 1).

Table 1: Results of statistical analyses showing the relationship of the germination percentage and germination rate with different treatments (Means in column with the same letter are not significantly different at $\alpha = 0.05$)

Growing Media	F-Ratio	GP (%)	F-Ratio	GR (days)
Peat+manure (2:1)	16.226*	7.03a	3.855 ^{NS}	11
Peat+perlite+manure (2:1:1)		10.18a		16
Peat+forestsoil+manure (1:1:1)		12.40a		12
Forest soil+sand+manure (2:1:1)		23.88b		11
Sowing Depth (cm)	F-Ratio	GP (%)	F-Ratio	GR (days)
1.0	7.554**	9.86a	0.220 ^{NS}	13
1.5		10.41a		12
0.5		19.86b		12
Growing Media*Sowing Depth	F-Ratio	GP (%)	F-Ratio	GR (days)
Peat+manure (2:1)-1.0 cm	116.314***	2.77a	24.545***	9a
Peat+manure (2:1)-1.5 cm		6.67b		11bc
Peat+forestsoil+manure (1:1:1)-1.0 cm		6.67b		13de
Peat+forestsoil+manure (1:1:1)-1.5 cm		7.77b		10ab
Peat+perlite+manure (2:1:1)-1.0 cm		8.33b		18g
Peat+perlite+manure (2:1:1)-1.5 cm		8.33b		15f
Peat+manure (2:1)-0.5 cm		11.67c		12cd
Peat+perlite+manure (2:1:1)-0.5 cm		13.89c		14ef
Forest soil+sand+manure (2:1:1)-1.5 cm		18.89d		12cd
Forest soil+sand+manure (2:1:1)-1.0 cm		21.66e		13de
Peat+forestsoil+manure (1:1:1)-0.5 cm		22.78e		14ef
Forest soil+sand+manure (2:1:1)-0.5 cm		31.11f		9a

* VS: Growing media, significantly different at $\alpha = 0.05$, ** VS: Sowing depths, significantly different at $\alpha = 0.05$, *** VS: Growing media*sowing depths, significantly different at $\alpha = 0.05$, NS: Not significant at $\alpha = 0.05$

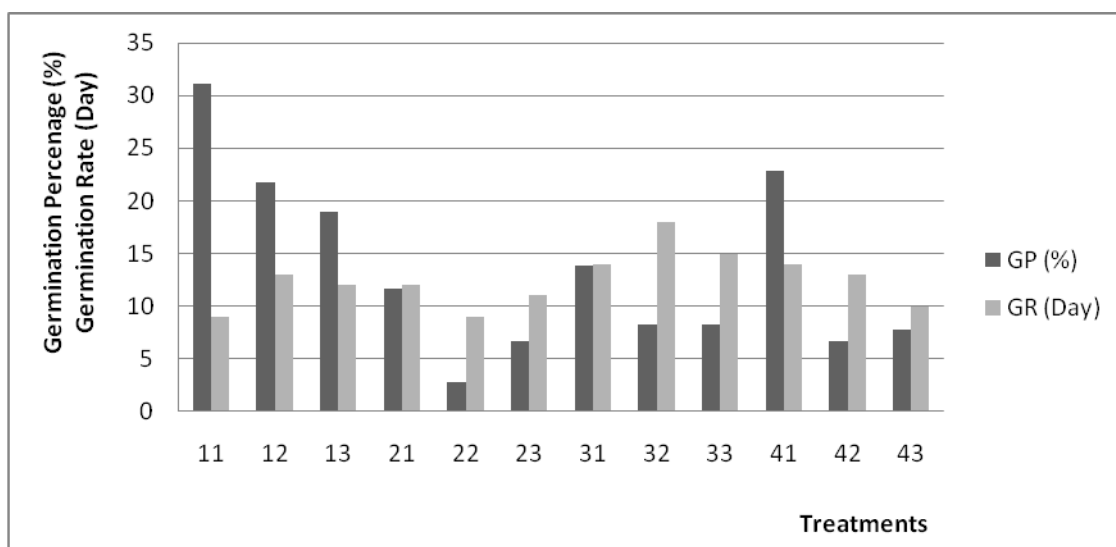


Figure 1: Germination percentage (GP) and germination rate (GR) of the seeds that were sown in different growing medium (1: Forest soil+sand+manure (2:1:1); 2:Peat+manure (2:1); 3:Peat+perlite+manure (2:1:1); 4:Peat+forestsoil+manure (1:1:1)) and depth (1: 0.5 cm; 2: 1.0 cm; 3: 1.5 cm) combinations

CONCLUSION

Consequently, among all the treatments applied to the *C. armena* seeds, the growing medium of forest soil+sand+manure (2:1:1) and sowing depth of 0.5 cm resulted in the highest germination percentage (31.1%) and the shortest time before maximum germination rate (9 days). It is followed by the treatment of

sowing in peat+forestsoil+manure (1:1:1) and in 0.5 cm-depth with 22.8% of germination percentage and 14 days before maximum of germination rate. Therefore, these results indicate that the substrate by including forest soil, sand and manure (2:1:1) and sowing in depth of 0.5 cm should be used to obtain a good germination from *C. armena* seeds.

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