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The effect of seed size and some priming method on germination of *Vicia sativa* L.

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**Abstract.** The study was conducted to determine the effect of seed size and some priming methods on germination of common vetch. Seed was fractionated into two classes “small or large seed”. The seeds for each seed size were primed in different priming medium. Germination performance of large seed is higher than small seed. PEG solution is suitable for common vetch.

**Keywords.** Germination – Priming – Seed size – *Vicia sativa* L.

**I – Introduction**

Both increased feed requirements for an expanding Turkish livestock population and sustainable agriculture necessitate the introduction of forage legumes into crop rotations (Fırıncıoglu *et al.*, 2009). Common vetch (*Vicia sativa* L.), a major annual forage legume in Turkey, is grown over a large area 500 000 ha (TUIK, 2009). It is grown under both arid and wet conditions in every region of Turkey. It is exposed to different stress factors depending on its growing environment. For example, waterlogging damage to fall sown common vetchs can be a serious problem in North part of Turkey (Manga *et al.*, 2003). In arid environments, freezing temperatures in winter, low and inconsistent distribution of annual rainfall, and high temperatures at maturity are all important abiotic stres (Fırıncıoglu *et al.*, 2009).

Successful stand establishment of common vetch depends on seed germination and seedling growth (Samarah, 2006). Pod shattering has been a major constraint to seed production of common vetch (Acıkgoz, 2001). Delayed seed harvest may increase seed losses due to pod shattering; however, early harvest may influence seed weight and germination. Samarah (2006) reported that germination of immature seeds of common vetch differed mature seeds depend on drying method of seeds. Also Acıkgoz and Rum-Baugh (1979) determined that large-seeded cultivars of common vetch tended to produce larger and more rapidly growing seedlings.

Seed priming is a tecnique which involves uptake of water by the seed followed by drying to initiate the early events of germination up to the point of radicle emergence (Varier *et al.*, 2010). Its benefits include rapid, uniform and increased germination, improved seedling vigour and growth under a broad range of environments resulting in better stand establishment (Varier *et al.*, 2010).
Priming can be accomplished through different means such as hydropriming (soaking in water), osmopriming (soaking in osmotic solution such as polyethyle glycol (PEG), mannitol, sodium and potassium salts) (Elkoca et al., 2007; Tiryaki et al., 2009). Although there is some information about the effects of seed priming on germination of some forage legumes in the literature (Gullap et al., 2007; Tiryaki et al., 2009; Rouhi et al., 2010), seed priming was not reported for common vetch.

The objective of the present work was to determine the effects of some priming treatments on seed germination of common vetch (*Vicia sativa* L.).

II – Materials and methods

Seed of common vetch (*Vicia sativa* L.), cultivar Albayrak, was obtained from Black Sea Agriculture Research Station, Samsun, Turkey. Seed was fractioned into two classes “small or large seed”. While small seeds were those that passed through a 4 mm slotted sieve, large seeds were those retained on it. Subsequent to fractionation, all physically damaged seeds were manually removed. Thousand seed weight (TSW) was determined for each fraction by counting and weighing 8 samples of 100 seeds (ISTA, 1993). It varied between 76 and 54 g. Moisture content of each seed size was determined by grinding the seeds and then drying at 130 ºC for 4 h and they were found to be 10.5 % and 10.4 % on a fresh weight basis (respectively, small and large seeds).

The seeds for each seed size were divided into lots. In osmopriming treatments, the seed lots were fully immersed in different osmopriming medium at various concentrations: 1, 2 or 3% of KNO₃, KH₂PO₄, NaCl or boric acid, 10, 20 or 30% of PEG 6000 or 4% mannitol. The seed lots were imbibed in distilled water in hydropriming treatments. The ratio of seed weight to priming solution volume was kept 1:5 (g ml⁻¹) (Ghiyasi et al., 2007). The seed lots were primed in darkness in an incubator at 25 ± 1 ºC (Kaur et al., 2002) for 3 days (although seed coat began to break down, radicle did not prosturated, hence, priming got through). Following priming, seeds were rinsed under running tap water for 2 minutes to remove the priming agent (Tiryaki et al., 2009) and dried on filter paper at 25 ± 1 ºC for 24 h (Elkoca et al., 2007). Seeds whose seed coat began to break down during priming were eliminated before the germination test. Untreated (non-primed) seeds were used as the control.

Germination test were completed in darkness in an incubator at 25 ± 1ºC (Akhtar and Hussain, 2009). 20 seeds were placed on 2 layers of filter paper moistened with 10 ml of deionised water in covered 9 cm petri dishes replicated four times for each treatment. Captan (1 g /litre) was added into the deionised water to prevent fungal development. Germinated seeds, which the radicle was approximately 3 mm length (Killi and Erol, 2006), were recorded and removed from petri dishes daily until the number stabilized (for 9 days). The percentage of germinated seeds was calculated as formula. The percentage of germinated seeds = (total germinated seed number/20) x 100.

Four replicates of 20 seeds for germination were arranged in split plot design. Seed size was main plot, priming agent was subplot. Seeds in KNO₃, NaCl and boric acid and in higher concentrations (>1%) of KH₂PO₄ did not germinate, thus, these priming treatments did not participate in the statistical analysis. Before analysis, arcsine transformation was used. Analysis of variance of data was done by SPSS 10.0 V. The means were ranked according to LSD test.

III – Results and discussion

Seed size, as a characteristic of seed quality, influences seedling growth and establishment (Nik et al., 2011). There were significant differences (P≤0.01) between seed size regarding germination percentage. As predicted, the highest germination percentage (18.8 %) was obtained from large seed. In the present study, large seeds exhibited two times greater germination than small
seeds, regardless of priming. With increased seed size, higher germination percentage was determined in triticale (Kaydan and Yagmur, 2008) in oat (Mut et al., 2010). Because delayed seed harvest in common vetch can increase seed losses due to pod shattering; harvest is done before all seeds are mature, thus, small seeds may be immature.

Priming media significantly (P≤ 0.01) altered germination performance of *Vicia sativa* L. While 20 % PEG 6000 enhanced germination percentage in both seed size, 4% mannitol enhanced germination percentage in large seeds (Fig. 1). PEG is commonly used as osmotic priming material because it is readily available and has no physiological reaction with seed. Very large molecules of this substance do not pass through seed cell membranes but control diffusion of water through the seed coats by providing lower osmotic potential in the seed environment (Pill, 1995). The other priming treatments reduced germination. Moreover seeds in KNO₃, NaCl and boric acid and in higher concentrations (>1%) of KH₂PO₄ did not germinate. The effect of priming can change depending on chemical, duration time and plant species. For example, 1% KNO₃ and KH₂PO₄ enhanced germination percentage of *Lolium multiflorum*, higher concentrations (> 1%) of the same solutions had an adverse effect on seed germination (Tiryaki et al., 2004). Additionally priming seeds in 3% boric acid significantly improved germination rate and uniformity of *Amaranthus caudatus* L. At 15°C (Tiryaki, 2009). Contrary to present result, 2% NaCl and KNO₃ enhanced germination percentage of white clover when seed were primed in 2 days (Tiryaki et al., 2009). It may be toxic ion effect of NaCl, rather than osmotic effect, which has been reported that salt concentration did not affect the proportion of seed imbibing of red clover (Onal Asci, 2011).

![Fig. 1. Germination percentage of *Vicia sativa* L. seeds in different priming treatments. (LS: Large seed, SS: Small seed).](image)

The results of this study confirmed that the selection of larger seed is suitable for much germination percentage. The resultant effect of priming depends on the used method. Although 20 % PEG seems to be useful to increase germination percentage, time of treatment must be investigated to learn the most effective method.

**References**


