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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 sudty 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.

L'effet de la taille des graines et une méthode d'amorçage sur la germination de* Vicia sativa *L.

Résumé. *L'étude a été menée afin de déterminer l'effet de la taille des graines et une méthode d'amorçage sur la germination de la vesce commune. Les semences ont été divisées en deux classes de "taille petite ou grande". Les graines de chaque taille ont été amorcées en milieux d'amorçage différents. Les performances germination des graines grandes sont plus élevées que celles de petites graines. La solution de PEG est appropriée pour la vesce commune.*

Mots-clés. *Germination – Amorçage – Taille des graines –* 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).

Succesful 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 iniate 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 KNO_3, KH_2PO_4, 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 (altough seed coat began to break down, radicle did not prosturated, hence, priming got through). Following priming, seeds were rinsed under running top 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 KNO_3, NaCl and boric acid and in higher concentrations (>1%) of KH_2PO_4 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 ($P \leq 0.01$) 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 KNO_3, NaCl and boric acid and in higher concentrations (>1%) of KH_2PO_4 did not germinate. The effect of priming can change depending on chemical, duration time and plant species. For example, 1% KNO_3 and KH_2PO_4 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 KNO_3 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 proprotion of seed imbibing of red clover (Onal Asci, 2011).

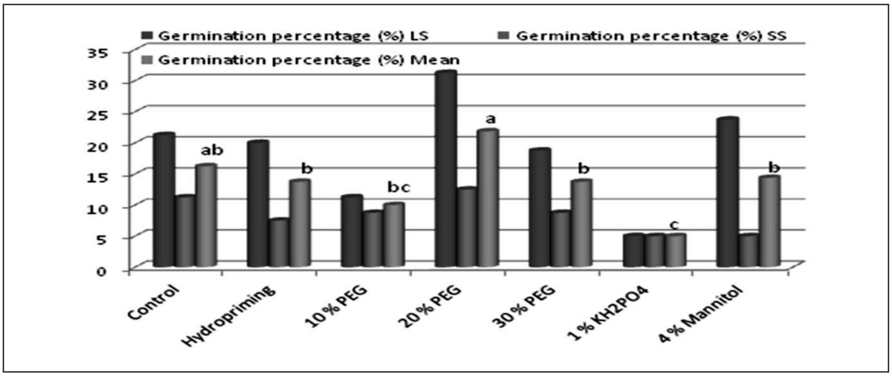

Fig. 1. Germination percentage of *Vicia sativa* L. seeds in different priming treatments. (LS: Large seed, SS: Small seed).

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. Altough 20 % PEG seems to be useful to increase germination percentage, time of treatment must be investigated to learn the most effective method.

References

Acıkgoz E., 2001. Forage, Bursa, Turkey.

Acıkgoz E. and Rum-Baugh M.D., 1979. Variation in seed and seedling traits of common vetch (*Vicia sativa* L.). In: *Can. J. of plant Sci.,* 59(2), p. 511-513.

Akhtar R. and Hussain F., 2009. Growth performance of *Vicia sativa* L. under saline conditions. In: *Pak. J. Bot.*, 41(6), p. 3075-3080.

Elkoca E., Haliloglu K., Esitgen A. and Ercisli S., 2007. Hydro-and osmopriming improve chichkpea germination. In: *Acta Agriculturae Scandinavica Section B-Soil and plant Sci.,* 57, p. 193-200.

Fırıncıoglu H.K., Erbektas E., Dogruyol L., Unal S. and Mentes O., 2009. Enhanced winter hardıness ın common vetch (*Vicia sativa* L.) for autumn-sowing in central highlands of Turkey. In: *J. Central Europen Agriculture,* 10(3), p. 271-282.

Ghiyasi M., Fayyaz Moghadam A., Tajbakhsh M. and Amirnia R., 2007. Effect of osmopriming with polyethylene glycol (8000) on germination and seedling growth of wheat (*Triticum aestivum* L.) seeds under salt stres. In: *Turkey 4 th Field Crops Congress*, 25-27 June 2007, Erzurum, p. 240-243.

Gullap M.K., Elkoca E., Haliloglu K., Koc A. and Dascı M., 2007. The effect of different presowing seed treatments (priming) and durations on germination performance of variegated alfalfa (*Medicago varia* L.). In: *Turkey 4 th Field Crops Congress*, 25-27 June 2007, Erzurum, p. 399-402.

ISTA, 1993. Rules for testing seeds: Rules. Seed Sci. Technol. 21 (Suppl.), p. 259.

Kaur S., Grupta, A.K. and Kaur N., 2002. Effect of osmo-and hydropriming of chichkpea seeds on seedling growth and carbonhydrate metabolism under water deficit stres. In: *Plant Growth Regulation*, 3, p. 17-22.

Kaydan D. and Yagmur M., 2008. Germination, seedling growth and relative water content of shoot in different seed sizes of triticale under osmotic stress of water and NaCl. In: *Afr. J. Biotechnol.,* 7, p. 2862-2868.

Killi F. and Erol A., 2006. Effects of by-product of the olive oil mill process on germination and early seedling growth of grasspea (*Lathyrus sativus* L.) common vetch (*Vicia sativa* L.) and hairy vetch (*Vicia villosa* Roth) seeds. In: *J. of Environmental Biology*, 27(2), p. 207-210.

Manga I., Acar Z. and Ayan I. 2003. Forage Legume. Samsun, Turkey, 451 pp.

Mut Z., Akay H. and Aydin N. 2010. Effect of seed size and drought stres on germination and seedling growth of some oat genotypes (*Avena sativa* L.). In: *Afr. J. Agric. Res.,* 5(10), p. 1101-1107.

Nik M.M., Babaeian M. and Tavassoli, A. 2011. Effect of seed size and genotype on germination characteristic and seed nutrient content of wheat. In: *Scientific Res. and Essays*, 6(9), p. 2019-2025.

Onal Asci O., 2011. Salt tolerance in red clover (*Trifolium pratense* L.) seedlings. In: *Afr. J. Biotechnol.,* 10(44), p. 8774-8781.

Pill W.G., 1995. Low water potential and pre-sowing germination treatments to improve seed quality. In: Basra AS P(ed) *Seed Quality*, p. 319-359. New York.

Rouhi R.H., Afshari R.T., Moosavi S.A. and Gharineh M.H., 2010. Effects of osmopriming on germination and vigour traits of bersim clover (*Trifolium alexandrinum* L.). In: *Not. Sci. Biol.,* 2(4), p. 59-63.

Samarah N.H., 2006. Effect of air-drying immature seeds in harvested pods on seed quality of common vetch *(Vicia sativa* L.). In: *New Zealand J. of Agricultural Research*, 49, p. 331-339.

Tiryaki I., Korkmaz A., Ozbay N. and Nas M.N., 2004. Priming in the presence of plat growth regulators hastens germination and seedling emergence of dormant annual ryegrass (*Lolium multiflorum* Lam.) seeds. In: *Asian J. of Plant Sci.,* 3(5), p. 655-659.

Tiryaki I., Kızılşimşek M. and Kaplan M., 2009. Rapid and enhanced germination at low temperature of alfalfa and white clover seeds following osmotic priming. In: *Tropical Grasslands*, 43, p. 171-177.

Tiryaki I., 2009. Osmotic priming increases seed germination of *Amaranthus caudatus* L. at low temperature. In*: Agrochimica*, 53(3), p. 177-182.

TurkStat, 2009. Turkish Statistical Institute. http://www.turkstat.gov.tr

Varier A., Vari K.A. and Dadlani M., 2010. The subcelluar basis of seed priming. In: *Current Sci.*, 99(4), p. 450-456.