

ORIGINAL ARTICLES

Studying of seedling production under hydropriming in cumin (*Cuminum cyminum* L.)

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ABSTRACT

Hydropriming is a simple and inexpensive priming method. In order to the studying of seedling production under hydropriming in cumin (*Cuminum cyminum* L.), this experiment was conducted in 2011 by a completely randomized design with four replications. The factor was including hydropriming (0, 3, 6 and 9 hours). The results showed that the effect of hydropriming was significant on germination percentage, seedling vigour, seedling length and seedling dry weight in cumin. Means comparison showed that the highest germination percentage, seedling vigour and seedling dry weight were achieved under hydropriming after 9 h but the highest seedling length was achieved under hydropriming after 6 h. The results showed that use of hydropriming can improve seedling production in cumin.

Key words: Hydropriming, seedling production, cumin (*Cuminum cyminum* L.).

Introduction

The present study was carried out in 2006 and 2007 crop seasons at Suleyman Demirel University research farms, Turkey. The aim of the study was to investigate the effect of sowing times and different seed treatments (control, distilled water, 100, 200, 300 and 400 ppm GA3) on 100 seed weight, harvest index, seed yield and protein content in 3 chickpea cultivars (Gokce, Akcin 91 and Ispanyol). Significant differences were detected for cultivars, sowing dates and seed treatments. 100 seed weight, harvest index, seed yield and protein content were recorded as 32.7 - 44.2 g, 38.7 - 54.1%, 63.1 - 180.3 kg/da and 20.1 - 27.3%, respectively. 100 seed weight, harvest index and seed yield were significantly affected from sowing dates and seed treatments. On the other hand, protein content was highly affected from late sowing and gibberellic acid (GA3) treatments. It was concluded that early sowing along with 100 ppm GA3 and dH2O treatments could be practiced to obtain higher seed yield in chickpea (Kaya *et al.*, 2010). An experiment was conducted to evaluate the effects of osmopriming with KNO3 on germination traits, seedling growth and phosphatase activities of lettuce (*Lactuca sativa* L.) seeds under salinity condition. Lettuce seeds (Var. Vista) were primed with KNO3 (0.05%) for 2 h at 25°C in the dark. Primed and nonprimed seeds were germinated on distilled water containing 0 or 100 mM NaCl, for four days. Results show that germination percentage, root and shoot length and seedling fresh weight of primed seeds was higher than that of non-primed seeds in saline condition. Priming also increased acid phosphatase and phytase activities in the roots, shoots and cotyledons under salt stress. It seems that seed priming can be used for improving performance of lettuce seeds and seedlings grown under saline conditions (Nasri *et al.*, 2011). Plant materials have long been known to contain biochemical substances that could have adverse effects on animal tissues. A study was initiated to investigate the effect of hydroalcoholic extract of *Cochlospermum planchonii* rhizome on biochemical and haematological indices of hepatotoxicity in adult albino Wistar rats. Four groups of five rats per group were used. Group A was given only distilled water and served as control, while groups B, C and D were given 125, 250 and 500 mg/kg body weight of the extract, respectively, by oral administration for four weeks. The results revealed that there was a dose-dependent significant increase ($p < 0.05$) in aspartate aminotransferase, alanine aminotransferase, alkaline phosphatase, triglycerides and total bilirubin of all the treatments groups when compared with the control group, while the high density lipoprotein cholesterol of all the treatment groups was significantly ($p < 0.05$) reduced. The 500 mg/kg body weight of the extract produced a significant decrease ($p < 0.05$) in PCV and haemoglobin concentration. The levels of low density lipoprotein cholesterol, total cholesterol, glucose, albumin, globulin and total protein of all the treatment groups were not significantly ($p > 0.05$) altered. These results showed that hydroalcoholic extract of *C. planchonii* rhizome might be injurious to the liver, if administered at a high dose and over a prolonged period of treatment (John *et al.*, 2011). *Kelussia odoratissima* Mozaff. is one of the endogenous plant species of Iran which is exposed to extinction during the recent decades. Seeds of this plant have dormancy that causes reduction of seed germination. Experiment was performed as factorial with complete randomized design with 3 factors: polyethylene glycol (PEG) priming, gibberellic acid (GA3) treatment, GA3 application time. This research was

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performed to evaluate priming effect alone and in combination with GA3, on seed germination and seedling growth parameters. Results show that seed priming with PEG alone had negative effect and GA3 application solely did not have any significant effect on the seed germination percentage in comparison with the control. Seedling growth responses to PEG priming was similar (in -1 MPa) or lesser (in -1.5 MPa) than control, GA3 significantly improved seedling growth as compared to the control. Application of GA3 after PEG was better than using of GA3 before PEG or co-application of GA3 and PEG. These results suggest that probably, GA3 compensated negative effect on long time priming (Amooaghaie and Valivand, 2011). Therefore, the objective of this study was to evaluate the studying of seedling production under hydropriming in cumin (*Cuminum cyminum* L.).

Materials and Methods

In order to the studying of seedling production under hydropriming in cumin (*Cuminum cyminum* L.), this experiment was conducted in 2011 by a completely randomized design with four replications. The factor was including hydropriming (0, 3, 6 and 9 hours) and then in the laboratory at each Petri dish 100 seeds were placed between two layers of paper culture and Petri dishes were placed in Germinator for 9 days at 15 to 18°C. After 9 days, 10 seedlings were selected and was determined seedling length and then placed on electrical Owen for 48h at 75°C and determined seedling weight by electrical scale. Finally, germination percentage determined for cumin by following formula:

$$(\text{Number of Seeds Germinated} / \text{Total Number of Seeds on Petri Dish}) * 100$$

Data were subjected to analysis of variance (ANOVA) using Statistical Analysis System [SAS, 1988] and followed by Duncan's multiple range tests. Terms were considered significant at $P < 0.05$.

Results and Discussion

The results showed that the effect of hydropriming was significant on germination percentage, seedling vigour, seedling length and seedling dry weight in cumin. Means comparison showed that the highest germination percentage, seedling vigour and seedling dry weight were achieved under hydropriming after 9 h but the highest seedling length was achieved under hydropriming after 6 h.

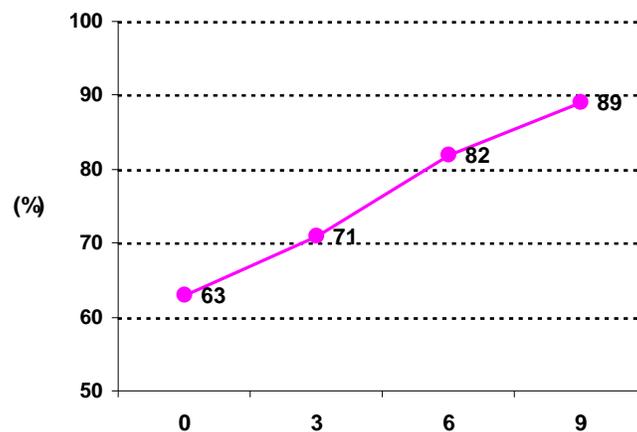


Fig. 1: Germination percentage in cumin under hydropriming.

The results showed that use of hydropriming can improve seedling production in cumin. Laboratory tests and a field experiment were carried out to evaluate the effects of salt priming (0.8% NaCl with electrical conductivity of 15.3 dsm-1 and 0.8% KNO3 with electrical conductivity of 12.5 dsm-1 for 8 h at $20 \pm 1^\circ\text{C}$) on seed invigoration and field performance of three winter rapeseed cultivars (Okapi, Opera and Talayeh). The field experiment was arranged as split plot factorial based on RCB design in three replicates, with irrigation regimes (I1, I2 and I3: irrigation after 80, 120 and 160 mm evaporation from class A pan) in main plots and cultivars and salt priming treatments in sub-plots. Salt priming, particularly KNO3 priming, decreased mean germination time and increased seedling size, compared with non-primed seeds. Irrigation treatments had no significant effect on yield and yield components of rapeseed cultivars in the field, suggesting that this crop was well-performed even under the limited irrigation regimes. Although response to salt priming varied among

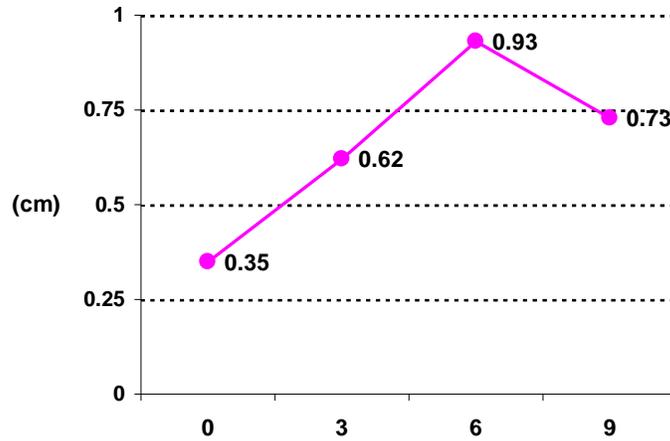


Fig. 2: Seedling length in cumin under hydropriming.

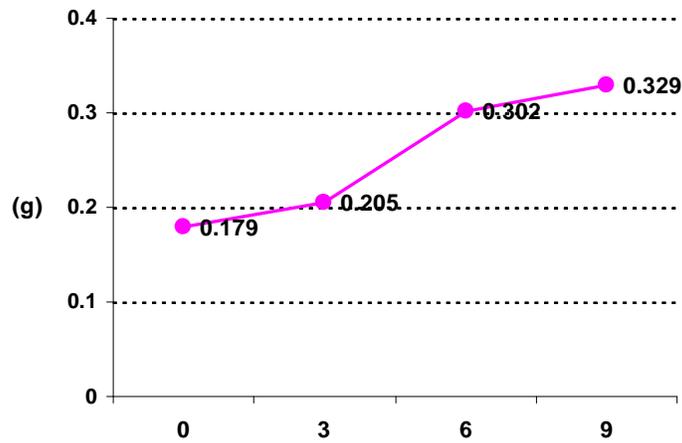


Fig. 3: Seedling weight in cumin under hydropriming.

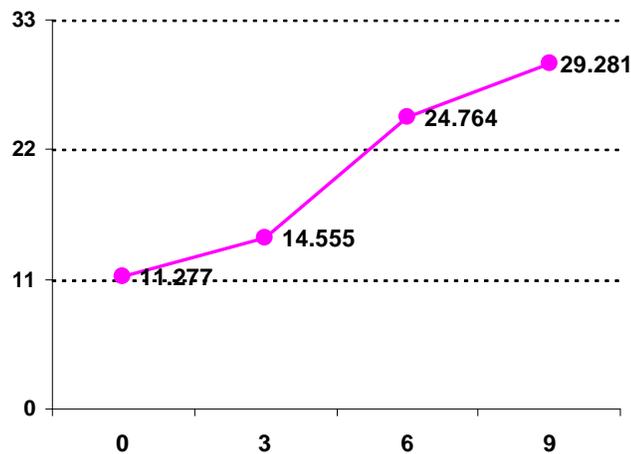


Fig. 4: Seedling vigour in cumin under hydropriming.

rapeseed cultivars, seed priming generally increased grain yield per unit area through enhancing rate and percentage of seedling establishment, pods per plant and grains per plant. The highest improvement in grain yield per unit area was observed for seeds primed with KNO₃ (31.5%) followed by those primed with NaCl (22.5%) (Ghassemi-Golezani *et al.*, 2010). An area of plant science that is still unexplored is how leaf area

affects crop dry matter production due to aeration of seed in osmoticum. In view of this, an experiment was conducted at Agricultural Research Farm of NWFP Agricultural University, Peshawar, Pakistan in the summer of 2003 and repeated in 2004. The seeds of two mung bean cultivars (NM-92 and NM-98) were primed, some for 6 h and others for 12 h in using either distilled water (0MPa osmotic potential) or Polyethylene glycol-8000 (PEG) solution having -0.2, -0.5 and -1.2 MPa osmotic potential. A control treatment (dried seeds) was also included in the experiment. The primed seed were dried back, till the weight become constant and were store for sowing at 25°C. Data was collected on mung bean leaf area, dry matter production and growth parameters at different growth stages. Seed moisture content at maturity stage was also determined. There was no significant difference in leaf area for the different cultivars and seed treatment duration also did not lead to a significant difference in leaf area. However, seed priming techniques significantly affected the measured parameters. Dried seed had developed lower leaf area and dry matter compared to primed seeds. An exponential linear model of leaf area and total dry matter revealed that dry matter production was linearly related to leaf area ($r^2 = 77.23$). The linear relationship between the leaf area and dry matter hold true the hypothesis and thus concluded that beside environmental and genetical factors, the dry matter production is a function of leaf area in aerated seed of mung bean crop in semi-arid areas like North western Pakistan (Khan and Khalil, 2010). To evaluate the response of bambara groundnut seeds to flooding stress a laboratory study (experiment 1) and a greenhouse study (experiment 2) were conducted. In the laboratory study seeds of a brown-coloured local bambara groundnut landrace were completely immersed in distilled water (presowing soaking) for 2, 4, 6 and 8 d in an incubator at 20, 25, 30 and 35°C. In the greenhouse study flooding stress was imposed on seeds of the uniswa red landrace at 1, 3, 5 or 7 d after start of imbibition. In experiment 1 pre-sowing soaking enhanced germination rate, but final germination percentage decreased drastically as the duration of soaking increased beyond 2 days. There was a significant flooding duration x temperature interaction on final germination percentage. The germination ability of bambara groundnut seeds was reduced by 60 and 80% when seeds were soaked for 6 days at 20 and 30°C, respectively, and a complete loss in germination occurred when seeds were soaked for 6 days at 35°C, and for 8 days at all temperatures used in the study. However, seeds germinated well (68%) even after 6 days of soaking at 25°C. In experiment 2, flooding bambara groundnut seed for 1 or 12 h at 1, 3, 5 or 7 days after start of imbibition did not reduce germination percentage significantly. However, flooding at any time for 24 or 48 h significantly reduced germination percentage, compared with non-flooded seed. These results suggest that, at least for the two landraces used in this experiment, short-term flooding of fields during the germination phase of bambara groundnut is detrimental to germination and uniform emergence, but that the response is influenced by the duration of flooding, temperature, germination stage and the interaction between flooding duration and temperature (Sesay, 2009).

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