Seed Germination and Seedling Growth Potential of Haricot bean under Laboratory Conditions

Research Article

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Abstract

Haricot bean (Phaseolus vulgaris L.*) differ in their low temperature tolerance regarding growth and yield. Varieties tolerant to low temperature during germination and carriers of the seed quality standards are needed for the success of the crop. Ten seeds were placed per petridish uniformly and covered with lid to prevent loss of moisture through evaporation. The seeds were allowed to germinate for 10 days at room temperature. The germination percentage was recorded on the 10th day. Germination was considered to have occurred when radicles attained a length of 2 mm. The objectives of this study were to evaluate the germination of bean seedlings under controlled environment with in laboratory conditions. Trial were conducted with dry bean seed in moderate or controlled environment. The seedling, shoot length for varieties Awash-2 a little bit different than other two moreover seedling fresh and dry weights all are equal values. Morpho-agronomic data were used to evaluate the phenotypic performance of the different varieties before the seed or seedlings going on the field.*

Key words: Bean, controlled, phenotypic, varieties

Introduction

Haricot bean (Phaseolus vulgaris L.) is the second most important grain legume cultivated as cash crop in Ethiopia (CSA, 2011) and is mainly produced in the rift valley area of the country characterized by high industrialization and urbanization. The Haricot bean (*Phaseolus vulgaris* L.) is native to the Americas where two major domestication centers and gene pools have been described, Andean and Mesoamerican, which differ in their adaptation to different climatic and eco-geographic conditions. Differences in the seed type and size are clear between both genetic pools (Singh et al., 1991; Santalla et al., 2001), having the Andean varieties larger seeds than the Mesoamerican ones. Early breeding efforts primarily focused on improved disease resistance and adaptation to local environments, with later efforts focused on improved seed quality, improved plant architecture, and breeding for yield (Duc et al., 2015). Seed germination and seedling emergence in the small seeded Mesoamerican genotypes is generally faster than that in the Andean ones, and this phenotypic trait has been used to distinguish between the two genetic pools (White and Montes, 1993). Faster emergence may reflect both genetic variation for adaptation to specific environments and effects of seed size in emergence. Seed size has been recognized as a factor affecting bean germination (Hanley et al., 2003; Kaya et al., 2008) and is probably related to water uptake, a key process in seedling emergence (Bewley, 1997). Seed germination is the process that commences with uptake of water by the dry seed—i.e., imbibition, and terminates with emergence of the seedling.

Thus, the process involves two temporal stages, namely the germination stage and the emergence, or seedling-growth stage (Bewley and Black, 1985; Bewley, 1997). Fast seed germination is considered an important adaptive trait marking a quick transition to the growth phase in the life-cycle of a plant. The time taken for the germination process to be completed is one of the important parameters of seed quality (Copeland and McDonald, 1995; Dutt and Geneve, 2007). The purpose of germination testing is to provide information on the comparative and foreseeable field planting value of different seed samples. The objectives of this study were to compare the germination of bean seedlings under controlled environment.

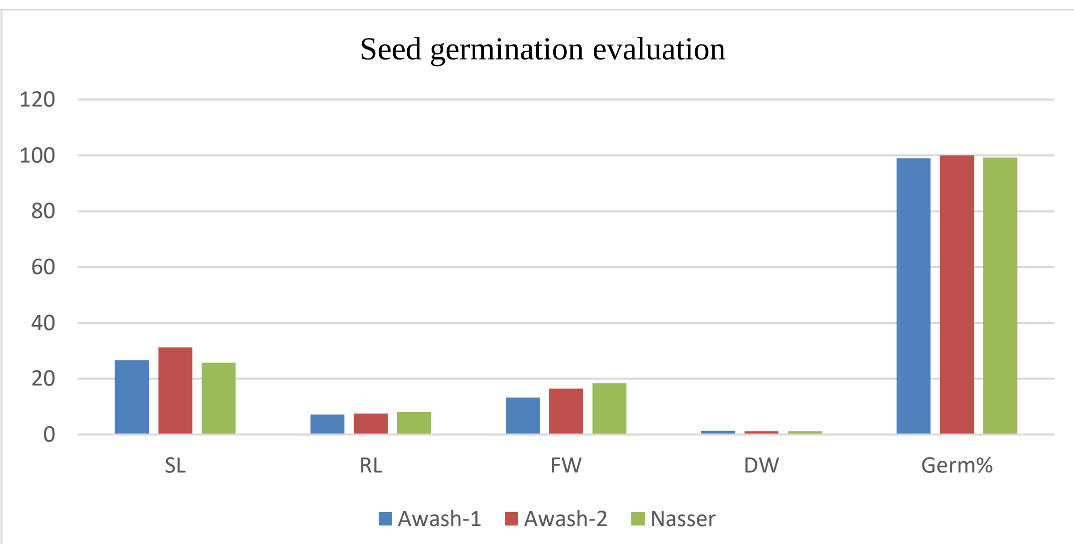
Materials and Methods

A complete block design (CRD) with four replications was used. Ten seeds of each variety were sown in sterile peat in plastic containers with moist sand under continues white light and dark temperature. Monitoring of emergence was carried out every day. Seedlings with a hypocotyl-radicle were considered as emerged. Proportion of germination (% of sown seeds) were measured. On the 10th day, 10 seedlings in each Petri plate were sampled to measure the root length and shoot length using a scale. Shoot and root fresh weights of the same plants were measured using sensitive balance, and root and shoot dry weights were recorded after oven drying for 72h at 50°C.

The total number of germinated seedlings after sowing in each expressed as a percentage. Root and canopy dry weight determinations for the Haricot bean seedlings were obtained by removing the haricot bean seedlings, washing the root system in running water the weights of the root system and canopy were obtained after drying in a forced air chamber at 70°C for 24hrs to constant weight and the mean results expressed in gram per seedling.

Result and Discussion

In germination proportion between varieties marked differences were not found among varieties. During laboratory planting of the seed it used same seed class (pre-basic) Awash-1 and Awash 2 white in color but little bit difference in seed size. The three seed variety the so called Nasser it has brown in color. In controlled environments studies have shown that the rate of germination and seedling emergence linearly increases with temperature in several crop species including legumes, such as cowpea, soybean, chickpea, and peanut (Covell et al., 1986; Ellis et al., 1986; Mohamed et al., 1988; Craufurd et al., 1996; Awal and Ikeda, 2002). In this work we found that the variation in germination percent in temperatures was greater in controlled chamber for all varieties of haricot bean. It can be argued that environmental conditions in the control environment are strictly manageable to assess the germination potential of every seed which have hard seed coat. It had no clear difference between varieties for germination percent, seedling dry weight, and clear difference was observed on seedling shoot length and fresh weight.



SL= Shoot Length: RL= Root Length; FW: fresh Weight; DW: Dry weight and Ger%= Germination percent

Fig: 1. Evaluation of Haricot bean seedling under room temperature

Conclusions and Recommendation

Seeding that could be planted at room temperature were not differentiate with color and size. With regard to seed class and color, one of the factors that have been suggested as responsible for poor legume emergency in the field is imbibition damage caused by fast water uptake, resulting in cell death, solute leakage, and reduced emergence and growth. However, colored seeds which imbibed more slowly, suffer less damage than the white ones (Powell et al., 1986). These trends suggest that seed testa color could have some influence in seed germination and seedling emergence, in accordance with the results by other authors (Dickson, 1971; Powell et al., 1986).Therefore, white seeded market classes are typically more susceptible to this damage. As a result of the selection of phenotypic response of bean germplasm in controlled conditions, were identified with good performance they could be a valuable genetic material for breeding programs. The efficiency of bean varieties standard germination tests for predicting the performance emergence of bean seedlings under controlled environment.

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