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Early Identification of Salt Tolerant Foxtail Millet (*Setaria italica* L. Beauv)

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Abstract

The objective of this study was to identify the salt tolerance level of foxtail millet accessions. Salinity tolerance of 10 foxtail millet accessions was determined by a rapid screening method at 7-days-old seedlings and at 3-weeks-old seedlings. Based on the root length and relative seed germination of the 7 days-old-seedlings, and based on the root growth and plasma membrane integrity of the root tip under salinity at the seedling stage, ICERI-5 and ICERI-6 accessions were identified as tolerant accessions, while ICERI-10 were identified as sensitive accessions. Accessions with tolerance to salinity are valuable genetic materials for further crop improvement program.

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Keywords: abiotic stress, foxtail millet, NaCl, salinity, screening method

Introduction

Abiotic stresses, including salinity, are negatively influence the yields of staple food crops worldwide, hence threaten the world food security [1]. Salinity affected nearly 20% of the world's cultivated area and nearly half of all irrigated lands [2]. Foxtail millet (*Setaria*

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italica L. Beauv) is a Panicoideae grass that has been reported to have comparable tolerant level to drought [3] and salinity [4], thus it became an important food crop in the arid and semi-arid regions. This plant is originated from Northern China and it has been widely cultivated in Asia and Europe [5, 6]. The short life cycle of foxtail millet has made this plant suitable as a second food or fodder crop after wheat or barley [7]. Furthermore, because of the close relative of foxtail millet with several important C4 biofuel crops, this plant is also has been suggested as an appropriate model for biofuel feed stocks [3, 8].

Although foxtail millet is a potential crop to be grown in the saline affected areas where high salinity levels prevent crop production, considerable variation for salt tolerance has been reported within foxtail millet genotypes [9, 10]. Identification of genetic materials contrasting in tolerance level to salinity stress is an important step in generating salt tolerant varieties in an efficient breeding program. Most published research papers about response of C4 grasses to salinity were concentrated on the close relative of foxtail millet, pearl millets (*Pennisetum glaucum* (L.) R. Br.). Various growth stages of pearl millets had been reported to be affected by salinity [2, 10, 11]. Some studies showed that it was possible to identify the salt-tolerance level of pearl millet during germination and early seedling growth [12-14]. However, there is only limited information available for response of foxtail millet to salinity at germination and seedling stages. The objective of this study was to identify foxtail millet accessions with different sensitivity to salt stress at germination and seedling stages.

Materials and Methods

This study consisted of two experiments, identification of foxtail millet accessions differing in salinity tolerance at germination stage (1st experiment) and at seedling stage (2nd experiment). The first experiment was arranged in completely randomized design with two factors and three replications. The first factor was foxtail millet accession comprised of ten (10) accessions from Indonesian Cereals Institute (ICERI), while the second factor was NaCl concentration in the culture solution comprised of 0, 75, 100, and 150 mM NaCl. The range of NaCl concentration was based on germination study on pearl millet [13]. Twenty seeds of each of the 10 entries were germinated on filter paper in closed petri dishes for 7 days in 15 mL deionized water (control) or in 15 mL of NaCl solution in room temperature. Germination percentage was observed at 7 day after treatment (DAT). Ten representative seedlings from each petri dish were used for the measurement of root and shoot length, relative seed germination (RSG), relative root length (RRL), and relative shoot length (RSL) [14].