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RAPD polymorphism in the prebreeding material for cultivation of synthetic variations of lucerne (*Medicago sativa* L.)

Research Article

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Abstract: Genetic diversity between synthetic cultivars (Syn5, Syn7), inbred lines (D_3, D_5, $E_{1/2}$, $G_{1/1}$, $G_{1/2}$) and ecotypes (E16, E51, E182, E231) of lucerne (*Medicago sativa* L.) was studied using the RAPD-PCR method. The plants differed in the efficiency of seed set and in the yield of green mass. The ecotypes E182 and E231 and the synthetic population Syn5 showed the highest fertility. Additionally, Syn5 also showed the highest efficiency of seed set and the yield of green mass. Among the inbred lines, D3 was characterised by the highest yield of green mass and E1/2 by the highest fertility. An optimal combination of yield and biomass was observed for the synthetic population Syn5, obtained by crossing the lines D_3, D_5 and $G_{1/1}$, as demonstrated using comparative analysis. A total of 338 polymorphic products were generated using 20 arbitrary primers. Cluster analysis using the *Unweighted-Pair Group Method with Arithmetic Mean* (UPGMA) in the Molecular image Gel Doc™ XR (Bio-Rad) software based on the Dice's coefficient of genetic similarity showed a division of the studied forms into two groups based on genetic similarity. The ecotype E16 formed one of the groups whereas all of the other ecotypes observed in this study clustered into the second group. A high level of polymorphism among the studied lucerne forms was detected indicating an interesting gene pool awaiting future exploration. Analysis of variance also supported a high diversity among the studied forms. This study provides insightful information into the heterosis effect of synthetic populations or hybrids of F1 lucerine by providing correlations between the genetic background of the inbred lines and their ability to produce a specific yield.

Keywords: *Medicago sativa L.* • *Prebreeding material* • *RAPD* • *Polymorphism*

1. Introduction

With about 32 million hectares cultivated globally, the *Medicago* is one of the most important forage crops [1]. The plant in its current form is believed to have originated in the Caucasus region, which today extends over northeastern Turkey, Turkmenistan and northwestern Iran [2]. Not only is it the oldest cultivated plant, but also the oldest wild crop in this area. Due to its genetic structure, cultivation of alfalfa, which is another name for lucerne, is a rather complex process. Cultivated alfalfa (*Medicago sativa* L.) is autotetraploid (2n=4x=32), allogamous and seed propagated [3].

The synthetics alfalfa cultivars are developed by successively intercrossing selected plants and increasing the seed yield in 2-3 generations. For alfalfa breeders a desirable goal in these cultivars is capturing heterosis. In breeding of synthetic cultivars, there is an inbreeding stage. Unfortunately, alfalfa suffers severe inbreeding depression upon repeated selfing. Severe inbreeding depression results from the high level of deleterious recessive alleles carried by alfalfa

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