Investigation of the Effect of Fusion on Quantitative and Qualitative Characteristics of *Eucalyptus camaldulensis* Dehnh. and Soil Characteristics of Laleh Forest Park in Dezful

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Introduction:

The ever-increasing growth of the population and the subsequent increase in human needs on the one hand and the significant decrease in the world's forests on the other hand, show the role and importance of forestry. In recent years, due to the process of forest destruction in the world, the desire to implement and revive forestry projects has increased as an optimal solution to prevent excessive exploitation of natural resources. In general, afforestation in degraded lands provides tangible products through increasing wood production, providing fuel, fodder, and intangible products such as carbon sequestration, hydrological balance, soil regeneration and fertility, and stability of sloping lands. Forestry creates a new and sustainable ecosystem. Therefore, species with high production capacity and optimal survival should be selected. From the point of view of ecology and forestry, suitable species for forestry should improve the quantitative and qualitative condition of the soil and increase plant diversity. In the afforestation process of species selection, continuous monitoring of quantitative and qualitative characteristics of trees, as well as the study of the impact of afforestation stands on the soil

conditions of the region, are very important to the extent that many studies have been conducted in this field in Iran and the world.

This study was conducted with the objectives of investigating the vegetative characteristics of *Eucalyptus camaldulensis* species in pure and mixed forestry with *Ziziphus spina-christi* species, as well as investigating the physical and chemical characteristics of the soil in these two stands in the tropical region.

Materials & Methods:

Lale Forest Park with an area of 91.3 hectares and geographical coordinates of 22° and 32° north latitude and 24° and 48° east longitude was built at 11 km from the northeast of Dezful city in 1370. The maximum height above sea level in the studied area is 176 meters and the minimum is 142 meters, and it is almost flat in terms of physiography with a slope of 0-2%. This forest park has shallow to semi-deep soils with medium to heavy textured gravel. According to the information of meteorological station, the average annual temperature in this area was 24.4 degrees Celsius and the annual rainfall was estimated at 472.8 mm. The dominant tree species in this forest park is *Eucalyptus camaldulensis*, which is mixed with species such as *Ziziphus spina-christi*, *Prosopis juliflora* and *Olea europia* in some parts with a planting distance of 5×5 meters.

This study was started in April 2021 and sampling was done in a period of 2 months. In this study, data were collected in the form of a completely randomized design with two treatments including pure Eucalyptus afforestation and mixed afforestation (*Eucalyptus-Ziziphus*) in three replications. In each treatment, with a random start, two transects perpendicular to each other with a length of 150 meters and on each transect with 50 meters intervals, square sample pieces with dimensions of 400 square meters (20×20 meters) with the aim of collecting quantitative and qualitative characteristics of the trees in the stand Forestry was implemented. In this research, the quantitative characteristics of Eucalyptus trees as the target species include diameter (Cm), total height (m), crown area (m^2), stability coefficient, diameter reduction coefficient, trunk volume (m^3), leaf dry weight (gr), leaf surface index (cm^2/gr), annual circle width (mm) and wood density (gr/cm^3) were estimated and studied.

Before performing any analysis, the test of normality and homogeneity of the data was performed by the K-S and Lone test. Next, t-test (Independent Samples T-Test) was used to compare the average physical-chemical and quantitative characteristics of trees in two stands. Principal Component Analysis was used to summarize the environmental data and examine the explanation of the degree of dependence of the pattern of mass changes on the environmental

data. By showing the sample parts based on environmental characteristics in the PCA diagram, their change and differentiation pattern was investigated in terms of environmental characteristics. Multivariate analysis was done using PC-ORD software and comparing quantitative characteristics of trees and soil with SPSS version 26 software.

Results & discussion:

The data analysis showed that the mean diameter at the breast, the height of the whole tree, the volume and the width of the annual circles of Eucalyptus were significantly higher in the pure mass than in the mixed mass. The average width of the annual circles in the pure Eucalyptus stand was more than that of the mixed Eucalyptus. The trend of changes in wood density compared to the radial changes in wood density was completely like each other in the two groups studied and fluctuated in the range of 0.99 gr/cm^3 to one gr/cm^3. The results of the examination of crown symmetry between two pure and mixed Eucalyptus stands showed that there is a significant difference, and the symmetry of pure afforestation was more than mixed afforestation. Based on the results of this study, it was found that the amounts of potassium, phosphorus, total nitrogen and organic carbon in the pure mass of eucalyptus were estimated to be higher than the mixed mass.

In this research, the first and second axes of PCA, which had the highest eigenvalues (0.91 and 0.64, respectively) were used. Based on the analysis of PCA, the two groups are separated along the first and second axis, which is the most differentiated along the first axis. Most of the samples of the first group belong to the mixed mass. This group is in the positive direction of the first axis and has the highest correlation with this axis. The second group, where most of the sample parts are related to the pure mass, showed the highest correlation in the negative direction of the first axis. High diameter, trunk volume, total tree height and annual circle width in the net mass play the most important role in the formation of this group. According to the findings of the research, the height and width of the tree's annual rings have a negative correlation with the first and second axis, and the diameter at the breast and the volume of the tree have a negative correlation with the first axis and a positive correlation with the second axis.

Conclusion:

Based on the results of this study, it can be said that many characteristics of trees affected by the composition of tree stands can change. Although these changes are more noticeable at older ages and in the third decade of growth. Therefore, the results of this study can be used in the

management of forestry and its recommendation for planting tree species with a higher growth rate such as Eucalyptus on a large and economic level so that they bring the least consequences and environmental damage.

Keywords: Growth features, Principal component analysis, Pure and mixed plantations, Semi-arid zones, , soil properties.

Declaration of conflict of interest: *The authors declare that they have no conflicts of interest.*