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Study of the Effect of Thinning on *Haloxylon sp*. Stands in Hosein Abad Mish Mast of Qom Plantations,Iran

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ABSTRACT

Careful operation of the silviculture application is one of the most important method for improving the quality and quantity of forestry that thinning forest is one of the important stages of the application. In this study, for investigation forest changes in result operation of thinning application, two stands (thinned stands and un-thinned stand) with equal condition in Hosein Abad are selected. In every stand, 15 samples of 2 Ar (100 m*2) are selected and different factors in two stands after analyzing data and drawing diagram, are compared. Analyzing the data indicated that regeneration and stem height and canopy diameter variables have significant differences but no significant difference in other variable could be observed in two treatment and improved quality of forest caused increasing of them in thinned stands. Quality studies also showed that trees in thinned stands have higher quality and vitality. percentage of trees that have remarkable vitality and stem form were respectively 88.7 % and 10 % in thinned stand ,61 % and 0 % in un-thinned stand. The little effect that thinning has upon motioned stand is due to locating this stand in a desert ecosystem, it also cause the limitation of increment in this area.

KEY WORDS: Thinning; Silviculture; Haloxylon sp.; Vitality.

INTRODUCTION

Half of the countries in the world are totally or partially located in arid and semi-arid regions. Iran is not an exception in this regard. In spite of the bad environmental conditions in most of the regions especially central regions and the extensive role of human being in destruction of natural resources, fortunately, there are remaining of natural values in this land and giving thought to them is of great importance. The existence of destroyed forests of Haloxylon sp. is good examples here. To rebuild these pieces of land and considering the policy of the forests organization in 1965 forestry of Haloxylon sp. as the best consistent species with arid conditions of Iran was done (Khakdaman et al, 2003).

The aim of thinning is concentrated on diameter growth to increased quality, quantity and stability of forest stands. Thinning slices are having two properties of silviculture and economics. Thus, these slices are not decorative tasks. Thinning is gradual release of valuable elements from the pressure of adjacent trees canopy and also individual best selection in favor of selected elements by cutting intrusive elements (Hung, et al, 2005).

Considering the studies done in the world regarding the study of the effect of thinning on different stands of tree species, we can understand the importance and necessity of silviculture operation. These are the examination of the effect of thinning on anatomical properties and properties of Beech in a forest region in Pajim of Behshahr (Rafiqi, 1994), the study of 8-year results of the effects of thinning on man-made planted stands of plot in pilot plan of Emamzadeh Abdollah of Amol (Hassani & Amani, 2004), the study of the effect of thinning operation on Cedrus atlantica Manetti in Kelardasht region (Pourmajidian and Tabari, 2005), the study of the effect of silviculture operation of thinning on qualitative and qualitivative properties of Pinus taeda L (Firuzan, 2006), The study of the effect of thinning on the growth of Pinus taeda in Alabama (Zahner & Whitmor.1960), qualitative reaction of even aged stands of white oak to thinning (Kozlowski, 1971), The study of the condition of thinned habitat and the quality of the wood of their species (Nebeker et al., 1985), the study of the thinning results in a natural stand of Pinus sylvestris in mountainous region of Spain (Montro et al., 2001) , The study of the effect of thinning on surface layer of the forest and its existing nutrient in spruce stands in a region in Belgium (Jonard et al., 2006) and the results of these studies indicating diameter increase, producing wood and improving quality of the body and the condition of stand by thinning operation.

Withering of Haloxylon sp. was taken into attention when 5-6 years passed from the life of the first man-made stands of Haloxylon sp. in Sabzevar and some researches were done regarding the reasons of manmade Haloxylon sp. withering and its result was achieving the necessity of extensive interventions recommended as

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removing a part of stems called "thinning". This was normally the first idea to pay attention to the life of man- made Haloxylon sp. and its related operation (Amani & Parvizi, 1996). These issues had already took the attention of forest authorities as to solve the access to better condition problem of these species in forests and land and high growth, they tried to apply silviculture operation in forested land (Khakdaman et al , 2003, Rahbar, 1987). In Iran habitat characteristics of this plant species is studied in different researches until now (Rahbar, 1987, Amani & Parvizi, 1996, Moqimi, 2005). Fereidooni and Rahbar (2004) in a 5- year study in Gonabad Haloxylon sp.plantations showed that the effect of thinning is little on the height growth and canopy diameter growth of the trees but the general size index of Haloxylon sp. trees was different between treatments.

In the current research, it is attempted to study specifically in the effect of thinning on this stand and in arid ecosystem environment.

MATERIALS AND METHODS

The studied region is located in 35 km distance of Qom-Kashan road. The area of the region is calculated as 19.875 hectare. The average annual rainfall is 140 mm. The natural condition of the region creates condition in which the plants are including between steppe region, arid and desert. Haloxylon sp. plantation in Hosein Abad Mish Mast of Qom is created in 1983 with the density of 100-200 stems per hectare, thinning operation is done once in 2000, and another time in 2004.statistics network of 500×500m was designed. Level of each plot was considered 2R. Plots are rectangle and were measured with the dimension of 10× 20 m.In each plot altitude of the sea level, gradient of the region and geographical direction with UTM coordination were obtained. In each plot, inventory of all the existing trees were accomplished. The diameters under 2cm were considered as regeneration and the diameters above 2 cm were considered as bush. The diameter of branches from the main stem, tree height, canopy diameter, canopy area, the number of stems per hectare and regeneration per hectare and they are measured in terms of quality to vitality and stem for of Haloxylon sp. (Fig.1).

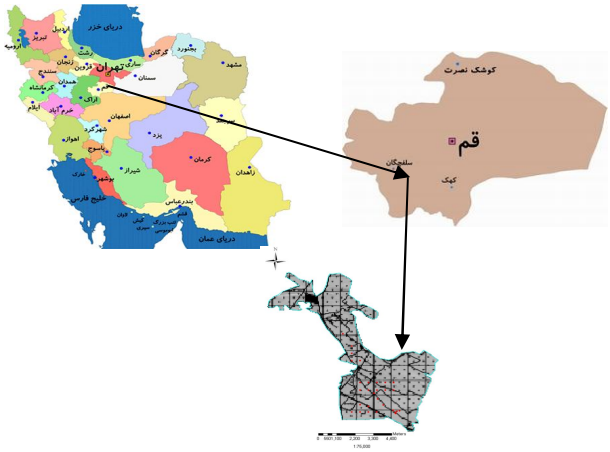

Fig 1- Geographical location of the studied zone

Estimation of average statistical parameters, mode, median, standard error, standard deviation, maximum and minimum with the probability of 95% were done for different variables in two thinned and un-thinned stands. In parametric data section to determine the normality of the data, Kolmogorov–Smirnov test was used. To compare the average of the variables of two thinned and un-thinned population in non-normal variables, Mann–Whitney test and in normal data t-student test were used. To determine correlation and regression between studied quantity variables and creating regression between them by SPSS software, correlation matrices tables for all the variables were obtained separately in two stands at level 95 %. In the next stage, to compare distribution (%) of the trees in different kinds of vitality degree and stem form in two stands thinned and un-thinned, non-parametric Kruskal-Walliswas test used. Also, some diagrams of distribution percent of stems Haloxylon sp.in different kinds of vitality degree and stem form in two stands thinned and un-thinned were drawn.

RESULTS

The results of the study of quantity variables

Statistical parameters calculations of all quantitative variables in thinned stands and un-thinned stands (control) are shown in figure (2).

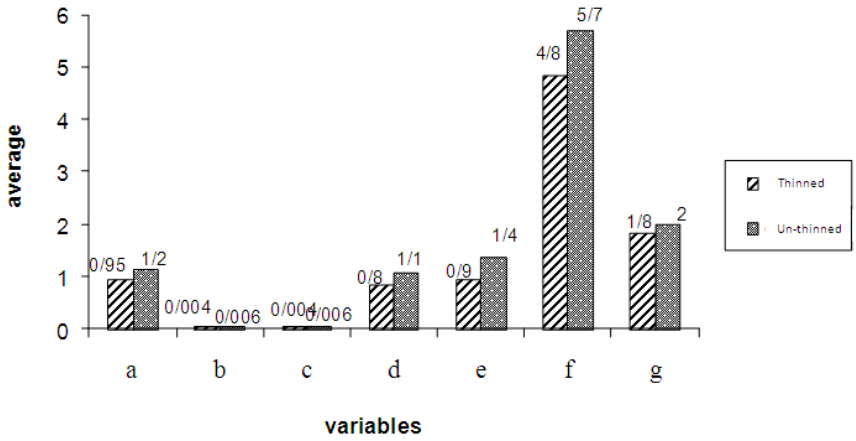

Figure 2- The comparison of indices average in thinned and un-thinned stands (a: Height, b: average cross section, c: Ground cover, d: canopy diameter, e: canopy cross section, f: stem average diameter, g: Dominant height

Kolmogorov–Smirnov test showed that two variables of dominant height and the number of regeneration in were in normal hectare and the remaining variables were non-normal.

The results of t-student test for normal quantity variables show significant difference at 95% level between the number of regeneration per hectare in thinned stands and un-thinned stands and there was no significant difference between dominant height between two stands. This means that thinning increased regeneration amount per hectare but it didn't influence dominant height (Table 1).

Table 1- The comparison of the average normal data by t-student test

	Sig	t	df
Average regeneration per hectare	0.012	2.677	28
Average dominant height (m)	**0.502**	**-0.680**	**28**

Figure (3) shows that thinning had positive effect on increasing regeneration per hectare but it did not increase other indices.

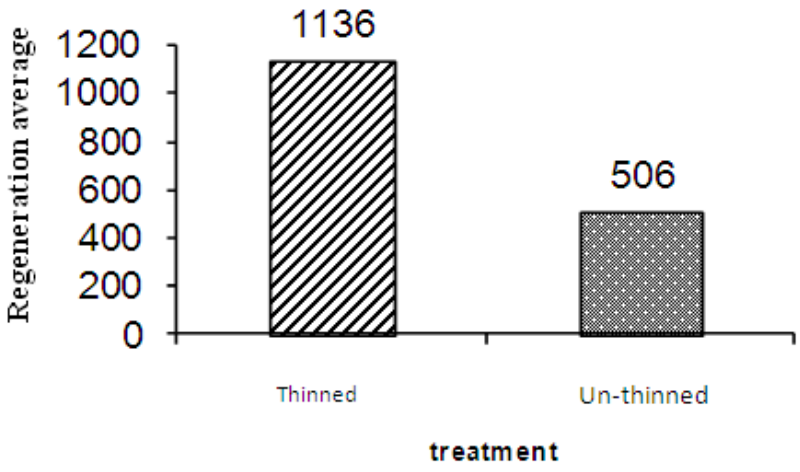

Figure 3- The comparison of regeneration average in thinned and un-thinned stands (control)

The comparison of non-normal data average by Mann–Whitney test shows significant difference between the height of stems and canopy diameter in thinned stands and un-thinned stands and the lack of significant difference between other variables. It means that thinning increased the canopy diameter and height of stems but it didn't influence other variables.

The results of the calculation of correlation coefficient between quantitative variables in thinned stands and un-thinned stands showed that the relations between the average diameter of stem and height in thinned stands and un-thinned stands, stem average diameter and ground cover in both stands, stem average diameter and canopy diameter, average stem diameter and regeneration amount per hectare, stem diameter average and average dominant height are significant by t-student table but there is no correlation between canopy diameter and canopy cross section in thinned stands and un-thinned stands.

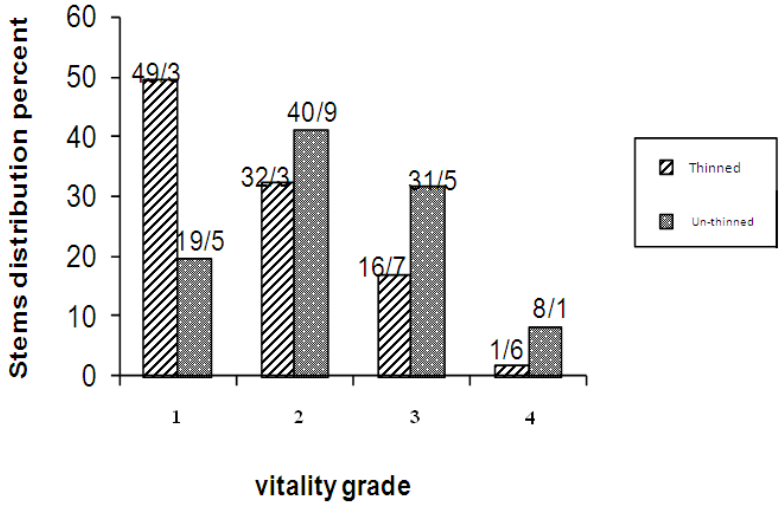

Figure 4- Frequency percent of stems in vitality grades (1, 2, 3, 4) in thinned and un-thinned stands (1: Totally vital, 2: Almost vital, 3: Almost withered, 4- Totally withered)

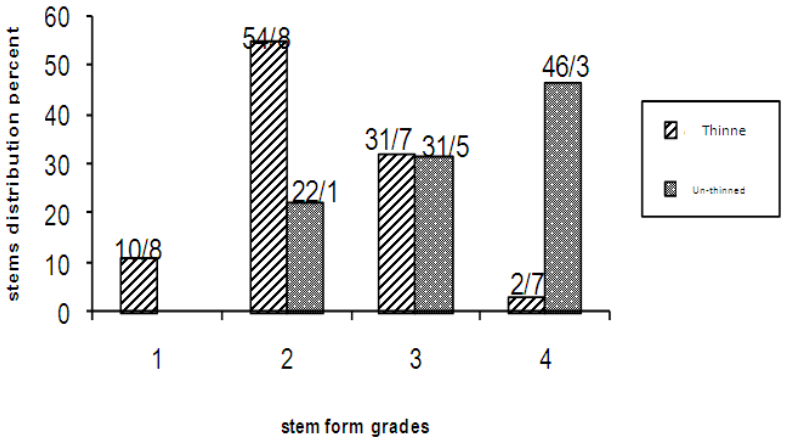

Figure 5- Frequency percent of stems in stem from grades (1, 2, 3, 4) in thinned and un-thinned stands (1: smooth stem, 2: two branches or oblique, 3: Multi-branches or complex, 4: Multi-branches and complex)

The results of quality variables study

1- Vitality

The highest distribution percent was observed 49.3% in grade 1 of vitality (Totally vital) in thinned stand and also in this treatment, the least distribution as 1.6% with grade 4 of vitality (totally withered).In un-thinned stand, the highest distribution of stems in grades 2 (Almost vital) and 3 (almost withered) are 40.9 % and 31.5 % , respectively. Thus, considering figure (4) we find that thinned stand is more vital than un-thinned stand (Fig.4).

Comparing the number of steams percentage in different vitality classes in two un-thinned stand (control) and thinned stand shows that the total percent of stems in 4 grade of vitality had significant difference at level 95% statistically and thinning had positive effect on vitality of the stand.

2- Stem form

The number of stems percentage in different grades of stem form in two thinned and un-thinned stands showed that un-thinned stand doesn't have grade 1 stem form and the highest frequency of the stems in stem form grade 4 is 46.3%. While thinned stand is with grade 1 stem for and the highest distribution percent in grade 2 form was 54.8% and the least distribution in grade 4 stem form was 2.7% (Fig. 5).

The comparison of the percentage of trees in different grades of stem form in two thinned and un-thinned stands by non-parametric Kruskal-Walliswas test showed that the percent of total stems in grade 4 of stem form had significant difference statistically at level 95% and thinning stand had positive effect on stem form.

DISCUSSION AND CONCLUSION

The results in this study showed that thinning on regeneration index per hectare had positive effect and it didn't influences the other studied variables and decreased them to some extent. In this study regeneration increased in thinned regions considerably and growth condition improved. The main reasons is water potential increase in hot seasons for remaining stems and helping the growth capability of bed and increasing organic and mineral storage of soil. Jafari et al (2004) in a study of sand hills of RigBoland in Kashan found that Haloxylon sp. and Calligonum comosum species had significant effects on soil properties of sand including organic substance, electrical conductivity, acidity, phosphor, potassium and the percent of soil texture components. Also they showed that Haloxylon sp. and Calligonum comosum species increase organic substances and nutrient elements of soil and improve soil structure in long term period. Jonard et al (2006)in his research about the effects of thinning on forest soil surface layer and nutrient elements in it in spruce stands in a region in Belgium found that some elements such as Nitrogen, Phosphor and potassium increased in forest bed and this case increases protection of root growth. Afkham Shoara (1995) in Khorasan and NIknahad (2002) in Hossein Abad of Qom found that Haloxylon sp. plantation area increased and fixed the amount of phosphor.

Kianipour (2007) in mass optimization of forestry of Haloxylon sp. in Kashan found that they expected that by thinning and extending growth space and decreasing completion between trees, growth intensity is increased but they showed that although growth intensity is more than control stand, it is not considerable. He believes that by increasing the distance between bushes, some of soil moisture storage is evaporated in the space between them due to receiving more light and they are out of reach for trees. This is because of the fact that horizontal extension of Haloxylon sp. root is restricted to shade of the bush. On the other hand, due to the wide open space between the bushes, more space of cover canopy is subject to light, wind and high evaporation.

Rytter & Stener (2005) in their study about thinning in hybrid stand of Populus in the south of Sweden found that un-thinned stands have high general annual growth but by a significant difference, average stem diameter in these stands is less than thinned stands. In the current study, we didn't find similar result as Rytter & Stener regarding stem diameter increase due to thinning and as thinning operation is done recently on the studied stand (2000, 2004), it seems that silviculture operation didn't have any influence on stand yet. Also, the arid ecosystem of this plant has caused poor habitat with weak regeneration and in besides soil salinity and growth speed is at low level. Due to the mentioned reasons we can justify the lack of effects of thinning on increasing stems diameter and their cross section.

Fereiduni and Rahbar (2004) in their study on the effect of thinning in a 5-year period in Gonabad Haloxylon sp. plantations found that the effect of thinning treatments is little on height growth and increasing the growth of canopy diameter. It is worth to mention that in this experiment in comparison with other similar experiments in which canopy diameter size of the trees in Gonabad was averagely 53.8% bigger than their height before thinning, 5 years after thinning, this figure decreased to 56.5%.

Considering the growth and climatic conditions, thinning operation should be done frequently and with light intensity because Haloxylon sp. trees longevity is low and they grow slowly and considering the ecosystem they are located in, in case of heavy or even moderate thinning, the stand cannot compensate lost stems.

As it was shown in the results, by thinning, stem form was improved considerably and high percent of the stems had well to excellent form. And about the vitality of the stems, by thinning, the quality and vitality of the stands increased. This can be said that thinned stands due to thinning operation and relative emptiness of the stand from dry and useless trees and finally high resistance of the stems against the environmental factors are having high

quality in comparison with un-thinned stand. A research in Denmark showed that the weeds are reduced by thinning operation as the trees with lots of weeds are treated in the next stages.

By the results in the current study, it is recommended that in silviculture management in these Haloxylon sp.plantations, irregular interventions should be avoided. This aim should be done in the form of silviculture management plan provided already.

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