Comparison of Natural Regeneration Establishment in the Forest Stands under Management

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Abstract: With regard to desired natural regeneration establishment that it is the goal of selection systems. The role of tree and group selection silvicultural systems on the quantity and quality of natural regeneration was conducted at four site of forest. First, 100 circular sample plots has been selected by use of random systematic inventory. Then into the each plots nine micro-plots defined. The results of one way analysis of variance, multiple ranges Tukey-HSD test and Chi square test of seedling showed that there is significant difference in the level of 0.05 between mean of seedlings number, mean of *carpinus* seedlings number, percent of the health, shining, even and vertical seedlings in tree selection and group selection systems. So in the establishment of natural regeneration the quantity and quality of natural regeneration in tree selection system is more desirable than group selection system. In the bigger cutting sites the stand comes out of climax conditions and in the result it will reduce the establishment percent of original species regeneration. With regard to the desirable results of tree selection system it is necessary to recommend that tree selection system should be write down in forest management plans description.

Key words: Natural regeneration · Tree selection system · Group selection system

INTRODUCTION

Since environment destruction especially in respect of forests, decreased forest varea and natural regeneration due to performing some silvicultural techniques are critical warnings and among major issues for human, then it's necessary to consider most important factor in survival of forests namely natural regeneration [1].

Firstly, it must be keep in mind that it is necessary to preserve bio diversity stability by using most suitable silvicultural system for forest stands with typical species [2]. Selection and execution of suitable silvicultural system can create a forest stand with good natural regeneration (quantitative and qualitative), normal and desired structure (normal species composition, normal stand density normal or ordinary blending from, normal diagonal distribution and scattering, existence of all germination stages including sapling, seedling, loose and spot) [3].

Then forest's beautiful view, natural form of waterway and natural components of habitat will be preserved wholly with biodiversity stability [4]. Therefore, results of performing forestry plans must be evaluated to recognize process of sustainable forests development

and spread [5]. In fact best indicator and natural result of conducting these plans is young established stands developed by using natural regeneration in another words seedlings established instead of harvested trees [6]. Then most suitable measure to evaluate success of forestry plans is extent of establishment natural life restoration [7].

Performing group single selection system will decrease natural life restoration strength and will bring down species diversity [4]. Silvicultural system has adverse effects on soil composition. various effects of silvicultural systems on leaf litter and soil nitrogen mineralization [3]. Regeneration as one of most important measures of evaluating sustainable management of natural forests [7]. Forest survival has meaningful dependence on key goal must be considered.

Preserving biodiversity stability through finding most suitable silvicultural system for stand. Than major goals of program could be achieved and measurements of developmental periodic evaluation towards these goals could be performed. According to the fact that natural regeneration is most inexpensive and sustainable regeneration system, then its establishment is major goal of all silvicultural systems.

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MATERIALS AND METHODS

Study Area: This study performed in district Guilan province in north of Iran. The area of district is 2145 hectares.

Studied Plots: 100 circular sample plots (with radius 17.8 m and area of 1000 m) and each sample plot containing 9 micro plots (3×3m) totally 900 micro plots.

Sampling Method: Firstly, using random systematic inventory moved from defined base point on a baseline in forest and 100 sample plots were selected with consistent distribution. 50 sample plots of those plots were centered with a log cutt10 years ago with 50cm diameter. (With help of labor cut related tree). Then 9 micro plots were defined in each plot first micro plot was defined in the centre of plot and 2 micro plots with equal distance (3.5m) were defined in each of 4 main directions. (Totally 900 micro plots). In addition, additional 50micro plots were selected adjacent to undisturbed or control parts and 9 micro plots were defined as previously in each sample plot. Finally in each micro plot following parameters were measured such as situation of plot, physiographic, soil status, forest stand status, typical plants, qualitative and quantitative status of maternal trees.

Statistical System of Data Analysis: Processing data analysis, comparison and evaluation of silvicultural systems were performed by software Excel, SPSS and MINITAB. Interpretation or evaluation of regeneration status results in respect of sapling and seedlings frequency (in 2 growing stage), percent of seedlings qualitative status (health, shining, even and vertical) were performed using figures resulted from EXCEL and Chi-square test. Mean frequency of sapling and seedling of various species in tree, group and control single - selection silvicultural system were compared using results of one way analysis and multiple - ranges turkey - HSD Test in significance level of 5%.

RESULTS AND DISCUSSION

Results of Sapling and Seedling Number Comparison (5- 130 cm Height) in Different Treatments: The greatest number was in single - selection system with 7246 seedling in hectare. Number of seedling in single - selection system was greater than number of seedling in control (undisturbed system with 6427 seedling in hectare) but number of seedling in group single - selection system (5765 seedling in hectare) was lower than number of seedlings in single and control single selection system. There is significant statistical difference between group selection and single selection systems (Figure 1).

Results of Comparing Mean Number of Saplings (5- 130 cm Height) in Hectare Various Treatments: Results of statistical analysis of one way analysis of variance indicated that there is no significant difference between mean number of sapling in studied system. (d.f = 2 F = 0.0166, P = 0.984).

Results of Comparing Mean Number of Seedlings (31 - 130 cm Height) in Hectare in Different Treatments: Statistical analysis was performed by using SPSS and one - way analysis of variance and multiple ranges Turkey - HSD tests. Results indicated that the number of seedlings in 3 studied treatments was different and there is significant statistical difference. (d. f = 2, F = 4.905 P = 0.011).
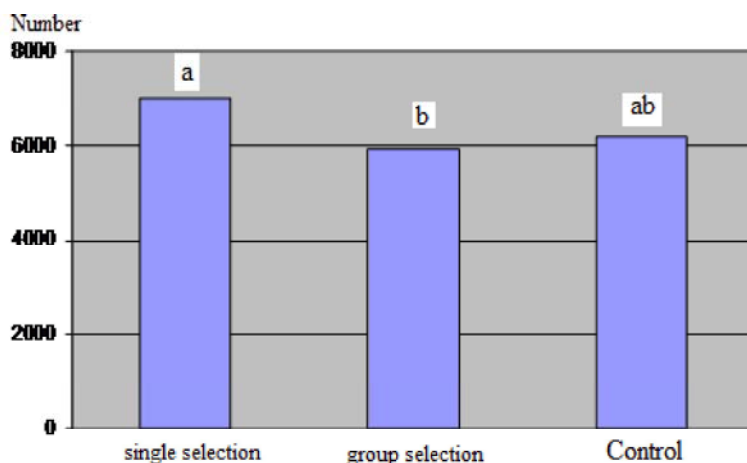

Fig. 1: Comparison of mean number of saplings and seedling (5 - 130 cm height) in group and tree single selection system
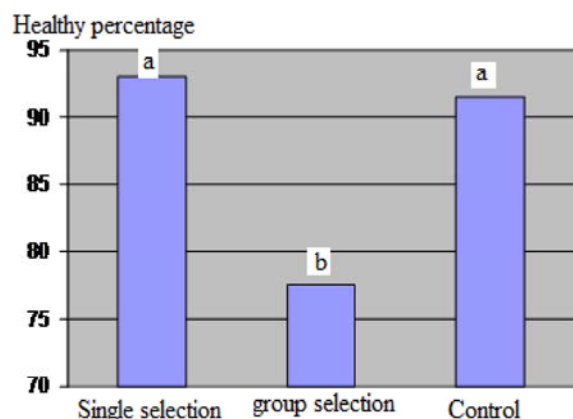
Fig. 2: Structure of qualitative status of seedlings (healthy percentage) in group single - selection and tree single - selection treatments

Results of Comparing Mean Number of Seedlings and Sapling of *Fagus* in 3 Treatments in Hectare: Results of analysis of variance indicated that there is significant difference of 5% between mean number of seedlings and saplings of *Fagus*.

Results of Comparing Mean Number of Acer Saplings and Seedling in 3 Treatments in Hectare: Results of analysis of variance indicated that there is a significant difference of 5% between mean number of saplings and seedlings of Acer (d.f = 2 F= 1.204, P = 0.306)

Results of Comparing Mean Number of Saplings and Seedling Carpinus in 3 Treatments: According to results of Turkey - HSD test, there is a meaningful difference of 5% in mean number of saplings and seedlings between treatments (d. f = 2, F = 4.31, P = 0.017).

Comparison of Mean Number of Seedling Seedlings of Other Species in 3 Treatments: According to results of analysis of variance there is no significant difference in mean number of saplings and seedlings between treatments (d. f = 2, F = 0.459, P = 0.634).

Comparing Percent of Healthy Saplings and Seedlings in Single, Group and Control Treatments: Percent of healthy seedlings in group single - selection (78%) was lower than percent of healthy seedlings in control (undisturbed) (91%) and tree single - selection (92%). results of chi - square test indicated that percent of difference in health of seedlings between 2 treatments is significant in level of 5 (Figure 2).

Comparison of Percent of Shining Saplings and Seedlings in Single, Group and Control Single - Selection Treatments: Percents of shining seedlings in single selection system was lower (91%) than control system (undisturbed, 93%) and group single - selection system (93%). Chi-square test indicated that difference between percent of shining seedlings of treatments is significant statistical difference between group and single - selection systems (Figure 3).

Comparison of Percent Age of Even Seedlings and Saplings in Single, Group and Control Single - Selection Treatments: Percentage of evenness of seedlings in single selections system was 39%. percentage of evenness of seedlings in group selection system (44%) was lower than percentage of evenness in seedlings of control system (undisturbed 42%). Results of chi - square test indicated that difference between percent of evenness in seedling of treatments is significant in 5%.
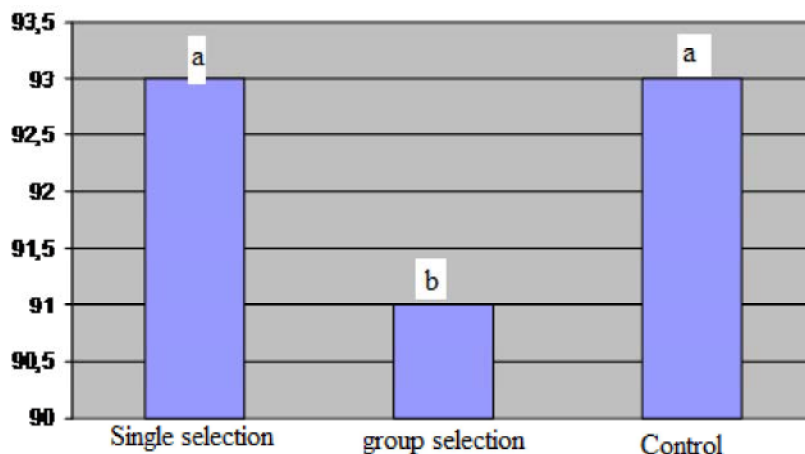

Fig. 3: Structure of qualitative status of seedlings (percent of shining) in group and single selection systems
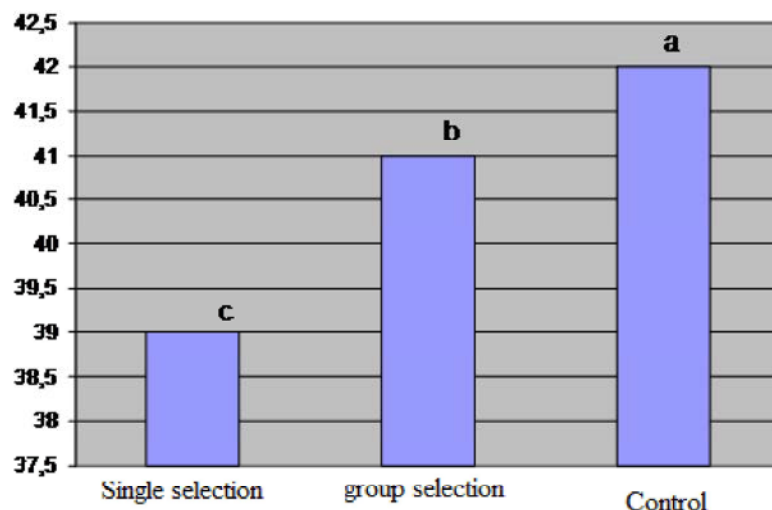
Fig. 4: Structure of seedlings qualitative status (evenness percentage) in single and group and control treatments)
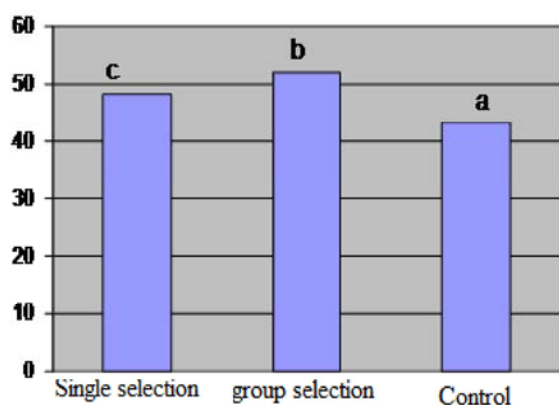

Fig. 5: Structure of seedlings qualitative status (vertical) in single and group and control treatments

In other word, there is significant qualitative difference between tree and group single selection systems (Figure 4).

Comparison of Percent of Vertical Saplings and Seedlings in Single, Group and Control Single Selection Treatments: Difference in percent of vertical (seedlings in treatments was significant in 5%. In other word there is significant difference between tree and group single - selection systems in respect of verticality according to chi - square test (Figure 5).

Total Results of All Tests Conducted on Seedlings Quantity: Total tests indicated that there is significant difference of 5% between means of three treatments. (Figure 1, d.f=2, F=4.905 P=0.011).

Results of one way analysis of variance indicated that there is no significant difference between mean number of systems (d. f = 2, F = 0.0166, P = 0.984). Total results of turkey - HSD test and one way analysis of variance of three parameters of mean number of saplings and seedlings in *Fugues, Acer* and *carpinus* indicated that there is no significant difference between 3 treatment in 5% (Table 1). But according to results of Tukey - HSD test there is significant difference of 5%, between number of saplings and saplings of *carpinus*. (d. f =2, F = 1.204, P = 0.306).

Total Results of All Tests Conducted on Seedlings Quality: Total results of chi-square test indicated that there is significant difference between percent of healthy, shining, evenness and verticality of seedlings in three treatments in 5 %. In other words, in respect of quality, percentage of health and shining seedlings in single selection systems is higher than group selection. (Figure 2, 3), reverse (Figures 4,5).

Explanation and Evaluation of Total Results of Tests: According to results of Tukey - HSD, difference between mean number of 2 parameters of saplings and seedlings, difference of mean number of seedlings, mean number of saplings and seedlings in three treatments is significant in 5%. Then according to these results, final conclusion is that conducting group selection system not only decreased the number of seedlings in hectare but also decreased the percent of shining and healthy seedlings (Figures 2,3).

Table 1: Mean frequency of sapling and seedlings of fagus, Acer, Carpinus and other species (*Parrotia persica, persimmon, birch, ulmus glabra*) in tree group and control single selection systems

Kind of management	Fagus seedling tree in hectare	Acer seedling tree in hectare	Carpinus seedlingtree in hectare	Otherspecres seedling tree in hectare
Single selection system	9395	3043	367	1441
Group selection system	778	2694	998	1295
Control (undisturbed)	1816	2724	612	1275

Mean while, decrease of seedlings numbers number in hectare is severe in vegetative stage. In relation of species composition structure, performing group single - selection system when compared to control caused increase of *carpinus* saplings and seedlings number. In contrast, seedlings of fugues and Acer have decreased (Table 1).

Discussion of Influence of Herbaceous Layer of Forest Floor on Regeneration: Results of present study indicates that by performing group selection system, raspberry and herbaceous species. Will cover all area due to creating larger space then seeds of maternal trees don't reach soil bottom easily, thus a few seedlings will grow (Table 1).

In addition greatest *carpinus* regeneration was observed in herbaceous layer with density of 50-55% and lowest regeneration of *carpinus* was observed in herbaceous layer with density of 40 - 45%.

Growing sites where there is competition between herbaceous species, soil moisture will approach earlier to critical limit due to increase of consumed water amount. Then water shortage in seedlings establishment soil will be slower.

Influence of Percent of Forest Canopy Layer on Regeneration: Results of this study show influence of lighting conditions on quality of *Fagus* restoration. Intensity of low light like high light has a negative effect of quality of restoration in *Fagus* (Table 1). *Fagus* restoration will decrease in open and closed canopy layer. Essentially, *carpinus* is a photopia and thermopile spacers. Thus, as soon as creation of a larger window and increase of light in forest floor, conditions for increased *carpinus* seedlings will be provided. Results of this study confirm this finding.

Influence of Altitude from Sea Level on Regeneration: Single selection system is completely suitable for severe conditions of regeneration in mountains [8]. Conducting groupselection system in mountainous forests will decrease number of seedlings in hectare [4]. Results of this study were consistent with mentioned study.

Determine sustainable development level of Belt forests, single selection system is more suitable than group single selection system [9]. Single selection silvicultural system in mountainous forests is more suitable than group selection due to extreme ecological conditions [10].

Final Discussion of All Parameters Influence on Regeneration: Results indicates that single selection method was completely consistent to nature and increased natural restoration strength (Figure 1). Then, tree regeneration system's restoration strength is higher than normal. Effects of cutting of tree and group selection systems by performing control system. They funded out that performing group selection system will decrease the number of seedlings of high class species in hectare. Results of this study also is consistent to previous study (Figure 1, Table 1). Permissible basal cuttings without decreased restoration strength of forest may be continued for long time [11].

Optimum Silvicultural System: Analysis of all results and discussion can be used as typical result for tree single selection system for this forest and other similar forests which is an optimums silvicultural system. At the end, it is recommended to avoid group selection system in product forests due to decreased regeneration and causing loss of forests production power.

REFERENCES

1. Prescott, C.E, 1996.a Field guide to regeneration of salal-dominated cedar hemlock sites in the CWH. Faculty of Forestry, U.B.C.J. For, 97: 4-10.

2. Hutcheson, J.W.P. and D. Given, 1999. Potential Value of Indicator Conservation and Management of New Zealand Terrestrial Communities. Science for Conservation.

3. Prescott, C.E., 1997. Effects of Clear Cutting and Alternative Silvicultural Systems on Rates of Decomposition and Nitrogen Mineralization in a Coastal Mountain Forest.forest Ecology and Management, 95: 253-260.

4. Heywood, V.H.P. and R.T. Watson, 1995. Global Biodiversity Assessment. Published for the United Nation Environment Program. Cambridge University Press, pp: 140.

5. Sardar, M.R., 1996. Imprtance of evaluation of forestry projects with refrencesto roural development Pakistan. J. Forestry, 46: 107-114.

6. Wang, B.G., G. Chen and H. Cao, 1999. Assessment of the forest landscape assets of Tianzhu shan forest park in Xiamen. J. Beiging Forestry University, 21: 84-88.

7. William, P.J. and P. Veit, 1998. Building capacity for sustainable management of natural forests in east Africa. Reader in Natural Resources Management, pp: 71-107.

8. Burn, F. and B. Gifu, 1998.a Mapping method for qualitative assessing the overall value of mountain forests. French J., 131: 131-147.

9. Brad, S., J.P. Kimmins, C. Welham and K. Scoullar, 1999. Defining stand level sustainability and exploring stand level steward ship. J. Forestry, 97: 4-10.

10. Przybylska, K., 1999. Avaluing system for assessing mountain forest a adapted to forest management planning needs. Sylwan, 143: 27-36.

11. Marusak, R., 1999. Problems of Expected Growing Stock Calculation with Reference to Calculation of Long Range Allowable Cut.acta Facultatis Forestalis Zvolen, 40: 131-144.