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## Effect of Application Method of Wet Strength Additives on Paper Properties

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### ABSTRACT

In order to simultaneously improve wet and dry strengths of paper and decrease environmental issues related to the wet strength resins, in this study effect of application method of wet strength additives on paper properties was investigated. Wet strength resins were applied in four methods including spraying an aqueous glyoxal solution on to the surface of wet paper, addition of aminated polyacrylamide (PAa), glyoxylated polyacrylamide (GPAM) and polyamide-epichlorohydrin (PAE) to the pulp suspension, and spraying of aqueous glyoxal solution on to the surface of wet paper containing PAa. The results showed that wet strength of paper increased significantly after glyoxal spraying, which had high correlation with the amount of applied glyoxal. The glyoxal spraying had insignificant effect on the dry strength of paper, however tensile energy absorption (TEA) of paper decreased and stiffness of paper with increasing glyoxal spraying. Addition of PAa to the pulp suspension slightly increased wet strength, while dry strength and TEA of paper increased significantly. Glyoxal spraying on the wet paper containing PAa distinguished as the best method improving paper properties while simultaneously increased wet and dry strengths without increasing effect on the stiffness of paper. By this method, the best results obtained in the paper contained 0.4% PAa and 1% glyoxal spraying which was optimum compared to the paper treated commercial GPAM and PAE resins.

**Keywords:** dry strength, glyoxal, aminated polyacrylamide (PAa), glyoxylated polyacrylamide (GPAM), spraying, wet strength resin.

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## Thermal Behavior and Formaldehyde Emission of Modified Urea Formaldehyde Resin by Furfural

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### ABSTRACT

There are adequate sources for wood adhesives, but scarcity of oil resources can affect the cost and future availability of oil based resins. For avoiding of this process, seeking for feasibility of replacement of these oil feedstocks is necessary. In present work, thermal behavior of urea formaldehyde resin modified by furfural was investigated. The thermo-gravimetry was used for this purpose, and FTIR spectroscopy also was used to determine the functional groups in adhesives. In this study, three types of resins including industrial urea formaldehyde, and urea formaldehyde furfural in 25% and 50% of formaldehyde replacement by furfural were considered as variables. The formaldehyde emission from manufactured particle-board also was measured. Results of thermal studying of adhesives indicated that resin modification had improving influence on thermal properties of resin, especially in higher temperatures (around 220-380°C). Obtained FTIR spectrums also revealed the much similarity between groups and bonds of industrial resin and modified resins. Modification of resin by furfural reduced the formaldehyde emission of particleboard to E<sub>1</sub> level.

**Keywords:** formaldehyde emission, furfural, IR spectroscopy, thermal behavior, thermogravimetry, urea formaldehyde resin.

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## Effect of Chitosan-Polyvinyl Alcohol Coatings with Nisin on Antibacterial Properties of Packaging Paper

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### ABSTRACT

It is possible to develop new biodegradable active packaging by coating biopolymers on paper-based packaging material and also incorporating proper antimicrobial agents into coating structure. In this study bacterial contamination of two commercial cardboard were evaluated. In order to manufacture an appropriate antibacterial packaging material, coating of chitosan-poly vinyl alcohol blends with different ratios and of nisin were applied on cardboard made from recycled fibers. The antibacterial activity was investigated separately by preparing corresponding films. The results indicated that the chitosan-poly vinyl alcohol films activity against Gram-negative *Escherichia coli* bacteria are significant. The more chitosan was blended the more antibacterial activity was observed. Although with incorporating nisin into film structure, the activity against Gram-positive *Staphylococcus aureus* bacteria and *Bacillus* bacteria extracted from the board also developed. The most antibacterial activity was observed at films with 15% nisin. The results indicated the synergistic effect of antimicrobial agents with different mechanisms in fabricating active packaging materials.

**Keywords:** antibacterial activity, chitosan, film, nisin, paper packaging, poly (vinyl alcohol).

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## Evaluation of Surface Sampling Method for Estimating Wood Quality (Fiber Length and Density) in Standing Poplar Trees

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### ABSTRACT

Wood farming and especially poplar plantation is a key answer to the increasing demand of raw materials in wood and cellulosic industries. According to the diversity of wood applications, taking into account the wood quality and grading by wood farmers/buyers as well as its quantity can lead to an optimal management of production and consumption. In this regard, it is necessary to introduce and promote an easy, economic and non-destructive method of evaluation wood and fiber quality in standing trees. In this research, it was tried to clarify whether extracting tiny samples from outer part of a trunk could be an appropriate method for evaluating wood quality of the whole tree. Hence, four elite poplar species from five different sites of Iran were selected and in each site, cores were extracted from breast height of 20 trees. Each core was divided into three parts: near bark, middle, and near pith and fiber length and wood density was measured for each part using conventional methods. Statistical analyses showed in most species/sites, there is significant difference between outer part and corresponding average values of a tree in term of measured variables. Fiber length and wood density, respectively, were lower and higher in outer part of a tree in comparison to the tree average. However, there was a strong correlation between the values of outer part and tree average and therefore, for each measured property, an equation was proposed by which the poplar wood quality can be estimated knowing the outer part property.

**Keywords:** Fiber length, NDT, *Populus*, standing tree evaluation, wet density, wood quality.

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## Using Magnesium Hydroxide as Replacement of Sodium Hydroxide in Deinking of Old Newspapers and Old Magazines Mixture

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### ABSTRACT

This study was aimed to investigate the possibility of using magnesium hydroxide as an alternative for sodium hydroxide in deinking of newsprint and magazine mixture. The old newsprint and magazine mixture (ONP/OMG -70/30) was treated by magnesium hydroxide at three levels: 1, 1.5 and 2 percent (based on oven dried pulp weight), for 20 min. Optical and mechanical properties and effluent COD load were compared to those of control and NaOH treated samples. Results showed that effluent COD load of Mg(OH)<sub>2</sub> chemical treatments was less than that of NaOH treatment. Also, results indicated that 1.5% Mg(OH)<sub>2</sub> treatment, which was done in pulp deinking, had better results compared to other treatments and also NaOH treatment. In the other words, it is the best treatment for both optical and mechanical properties. Thus, substitution of sodium hydroxide by magnesium hydroxide for deinking of newsprint and magazine wastepaper suggested.

**Keywords:** COD, deinking, magnesium hydroxide, old magazine, old newsprint, sodium hydroxide.

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## Performance of Pectinase on Improving the Properties of ONP Deinked Pulp by Washing Method

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### ABSTRACT

Influences of temperature as well as holding time on physical and mechanical properties of Fir wood were studied in this work during the oleothermal wood modification. Wood samples were cut and treated oleothermally in the soybean oil at 200 and 230°C for the holding time of 1, 3 and 5 hours. Weights and the dimensions were measured before and after treatment. Bending strengths, water absorption and swelling, dry density and the impact load resistance (un-notched) were determined in the samples. Results revealed that the oleothermal treatment of wood had no significant effects on the density. Dimensions and the weights were reduced significantly in the treated wood. There was more reduction in the radial dimension than that of the tangential one. It means that wood was collapsed in this direction after treatment. Reductions in the water and moisture absorption as well as the swelling were determined in the samples. Bending tests revealed reduction in moduli of the elasticity and the rupture. There was no significant change in the impact load resistance of the treated samples.

**Keywords:** fir wood, oleothermal wood modification, mechanical Properties, physical properties.

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## Producing Of Microball Nanosilver and Applying To the Paper to Improve Its Antibacterial Property

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### ABSTRACT

In this study, microball nanosilver was produced with dimensions of about 1 micrometer in order to reduce the risks of absorption of nanosilver particles through skin and inhalation. Different concentration levels of silver have been used in making of hand-sheets. The antibacterial properties of all hand-sheets were evaluated against *Escherichia coli* and *Bacillus subtilis* bacteria. Results indicated that the use of nanosilver in both concentration levels (25 ppm and 100 ppm) stop the growth of bacteria and reduce the rate of their growth by 99%. However, results showed that the use of microball nanosilver as an additive did not reduce any properties of paper such as physical, mechanical and optical properties except brightness parameter. The bulk of paper has shown a significant increase. Also, the microball nanosilver has no significant effect on the water absorption of final papers.

**Keywords:** anti-bacterial properties, *Bacillus subtilis*, *Escherichia coli*, nano silver.

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## Effect of Chemical Modification of Wood Flour on the Static and Dynamic Mechanical Properties of Polypropylene Based Composites

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### ABSTRACT

In this study, the effect of chemical modification of wood flour on the mechanical properties of polypropylene based composites was investigated using by dynamic mechanic thermal analysis. To meet this objective, the wood flour treated with chemical components including alkaline, acetic acid and benzoyl chloride, and then the chemically treated fibers were compounded with polypropylene at 180 °C, 60 rpm and 60 wt%, in an internal mixer. The samples were made by injection molding. Static mechanical tests including bending and tensile were performed. DMTA test in the range of -60 to 120 °C with 5 °C/min temperature rate and 1 Hz frequency was done. Changes in the chemical structure of chemically treated fibers were tracked by Fourier transform infra-red (FTIR) spectroscopy. Results indicated that the mechanical strength, storage modulus and loss modulus of samples increased by chemical modification; however, the mechanical loss factor decreased. Also, the glass transition temperature and alpha transition in the chemically treated samples transmitted to higher temperatures. The reduction in the intensity of O-H bond at 3400 cm<sup>-1</sup> and the formation of the ester bond at 1740 cm<sup>-1</sup> represents the change in the chemical structure of the fibers as a function of chemical modification.

**Keywords:** chemical modification, composite, fourier transform infra-red, mechanical properties, transition.

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## Influence of Joint Type Used in Core Layer on the Mechanical Properties of Blockboard Veneered with Different Wood Species

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### ABSTRACT

This study evaluated the effects of end to end joint types of athel stripes at three level (end to end basic, end to end mitrated and end to end half lap joint) used in core layer veneered with three wood species (fir, beech and oak) and glued with three different ratio of melamine formaldehyde/urea formaldehyde resin (0:100, 25:75 and 50:50) on the bending strengths of blockboard. According to analysis variance of data, it was determined that the type of joint had the effect on the modulus of rupture (MOR) and modulus of elasticity (MOE), significantly, so the panels having short stripes jointed with end to end half lap joint in core layer had the highest strength properties. The wood species of veneer and MF/UF resin ratio had the effect on the mechanical properties of panels, significantly. According to t-test results, the differences between the bending strengths perpendicular and parallel to the face/back veneer grain were significant. The MOR and MOE perpendicular to the face/back veneer grain were higher than other. The panels manufactured with strips joint by end to end half lap joint in core layer veneered with fir glued with MF/UF ratio of 50:50 had the highest MOR and MOE perpendicular and parallel to the face/back veneer grained (48.48 N/mm<sup>2</sup>, 40.50 N/mm<sup>2</sup>, 9153 N/mm<sup>2</sup> and 5962 N/mm<sup>2</sup> respectively).

**Keywords:** athel, bending strength, blockboard, half lap joint, melamine urea formaldehyde.

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## Evaluation the Maintenance Situation of Road in *Arasbaran* Region

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### ABSTRACT

Forest roads are basic infrastructures for management of forested areas. Sustainable management of roads depends on regular and timely forest road maintenance. Road inventory is as an important tool to recognize the needs of roads and do corresponding correction operations. GIS can be a powerful tool for acquirement, analysis and management of data in road management. The purpose of this study was to obtain the required information for road management in *Kaleibarchay* watershed, *Arasbaran* region, to provide practical maintenance and monitoring solutions. To do this, 131 samples were selected and for each sample some data such as road gradient, template, problems of surfacing and slope stability were collected. Then spatial data and corresponding database were developed in ArcGIS and were compared to standard values. According to the results cross-slope has the highest consistency with standard values. 25.19% of the road length was without any sign of surfacing problems. Among surfacing problems rutting has the highest and pothole has the lowest abundance and cut slope had more stability problems than fill slope. In order to better management of drainage system, we suggested some places for new cross drain including culverts and fords. The results of this research showed the potential application GIS for forest roads management.

**Keywords:** *Arasbaran* region, forest roads, GIS, road inventory, road maintenance, road management.

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## Institutional Network Analysis for Regional Policy Making of Zargros Dry Forests (Case study: Boyer-Ahmad County)

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### ABSTRACT

Doing centralized and coherent activities between governmental agencies is essential at any level. Creating suitable institutional structure for appropriate solutions of policy problem in natural resources at multiple levels is possible using application of network governance. The aim of this paper is institutional network analysis with co-management of Zagros dry forests in regional (county) level. Quantitative approaches are used for this research which all relevant institutions of co-management has been questioned. Based on this research results, institutional cohesion is 43 percent (medium) and sustainability of institutional network is about 47 percent (medium) according reciprocity index. The network centrality is medium based on output links that can be concluded policy must be on reducing centrality on decision making for sustainable management in Zagros dry forests at regional level. Finally, it could be said that network analysis is a successful tool that can help manager and planner on effective network governance. It is necessary to strength the institutional cohesion for natural resources policy.

**Keywords:** co-management, institutional cohesion, network governance, regional policy, social network analysis, Zagros dry forests.

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## Evaluating the HEC-HMS Hydrologic Model in Order to Simulating Flood Hydrograph in Forest Basin (Case Study: Kheyroud Forest)

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### ABSTRACT

Soil Conservation Service Curve Number method (SCS-CN) is a widely applied technique for predicting direct runoff from rainfall has been used around the world. In this study, the curve number maps and entry physical model data of Kheyroud basin to HEC-HMS model, the HEC-GEOHMS extension in ArcGIS software and Google Earth satellite images were used. In addition to the statistical analysis of survey data of maximum daily rainfall in rainfall stations, and entry the basin meteorological model into HEC-HMS, the SPSS, Excel, Easy Fit, and Curve Expert were used. Flood hydrograph in 2, 5, 10, 25, 50 and 100 years return periods have been simulated. Finally, in order to model calibration, after a review of hydrometric data of Kheyroud station, three events corresponding to the calibration and validation, two events were used for model calibration and one event was used for validation. The results of the peak flow output from each sub basin showed that A1 sub basin with a maximum peak flow was located in the first place of floodness and the B2 sub basin are ranked in the last place of floodness due to the minimum size compared to the other sub basins. Result showed that the performance of the calibrated HEC-HMS model to simulate the flood peak flow has been approved in the studied area.

**Keywords:** floodness, HEC-HMS model, Kheyroud forest, simulation, validation.

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## Afforestations Impact of *Pinus eldarica* and *Cupressus arizonica* on Rainfall Interception in a Semiarid Climate Zone

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### ABSTRACT

The main goal of this study was to compare of rainfall interception ( $I$ ) by *Pinus eldarica* and *Cupressus arizonica* plantations afforested in the Chitgar Forest Park in a semiarid climate zone of Iran. From the September 2012 to September 2013, gross rainfall ( $GR$ ) and throughfall ( $TF$ ) were collected through 10 and 50 rain-gauges, respectively.  $I$  was calculated as the difference between  $GR$  and  $TF$ . During the measurement period, fifty five rainfall events with the cumulative value of 262.5 mm were recorded. Over the study period,  $I$  was calculated 80.0 mm (30.5%), and 60.3 mm (23.0%) for *P. eldarica* and *C. arizonica*, respectively. The percents of the interception ( $I:GR$ )% were estimated 46.8% and 37.8%, respectively. Significant positive correlations were observed between  $I$  and  $GR$  by *P. eldarica* ( $I= 0.135GR+0.811$ ;  $r= 0.663$ ), and *C. arizonica* ( $I= 0.100GR+0.620$ ;  $r= 0.757$ ) afforestations ( $P < 0.05$ ). T-test suggested that there were significant differences between the ( $I:GR$ )% values at the small and very small storms classes (0.1-5.0 mm) between *P. eldarica* and *C. arizonica* ( $P < 0.01$ ). The greater interception loss by *P. eldarica* proposed that in this climate zone, it is preferable to plant *C. arizonic* relative to *P. eldarica* trees.

**Keywords:** afforested stand, Chitgar Forest Park, manual rain-gauge, rainfall amount.

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## Evaluation Variation Trend in Qualitative Measures in Natural Even-Aged Stand in Kheyroud Forest

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### ABSTRACT

In This research with using of obtained information from a natural *fraxinus* the variation of quantities and qualitative measures of current stand in an 8 year period was conducted in chelir part of Kheyroud forest. Data collection was conducted by full callipering method in two periods of 1384 and 1392. During the period of study the parameters of dominant mean height and relative crown height ratio have increased and Slenderness coefficient of stand has decreased. With Graphing of number distribution in hectare is determined that the stand is an even-age young stand and Skewness curve is in right direction Schematic figure of both stands are graphed in SVS software and is observed the variation of height in during the period. Results showed that forest stand during 8 years period has significant changes in quantitative measures.

**Keywords:** full callipering dominant height, even- aged, relative height coefficient, slenderness coefficient.

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## Application of DEA to Estimate Technical Efficiency in Iran Forest Nurseries (Case Study: 16 Nurseries in the North)

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### ABSTRACT

Forest nurseries in north are the main sources of seedlings production for forest organization and urban green spaces. For more produce and less cost should be done good management of the production operations. study included data from 16 nursery seedling production in the north. In this study land (an area of seedling land) and personnel (workers and employees) as an input and the number of seedlings product during years was output. Technical nurseries calculated and evaluated. The results showed that among the 16 studied nurseries, Pisesoon, Ghorogh, Kalardasht and Talokola nurseries achieved the greatest efficiency with an average of 49.5%. for the same reason, the Shahr posht, Koloodeh and Safrabasteh nurseries achieved a high efficiency with an average of 67.3%. the average of scale efficiency was 71.7%. The low efficiency nurseries should follow the pisesoon nursery due to its greatest efficiency. The difference between the greatest and average efficiency is 32.7% so if we can reduce the difference to zero by increasing the technical efficiency, the amount of seedling production will be increase to 32.7% without use of production factors.

**Keywords:** Data Envelopment Analysis (DEA), efficiency of management, nursery, technical efficiency.

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## Effect of Root Pruning On Physiology and Morphology of Greek Juniper Seedlings (*Juniperus Excelsa* M. Bieb.)

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### ABSTRACT

In order to investigate the effect of root pruning in morphological and physiological characteristics of *Juniperus excelsa* seedlings an experiment was carried out on transplanted one year-old seedlings. Treatments included root pruning intensities (1-slight pruning (2-moderate pruning and 3- control (no root pruning)) .Experiment design was completely randomized design. Each treatment included three replicates and each replicate included 20 seedlings (in total 180 seedlings). The results showed that root pruning improved the quality and growth of root and seedlings survival. Results indicated that root pruning enhanced seedling quality index of *J. excelsa* seedlings and had a good capability for pruning. Root length, root diameter, root biomass, shoot biomass and total biomass were significantly correlated with habitat quality index which increasing these factors improves plant quality. The ratio of root to shoot biomass and total biomass was significantly correlated with plant survival. Survival was improved by increasing these factors. Also, according to high correlation between quality index and root collar diameter and on the other hand, another characteristics such as root length, root biomass is so hard to identification, root collar diameter is suitable index for qualitative classification *Juniperus excelsa* seedlings in nurseries.

**Keywords:** *Juniperus excelsa*, morphology, root pruning, survival.

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## Variation of Vegetation and Soil Properties in Temperate Forests after Single Selection Implementation (Case Study: Golband forest-Noshahr)

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### ABSTRACT

This study was performed in order to investigate the changes in vegetation and soil properties in compartment No.317 (managed forest) and No.318 (control forest) of Jamand district of Golband forest in Mazandaran (Noshahr). For this purpose, random-systematic sampling method with regular grid of 100×200 m was used to locate samples. The plot size was 400 m<sup>2</sup> considering to tree and shrub species and in the center of each main plot, one 100 m<sup>2</sup> subplot was set up for herb species. Estimate of percent cover of each plant species recorded by using of Braun-Blanquet scale. In center each of 100 m<sup>2</sup> plots, 3 profiles in two depths (0-10 and 10-30 cm) were dug and soil samples were analyzed for physico-chemical properties of soil including pH, organic carbon, total nitrogen, available phosphorous, exchangeable potassium, bulk density, sand, silt and clay percent. Cluster analysis was used for classification of samples and CCA analysis was applied to determine the relationships between vegetation data and environmental variables. The results of t-student test showed that difference of averages of the measured soil variables were not significant in both compartments. Also based on the results cluster and CCA analysis found that vegetation was similar in two compartments and was not separable in distinct groups. Therefore, implementation of single-tree selection method after two periods hadn't significant effect on vegetation composition as well as soil properties in managed forest in comparison with control forest.

**Keywords:** cluster analysis, forest management, Golband forest, ordination, single-tree selection system, soil properties.

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## Morpho-Physiological Responses of Black Locust (*Robinia pseudoacacia* L.) Seedlings to Drought Stress

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### ABSTRACT

This study was conducted to study of morpho-physiological responses of *Robinia pseudoacacia* L. seedlings under drought stress by irrigation period at 4 levels (intervals of 4, 8, 12 and 16 days). The experiment was performed as completely randomized design in a greenhouse environment. Results indicated that all studied traits were affected by water stress, except water use efficiency (WUE). The greatest value of most traits was observed in 4-day irrigation. Seedlings treated by 12- day irrigation had the largest root length. The biggest root dry weight belonged to seedlings irrigated in intervals of 4 and 8 days. Irrigation periods of 8 and 16 days remained the highest water use efficiently (WUE) and electronic leakage (EL) for seedlings, respectively. Generally, seedlings with 4-day irrigation period indicated the best response to drought stress. Of course, 8-day irrigation period showed a relatively well response to water stress especially in terms of survival and growth parameters whereas it can be considered as an appropriate and economic irrigation. Similar investigations can be performed in forest nurseries where climate is adapted for *R. pseudoacacia* growing.

**Keywords:** black locust, drought stress, electrolyte leakage, growth, irrigation period, photosynthesis.

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