

DETERMINATION OF WATER AND DRY MATTER IN ORNAMENTAL TREES UNDER THE CLIMATIC CONDITIONS OF IASI

Carmen Lamban*, Gelu Corneanu**

*Research and Development Station for Fruit Tree Growing of Iasi, Romania

E-mail: lamban_carmen@yahoo.com

**Research and Development Station for Fruit Tree Growing of Iasi, Romania

Abstract

This paper presents some results concerning the determination of water and dry matter through the quantitative gravimetric method in ornamental trees (leaves and branches) of Juniperus, Thuja, Chamaecyparis, Picea, Pinus, Abies, Pseudotsuga genera, under the climatic conditions of Iasi. The purpose of carrying on this work is to see if moisture of vegetative part remains under normal limits. The success of propagation, planting, transplanting of woody plants is largely dependant on the presence of water.

Keywords: ornamental trees, dry matter, water, weather conditions, gravimetric method.

1. INTRODUCTION

The presence of water in a sufficient amount is an essential factor for the survival, growth and development of ornamental plants. Lack of water over a longer period along with high temperatures cause drying of branches (beginning from their peaks) or even of the whole plant. It differs depending on the species, various organs, being higher at the level of the leaves than in stems. The amount of water depends on their age and is influenced by climatic conditions (Boldor et al,1983). Results of the analyses carried out on plant material were expressed as a percentage.

2. MATERIALS AND METHODS

The biological material used in this experience consisted of 25 species of conifers, belonging to 7 genera (Iliescu et al, 1998), planted in the nursery of the Research and Development Station for Fruit Tree Growing of Iasi. We harvested leaves and branches from these plants and we conducted the determination of water and dry matter on them during their vegetative rest period. The analyses were carried out every three weeks during winter.

Method of work: gravimetric method. It consists of measuring water loss from the mass of the sample by heating it at 105°C, the oven. Mass loss by drying the material (humidity) is calculated using the formula: $U = B/A \times 100$, where:

U = percentage of mass loss by drying (%);

A = fresh sample mass (g);

B = mass of the sample after drying (g);

100 = used to express results in percentage.

Dry matter is given by the formula: $SU = 100 - U$, where:

SU = dry matter (%);
U = humidity (%).

3. RESULTS

Research on determination of humidity and dry matter is absolutely necessary, because climatic conditions are different from one month to another, even from one decade to another, as can be seen in Table 1. Thus, between December 2014 and February 2015, the lowest annual average temperature was - 9°C in January 2015, and the highest temperature was 0.4 °C in February 2015. The greatest amount of rainfall was recorded in February 2015 (21.2 mm/m²) and the smallest amount of rainfall was recorded in December 2014 (13.8 mm/m²). The highest atmospheric humidity was registered in December 2014 (87 %), while the lowest humidity was in February 2015 (77 %).

Table 1. Characterization of climate between December 2014 and February 2015

Month	Temperature °C	Rainfall (mm/m ²)	Humidity %
December 2014	- 0.1	13.8	87
January 2015	- 0.9	18.8	86
February 2015	0.4	21.2	77
Media	- 0.2	17.9	83.3

Figure 1 shows humidity and dry matter in leaves and branches of *Taxus Thuja* genus, harvested on 30.1.2015. For the leaves of *Taxus Thuja* genus, the highest humidity was recorded by *Taxus baccata* (59 %), while the lowest was recorded by *Thuja occidentalis obovata* (52%). The highest percentage of dry matter was obtained at *Thuja occidentalis obovata* (48 %), while the lowest was at *Taxus baccata* (41 %). For branches, the highest amount of water was recorded in *Thuja occidentalis* 'Aureovariegata', while the smallest in *Thuja occidentalis elvangeriana* 'Rheingold ' (38%). The highest percentage of dry matter was in *Thuja occidentalis elvangerian* 'Rheingold' while the lowest was in *Thuja occidentalis* 'Aureovariegata'.

Figure 2 shows humidity and dry matter for leaves and branches of *Juniperus* genus, harvested on 30.1.2015. For the leaves of *Juniperus* genus, the largest quantity of water was in *Juniperus horizontalis*, while the lowest in *Juniperus virginiana* (31%). The largest quantity of dry matter resulted in *Juniperus virginiana* (69 %), while the smallest was in *Juniperus horizontalis* (43%). For branches of *Juniperus* genus, the greatest quantity of water was in *Juniperus scopulorum* 'Skyrocket' (67%), while the smallest was in *Juniperus horizontalis* "Picta" (35%). The highest amount of dry matter was recorded in *Juniperus horizontalis* "Picta" (65%), while the lowest was in *Juniperus scopulorum* ' Skyrocket ' (33%).

Figure 3 shows humidity and dry matter in leaves and branches of *Chamaecyparis* genus, harvested on 30.1.2015. The leaves of *Chamaecyparis* genus recorded the largest amount of water in *Chamaecyparis pisifera* 'Boulevard' (57%) and the lowest in *Chamaecyparis lawsoniana semperauraea* (50%). Dry matter has high values also in *Chamaecyparis lawsoniana semperauraea* (50%) and low values in *Chamaecyparis pisifera* 'Boulevard' (43 %). For branches, the highest humidity was noted in *Chamaecyparis pisifera* 'Boulevard' (86%) and lowest in *Chamaecyparis lawsoniana* (46%). The largest percentage of dry weight was noted in *Chamaecyparis lawsoniana* of 54%, while the lowest in *Chamaecyparis pisifera* 'Boulevard ' (14%).

Figure 4 shows humidity and dry matter in leaves and branches of *Picea*, *Pinus*, *Abies Pseudotsuga* genera, harvested on 30.1.2015. For the leaves of the mentioned genera, the greatest amount of

water was noted in *Picea pungens* 'Glauca Globosa' (59%), while the smallest resulted in *Picea glauca* 'Conica' (50%). The highest amounts of dry matter were noted in *Picea glauca* 'Conica' (50%) and the lowest in *Picea pungens* 'Glauca Globosa' (41%). Tests on branches of *Abies nordmanniana* revealed that the greatest quantity of water amounted to 50%, while the lowest amounted to 33% in *Pseudotsuga meziensis* var. *glauca*.

Figure 5 shows humidity and dry matter in leaves and branches of *Taxus* and *Thuja* genera, harvested on 13.2.2015. The highest humidity from the leaves of *Taxus* and *Thuja* genera was noted in *Thuja occidentalis* 'Danica' (60%), while the lowest in *Taxus baccata* (20%). The highest percentage of dry matter was noted in *Taxus baccata* 80%, and the lowest in *Thuja occidentalis* 'Danica' (40%). The largest percentage of branch water was noted in *Thuja occidentalis* 'Aureovariegata' (50%), while the lowest was noted in *Taxus baccata* (19%). The best results in terms of dry matter were obtained from *Taxus baccata* (81%), while those less good were obtained from *Thuja occidentalis* 'Aureovariegata' (50%).

Figure 6 shows humidity and dry matter for leaves and branches of the *Juniperus* genus, harvested on 13.2.2015. For the leaves of the *Juniperus* genus, the largest amount of water was noted in *Juniperus squamata* 'Meyeri' (51%), while the lowest in *Juniperus horizontalis* 'Picta' (45%). The largest amount of dry matter was noted in *Juniperus horizontalis* 'Picta' (55%), and the lowest in *Juniperus squamata* 'Meyeri' (49%). Branches of *Juniperus scopulorum* 'Skyrocket' showed very good results in terms of amount of water (46%), compared to branches of *Juniperus horizontalis* 'Picta', *Juniperus virginiana*, *Juniperus squamata* 'Meyeri', with smaller amounts of water (42%). The largest percentage of dry matter was noted in *Juniperus horizontalis* 'Picta', *Juniperus virginiana*, *Juniperus squamata* 'Meyeri' (58%), while the lowest percentage was noted in *Juniperus scopulorum* 'Skyrocket' (54%).

Figure 7 shows humidity and dry matter in leaves and branches of *Chamaecyparis* genus, harvested on 13.2.2015. For the leaves of *Chamaecyparis* genus, the highest humidity was noted in *Chamaecyparis lawsoniana* 'Ellwoody Gold' (55%), and the lowest was noted in *Chamaecyparis pisifera* 'Plumosa' (47%). The highest values of dry matter were noted in *Chamaecyparis pisifera* 'Plumosa' (53%), while the lowest were noted in *Chamaecyparis lawsoniana* 'Ellwoody Gold' (45%). *Chamaecyparis lawsoniana* branches displayed a large percentage of water (50%), compared to the lower percentage of *Chamaecyparis pisifera* 'Plumosa' (44%). Branches of *Chamaecyparis pisifera* 'Plumosa' recorded the highest percentage of dry matter (56%), while branches of *Chamaecyparis lawsoniana* recorded the lowest percentage of dry matter (50%).

Figure 8 shows humidity and dry matter in leaves and branches of *Picea*, *Pinus*, *Abies* *Pseudotsuga* genera harvested on 13.2.2015. For the leaves of *Picea*, *Pinus*, *Abies* *Pseudotsuga* genera, the highest percentage of water was noted in *Picea pungens* 'Glauca Globosa' (52%), while the lowest percentage was noted in *Picea glauca* 'Conica' (44%). The highest amount of dry matter was noted in *Picea glauca* 'Conica' (56%), while the lowest noted in *Picea pungens* 'Glauca Globosa' (48%). In terms of branches, the highest amount of water was noted in *Pseudotsuga meziensis* var. *glauca* (50%), while the lowest was noted in *Picea glauca* 'Conica' (32%). The largest percentage of dry matter was noted in *Picea glauca* 'Conica' (68%), while the lowest was noted in *Pseudotsuga meziensis* var. *glauca* (50%).

Figure 9 shows humidity and dry matter in leaves and branches of *Taxus* and *Thuja*, harvested on 25.2.2015. For the leaves, the highest amount of water was noted in *Thuja occidentalis* 'Danica' (79%), while the lowest was noted in *Taxus baccata* (40%). The highest percentage of dry matter was noted in *Taxus baccata* (60%) and the lowest in *Thuja occidentalis* 'Danica' (21%). Branches of *Thuja pisifera* showed the highest percentage of water (53%), while those of *Thuja occidentalis* 'Rheingold' showed the lowest percentage (46%). The highest percentage of dry

matter was noted in *Thuja occidentalis elvangeriana* 'Rheingold' (54%), while the lowest was noted in *Thuja pisifera* (47%).

Figure 10 shows humidity and dry matter in leaves and branches of *Juniperus* genus harvested on 25.2.2015. For the leaves, *Juniperus horizontalis* 'Picta' recorded the highest percentage of water (53%), while *Juniperus scopulorum* 'Skyrocket' the lowest one (50%). For the branches, *Juniperus scopulorum* "Skyrocket" showed the highest percentage of dry matter (50%), and *Juniperus horizontalis* "Picta" the lowest (47%). The branches with the highest percentage of water were those of *Juniperus horizontalis* (59%), while the lowest percentage was noted in *Juniperus scopulorum* 'Skyrocket', *Juniperus squamata* 'Meyeri' (46%). For branches, the highest percentage of dry matter was noted in *Juniperus scopulorum* ' Skyrocket', *Juniperus squamata* 'Meyeri' (54%), while the lowest was noted in *Juniperus horizontalis* (41%).

Figure 11 shows humidity and dry matter in leaves and branches of *Chamaecyparis* genus, harvested on 25.2.2015. In terms of leaves, *Chamaecyparis lawsoniana* 'Alumii Gold ', *Chamaecyparis pisifera* ' Boulevard's showed the highest amount of water (55%), while the lowest was noted in *Chamaecyparis lawsoniana* 'Ellwoody Gold'. The lowest quantity of dry matter was noted in *Chamaecyparis pisifera* 'Chamaecyparis lawsoniana ' Boulevard ' Alumii Gold ' (45%), while the highest quantity of dry matter was noted in *Chamaecyparis lawsoniana* 'Ellwoody Gold' (56%). In terms of branches, *Chamaecyparis lawsoniana* 'Alumii Gold', *Chamaecyparis pisifera* 'Boulevard' showed the best results (50%), while the *Chamaecyparis pisifera* 'Plumosa' showed less good results (45%). The highest percentage of dry matter was noted in *Chamaecyparis pisifera* 'Plumosa' (55%), while the lowest percentages were noted in *Chamaecyparis lawsoniana* 'Alumii Gold', *Chamaecyparis pisifera* 'Boulevard' (50%).

Figure 12 shows humidity and dry matter in leaves and branches of *Picea*, *Pinus*, *Abies* *Pseudotsuga* genera, harvested on 25.2.2015. In terms of leaves, *Picea pungens* 'Glauca Globosa' recorded the highest amount of water (62%), while *Abies nordmanniana* recorded the lowest amount (45%). The highest quantity of dry matter was noted in *Abies nordmanniana* (55%), while the lowest was noted in *Picea pungens* 'Glauca Globosa'. In terms of branches, the highest percentage of water was noted in *Picea pungens* var. Glauca (54%), while the lowest was noted in *Picea glauca* 'Conica' (38%). The largest percentage of dry matter was noted in *Picea glauca* 'Conica' (62%), while the lowest was noted in *Picea pungens* var. Glauca (46%).

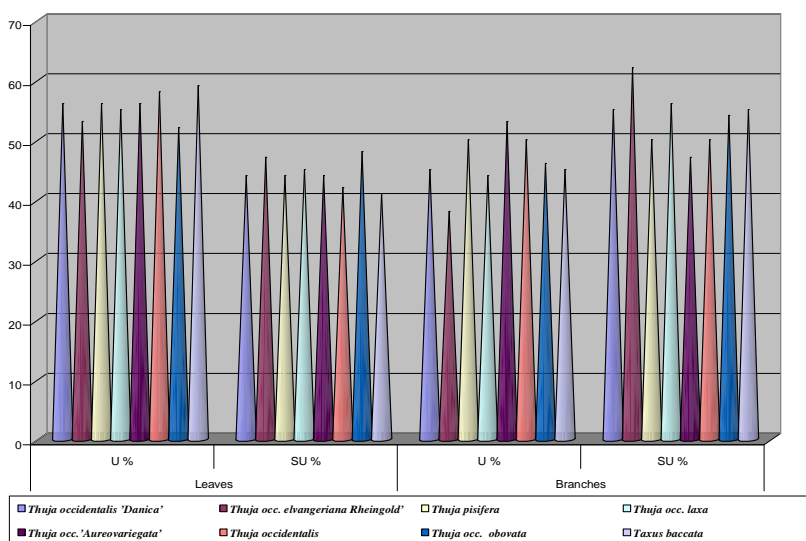


Fig. 1. Humidity and dry matter in leaves and branches of *Taxus* and *Thuja* genera (30.1.2015)

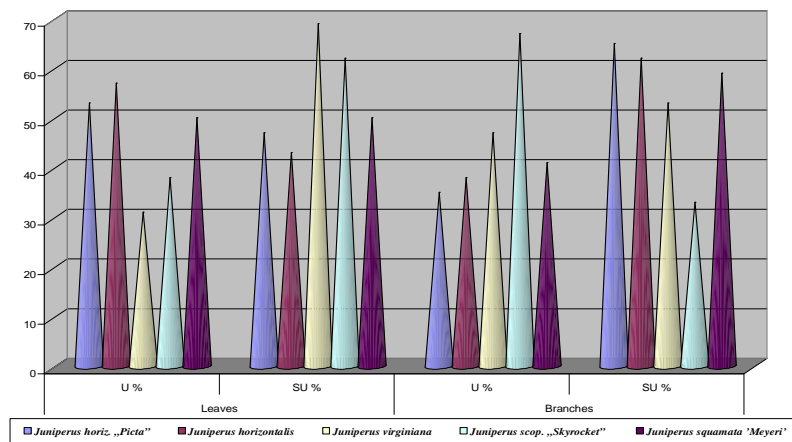


Fig. 2. Humidity and dry matter in leaves and branches of *Juniperus* genus (30.1.2015)

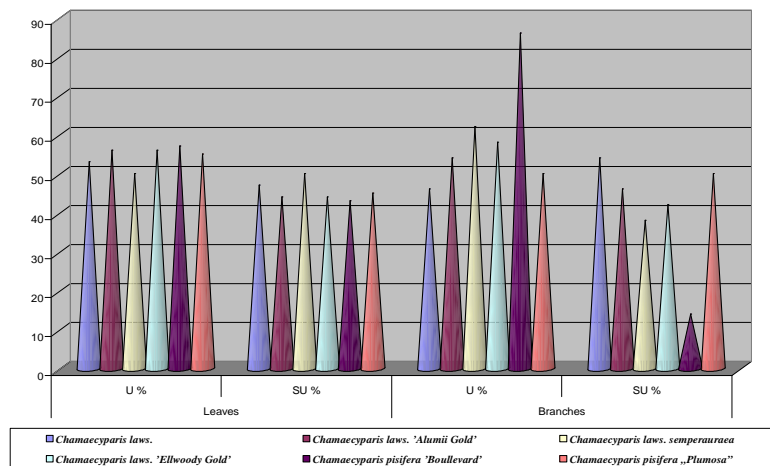


Fig. 3. Humidity and dry matter in leaves and branches of *Chamaecyparis* genus (30.1.2015)

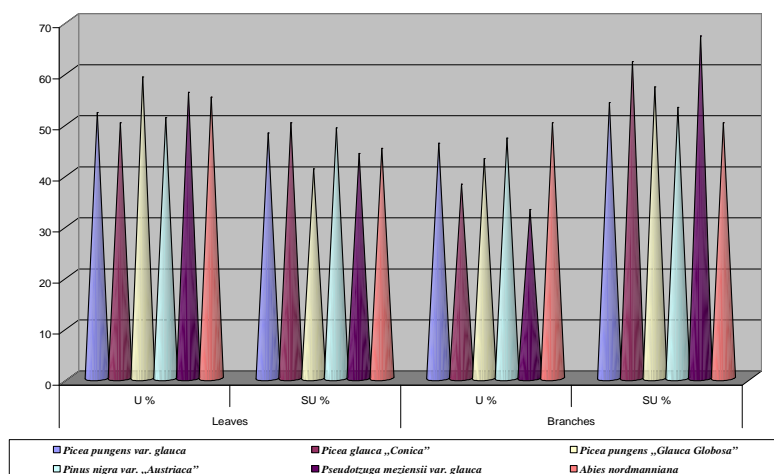


Fig. 4. Humidity and dry matter in leaves and branches of *Picea*, *Pinus*, *Pseudotsuga*, *Abies* genera (30.1.2015)

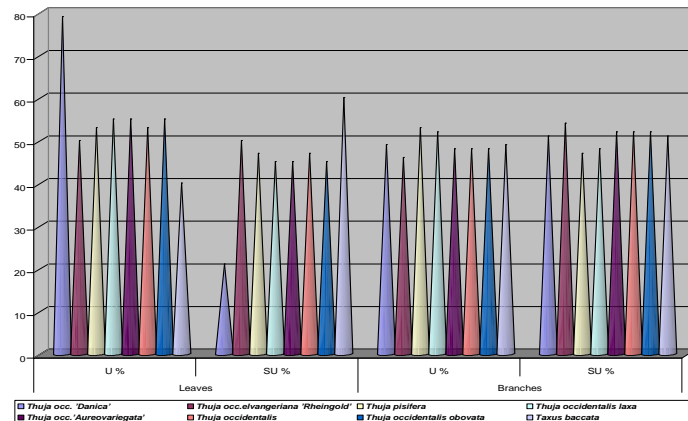


Fig. 5. Humidity and dry matter in leaves and branches of Thuja and Taxus genera (13.2.2015)

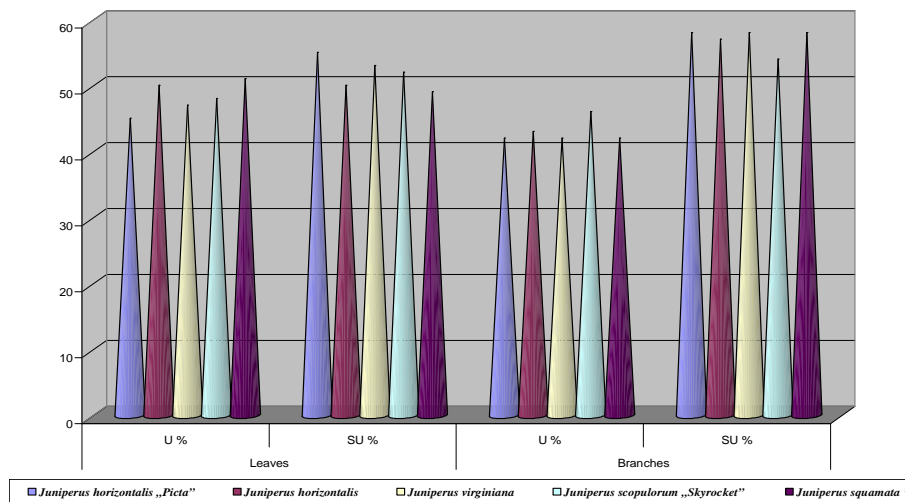


Fig. 6. Humidity and dry matter in leaves and branches of Juniperus genus (13.2.2015)

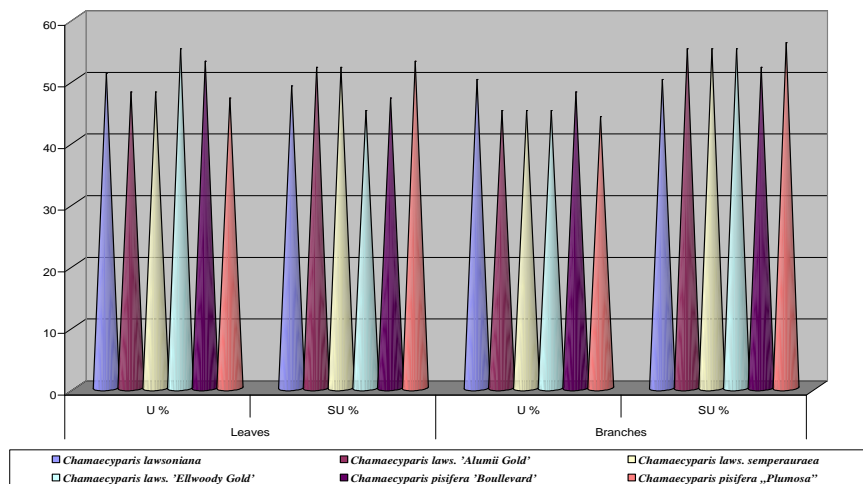


Fig. 7. Humidity and dry matter in leaves and branches of Chamaecyparis genus (13.2.2015)

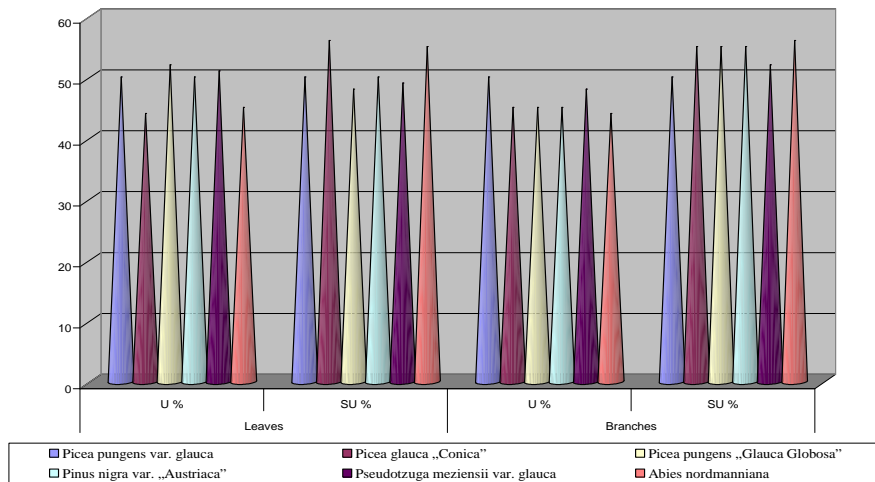


Fig. 8. Humidity and dry matter in leaves and branches of *Picea*, *Pinus*, *Pseudotsuga* and *Abies* genera (13.2.2015)

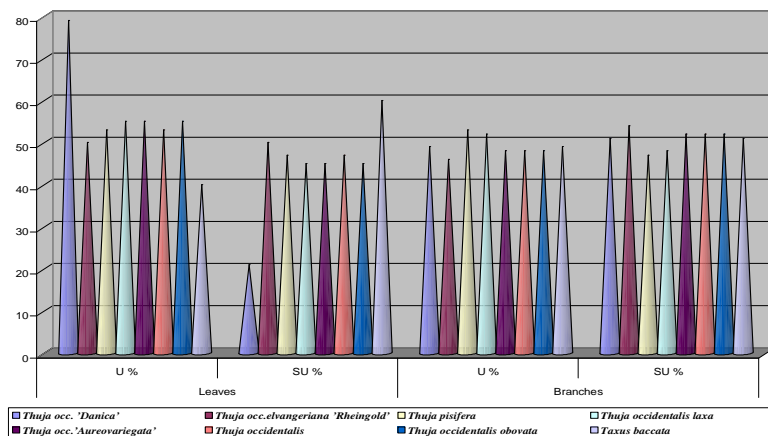


Fig. 9. Humidity and dry matter in leaves and branches of *Thuja* and *Taxus* genera (25.02.2015)

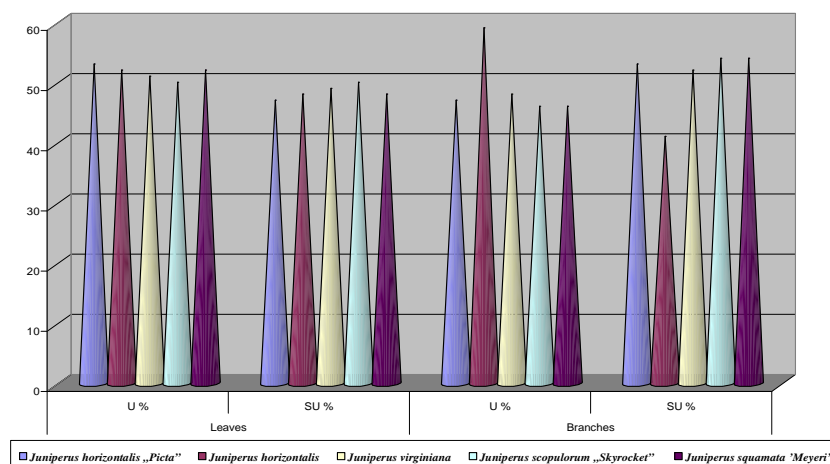


Fig. 10. Humidity and dry matter in leaves and branches of *Juniperus* genus (25.2.2015)

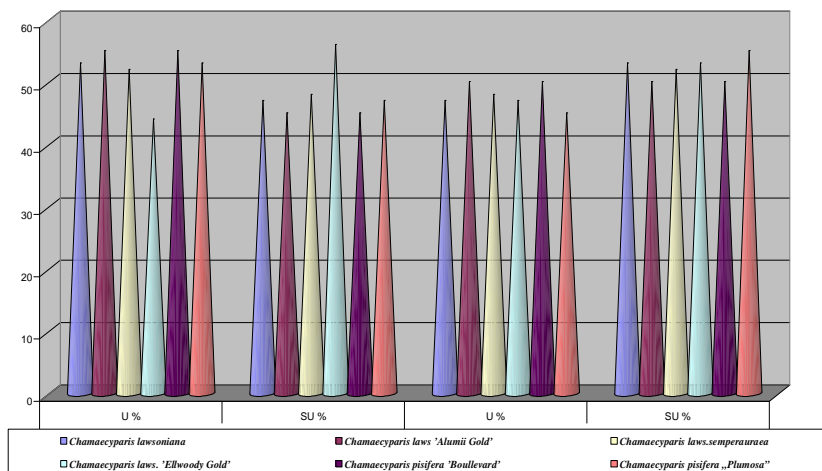


Fig. 11. Humidity and dry matter in leaves and branches of *Chamaecyparis* genus (25.2.2015)

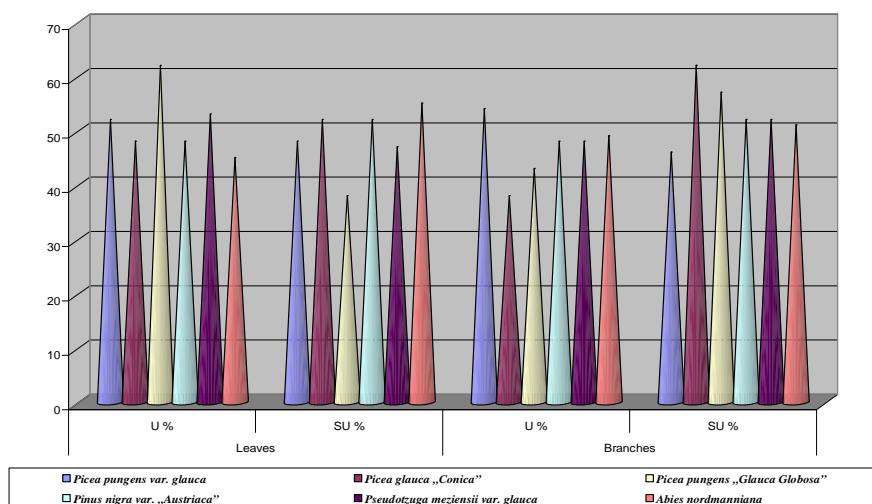


Fig. 12. Humidity and dry matter in leaves and branches of *Picea*, *Pinus*, *Pseudotsuga* and *Abies* genres (25.2.2015)

4. CONCLUSIONS

1. Among the genera studied, *Thuja* and *Taxus* genera showed the highest percentage of water in the leaves of *Thuja occidentalis* 'Danica' species (79%), harvested on 25.2.2015, while the leaves of *Taxus baccata* species, harvested on 13.02.2015, showed the lowest amount of water. For the branches of *Chamaecyparis* genus, the largest percentage of water was noted in *Chamaecyparis pisifera* 'Boulevard' (86 %), harvested on 30.1.2015, while the lowest was noted in *Taxus baccata* (19%), harvested on 13.2.2015.
2. By averaging the percentage values of the quantity of water and dry matter, the result is as follows:
 - a. in terms of leaves, the highest percentage of water was noted in *Taxus* and *Thuja* genera (56%), harvested on 30.1.2015, while the lowest percentage (46%) was noted in *Juniperus* genus, harvested on 30.1.2015. The highest percentage of dry matter was noted in *Juniperus* genus (54%), harvested on 30.1.2015, while the lowest was noted in *Taxus* and *Thuja* genera (44%), harvested on 30.1.2015.

- b. in terms of branches, the highest amount of water was noted in *Chamaecyparis* genus (59%), harvested on 30.1.2015, while the lowest was noted in *Picea*, *Pinus*, *Abies*, *Juniperus Pseudotsuga*, genera (43%), harvested on 30.1.2015 and 13.02.2015 respectively. The largest values of dry matter were noted in *Picea*, *Pinus*, *Abies*, *Pseudotsuga*, and *Juniperus* genera (57%), harvested on 30.1.2015 and 13.2.2015 respectively. The lowest values of dry matter were noted in *Chamaecyparis* genus (41%).
3. The degree of leaf hydration and dry matter content suggest, due to their quantitative dynamics, that the analysed plants display fundamental physiological processes with increasing intensity towards the optimal time to harvest branches for seedlings.

5. REFERENCES

- Bolder, O., Raianu, O., Trifu M. (1983). Fiziologia plantelor. *Didactic and Pedagogic Publishing House, Bucharest.*
- Iliescu, A.F. (1998). Arboricultură ornamentală. *Ceres Publishing House, Bucharest.*
- Zamfirache, M.M. (2005). Fiziologie vegetală I. *Azimuth Publishing House, Iasi.*