



## Full Length Article

# The Effect of planting pattern on quantitative and qualitative properties of *Platanus orientalis* and *Robinia pseudoacacia* in Tehran, Iran

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### ABSTRACT

Increasing population and developing urbanization towards forests and rangelands result in a reduction of green space area. Hence, the environmental values of vegetation are the eminent factors in urban management. The study aimed to assess different planting patterns in urban area that reveals the role of correct management. *Platanus orientalis* and *Robinia pseudoacacia* of district 2 of Tehran in stand (three locations for each species) and strip (three locations for each species) were selected. 100 trees of each species randomly-systematic were measured to study quantitative and qualitative properties of these species in both stand and strip. Inventory method in strip was based on numbering all trees. After that first tree was randomly selected and using this tree the traits of fifth tree were recorded. Quantitative properties including DBH, tree height, crown height and crown diameter, and qualitative traits including crown health, dieback, pest, stem form, ramification, canker and crown breaking were studied in both stand and strip. Results showed that qualitative and quantitative properties of *Platanus orientalis* in stand is better than those in strip and this value is more appropriate in *Platanus orientalis* than *Robinia pseudoacacia*. According to findings obtained by this study, *Platanus orientalis* is suggested for planting in stand and *Robinia pseudoacacia* for strip.

**Key words:** *Platanus orientalis*, *Robinia pseudoacacia*, planting pattern, Quantitative and Qualitative properties

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### INTRODUCTION

Increasing population and developing urbanization towards forests and rangelands result in a reduction of green space area. Hence, the environmental values of vegetation are the eminent factors in urban management. Plantation in past was not as common as now in Iran and it was used in small area to wind break. The ratio of green spaces to total area (about 1,700 km<sup>2</sup>) in Tehran city is 1.2% and is 2.71 m<sup>2</sup> per person. Afforestation area is approximately 2700 ha that covers 3.375 m<sup>2</sup> per person, and wholly 6.081 m<sup>2</sup> that is significant gap with global standard of green space (15-50 m<sup>2</sup> per person) [12]. Considering the green space urban area is essential. Therefore, having more information about urban area helps managers for desired green spaces. Urban forestry is a new scientific field in Iran that today is more considered, so various researches regarding to the potential of related region and especial species should be conducted. Using the potential of region with related species is an appropriate method to reinforce environment. In addition, quantitative and qualitative characteristics are the main factors in plantations. These factors are a set of effective patterns of stability according to the ecological talent of species. So, the various studies are needed to obtain the appropriate management. *Platanus orientalis* and *Robinia pseudoacacia* are the main species that are widely planted in urban areas of Iran especially in Tehran. Hence, the present study aimed to evaluate the planting pattern in both stand and strip and also its effect on quantitative and qualitative properties of *Platanus orientalis* and *Robinia pseudoacacia*.

### MATERIALS AND METHODS

The Tehran metropolitan area is a part of Tehran Province located on the southern slopes of the Alborz Mountains at a latitude of 35° 45' N and a longitude of 51° 25' E. (a.s.l: 1700 m). The northernmost side is contiguous with the town of Shemiran, and the southernmost side with the town of Rey and Eslamshahr.

The Tehran metropolitan area is divided into 22 municipal districts. This study was conducted in district 2, north of Tehran.

Figure1: The location of district 2 of Tehran city (scale of 1:35000).

The ten-year records of the meteorological data taken from the meteorological station nearest to the case study, Mehrabad Meteorological Station [1], indicates that the mean annual precipitation is 238.9 mm (SE: ± 20.4 mm). The meteorological data shows that the wettest and driest months are March and August, respectively. The dry period begins in May and ends in October. The mean annual temperature is 17.7 °C (SE: ± 0.1 °C); August is the warmest month with average temperature of 36.4 °C (SE: ± 0.3 °C) and January is the coldest month (4.8 °C; SE: ± 0.8 °C).

Different locations including Delavaran park, Pardisan park, Parvaz park, Goftogo park, Distance between Kaj and Sarv square, Tarasht street, Salehi boulevard, Distance between Samae and Shahid-Akbari crossway, Western Sarv Street, Municipality street and Ashrafiesfahani highway were selected as studied locations in the case study. Two Even-aged stands and strips were used and also they were selected in an area in order to reduce the environmental effects on the qualitative and quantitative features of plantation. The tools used in this study were Caliper, Tape, Altimeter, Suunto clinometer. Quantitative traits including DBH, tree height, crown height and crown diameter, and qualitative traits including crown health, dieback, pest, stem form, ramification, canker and crown breaking were studied in both stand and strip. Inventory method in strip was based on numbering all trees in the strip. After that first tree was randomly selected and using this tree the traits of fifth tree were recorded. Inventory method in stand was based on systematic method, i.e., according to the stand density, sample plots with an area of 2 R (Delavaran, Parvaz and Goftogo parks), and an area of 3 R (Pardisan park) had sufficient accuracy. Inventory network for stands with 2 R and 3 R was 80\*100 and 100\*170, respectively. T-test was applied to analyze the mean comparison and also Chi-square and Cal Wallis course were used for qualitative analysis.

**RESULTS**

Quantitative properties

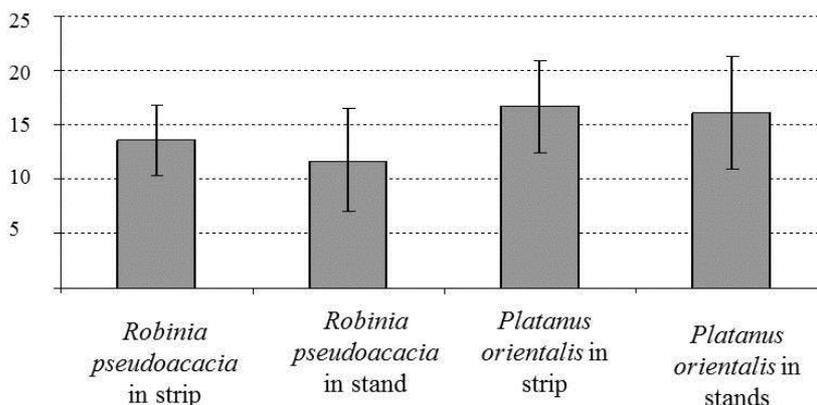


Figure 1: DBH parameter of tree in different stands

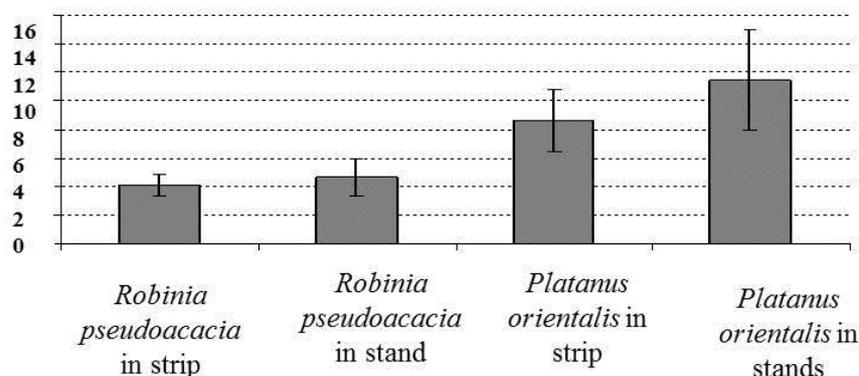


Figure 2: Height parameter of tree in different stands

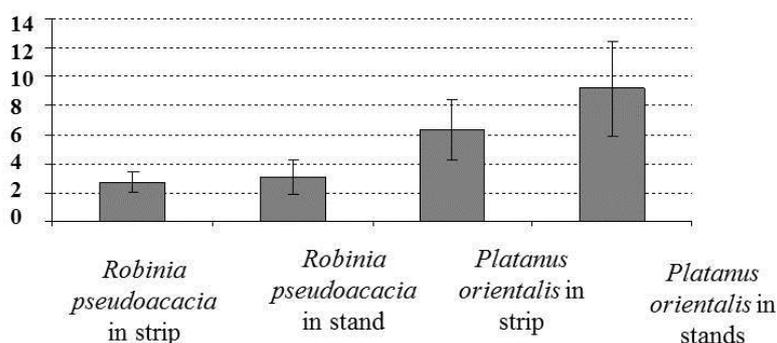


Figure 3: Crown height parameter of tree in different stands

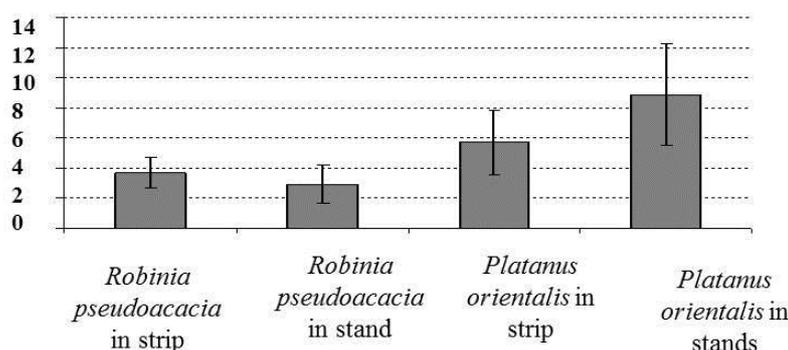


Figure 4: Diameter of crown parameter in different stands

Quantitative results indicated that the maximum and minimum DBH belonged to *Platanus orientalis* in strip and *Robinia pseudoacacia* in stand, respectively, while the highest and lowest tree height were obtained for *Platanus orientalis* in stand and *Robinia pseudoacacia* in strip, respectively. The maximum average of crown height was recorded for *Platanus orientalis* in stand and the minimum of this value was found for *Robinia pseudoacacia* in strip. As is shown by figure 4, *Platanus orientalis* in stand reached the climax and *Robinia pseudoacacia* in strip reached the lowest value.

Table 1: The quantitative properties of *Platanus orientalis* in stand and strip

S.D	Maximum	Minimum	Mean	N	station	Parameter
4/26	27/5	6	16/65	300	strip	DBH (cm)
5/16	31/5	5/5	16/09	300	stand	
2/19	16	3/3	8/62	300	strip	Height (m)
3/53	23/3	2/3	11/45	300	stand	
2/05	13/1	1	6/36	300	strip	Crown height (m)
3/28	20/6	1/6	9/18	300	stand	
2/14	12/2	1/8	5/7	300	strip	Diameter of crown (m)
3/4	20/4	3	8/9	300	stand	

Table 2: The quantitative properties of *Robinia pseudoacacia* in stand and strip

S.D	Maximum	Minimum	Mean	N	station	Parameter
3/21	21	6	13/59	200	strip	DBH (cm)
4/72	23	4	11/69	200	stand	
0/76	6/3	2/1	4/11	200	strip	Height (m)
1/32	7/8	2/3	4/62	200	stand	
0/7	4/8	0/7	2/73	200	strip	Crown height (m)
1/18	6	1	3/09	200	stand	
1/01	5/6	0/8	3/7	200	strip	Diameter of crown (m)
1/29	6/2	0/8	2/93	200	stand	

### Qualitative properties

Results of qualitative traits showed the highest value of crown health was recorded for *Platanus orientalis* in stand and the lowest was found for *Platanus orientalis* in strip, while *Robiniapseudoacacia* in strip was healthier than that in stand. Both species in stand were in appropriate quality in terms of dieback than those in strip. Results showed that the highest pest was recorded for *Platanus orientalis* in strip, while the minimum was found for *Platanus orientalis* in stand. On the other hand, there was found more pests in stand than strip for *Robiniapseudoacacia*. In addition, *Platanus orientalis* in strip reached the climax of appropriate form of stem, whereas the lowest value was recorded for *Robiniapseudoacacia* in strip. The quality of *Platanus orientalis* in stand was more than that in strip, while this value was vice versa for *Robiniapseudoacacia*. Results revealed that the maximum and minimum ramification was recorded for *Platanus orientalis* in strip and stand, respectively, whereas this value was in contrast with *Robinia pseudoacacia*. Both species in strip had the highest and lowest canker in strip and stand, respectively. The maximum and minimum crown breaking was recorded in strip and stand for *Platanus orientalis*, while it is found for *Robiniapseudoacacia* vice versa.

### DISCUSSION

Planting methods are in vast range of urban forestry. Depending on the location, tree species can be planted in strip and stand form in pedestrian, parks and around street. The present study was conducted in order to evaluate two different forms of planting in urban area and their effects on quantitative and qualitative traits of trees.

#### Quantitative properties

The results of quantitative traits show there is a significant difference of DBH between *Platanus orientalis* and *Robiniapseudoacacia* in both stand and strip. The DBH mean of *Platanus orientalis* in strip is maximum and in both species in strip is more than stand. In stand due to the high competition among trees, the DBH is less than that in strip. Distribution curve of the diameter classes in both species are approximately normal and skewness to right are in stand for both species and also the reduction trend is found for high diameter trees due to the high competition among species in stand. The tree height of in stand is more than that in strip and also the maximum of this value is found for *Platanus orientalis* in stand. The reason is the high competition among trees in stand for obtaining sufficient light. The highest crown height belonged to *Platanus orientalis* in stand due to the large competition in stand. The maximum crown diameter is for *Platanus orientalis* in stand, while this value in strip is more than that in stand for *Robiniapseudoacacia* because of the management type and high pruning in strip. As is shown by graphs and tables, *Platanus orientalis* is the more appropriate species in terms of quantitative properties. In addition this species in stand is more appropriate than strip, so planting the species in stand is suggested.

#### Qualitative properties

In terms of crown health, *Platanus orientalis* in stand is better than that in strip, while this value is vice versa for *Robiniapseudoacacia*. Dieback for both species in strip is more than stand due to water availability. Because trees in strip can't get sufficient water, they obtained it in stand easily. As it is indicated by tables of qualitative properties, *Platanus orientalis* is healthier than *Robiniapseudoacacia* in terms of pest. *Platanus orientalis* in stand is engaged with fewer pests than that in strip due to the fact that tree roots are fragile faced to poor soil conditioner (Zarinkafsh, 2001). Moreover, the plant sensitivity to ozone damages will be increases. However, this value in strip is more than that in stand due to air pollution derived from vehicles. The most important pests and diseases observed in *Platanus orientalis* and *Robinia pseudoacacia*:

*Platanus orientalis*: *Lithocolletis platani* L, *Aeolestes sarta* Solsky, *Tetranychus urticae*; *Robiniapseudoacacia*: two species of aphid and one species of seed-eating.

The stem quality of *Platanus orientalis* in stand is more appropriate than that in strip, while this value is vice versa for *Robiniapseudoacacia*. Ramification in parks and urban area is considered as useful factor due to its shade and view. The minimum ramification belongs to *Platanus orientalis* in stand. The lowest canker is in stand for *Platanus orientalis*. In both species the canker in stand is less than that in strip due to higher competition and lower light in stand than strip. Crown breaking reaches the minimum value in *Platanus orientalis* in stand; because this species is not affected by sever winds in stand. However, crown breaking in strip is more than that in stand for *Robinia pseudoacacia* due to the successive pruning.

### CONCLUSION

Due to limitations in the urban environments (human intervention, pruning, lack of water and minerals, soil compaction and contamination), trees can't achieve their real growth. Limitation factors such as irrigation regime were same in both treatments for both species in the present study. Totally, quantitative properties of *Platanus orientalis* in stand are better than those in strip. According to findings obtained by

this study, *Platanus orientalis* recommended for open area in wide streets and *Robiniapseudoacacia*s suggested for locations with space limitations such as small streets. In addition, soil compaction around plant roots has significant effects on water and nutrients absorption in strip and results in asymmetry roots. Qualitative properties of *Platanusorientalis* in stand are better than those in strip and this value is better in *Platanus orientalis* than *Robinia pseudoacacia*.

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