

A Review on seed and seedling technology of several forest tree species in Bogor

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Abstract The establishment of urban forests is a necessary matter nowadays considering the alarming state of the environment with a decreasing amount of green spaces in the cities. The utilization of the species of various forest trees in the development of city forests has long been done due to aesthetic value of several forest tree species, such as the colors of flowers or the architecture of the trees. At present, Bogor is one of the fastest growing cities in Indonesia. The success of city forest development is supported by the seed technology and nurseries to provide quality planting stocks. The objective of this paper was to provide information of seed and seedling technology of seven tree species, which are grown as an ornamental trees of urban forests in Bogor City. The species of forest trees which are mostly planted in the city of Bogor are kenari, angkana, mahogany, damar, kenanga, tanjung, and cempaka. The seed characteristics of each species are categorized into three major groups which are orthodox, recalcitrant and intermediate seeds. Kenari and tanjung seeds are categorized into the orthodox category, damar and kenanga seeds are categorized into the recalcitrant category, while angkana, cempaka and mahogany are categorized into the intermediate category. The conditions where seeds are ready to be planted are when its already wooden, healthy, and compatible with medium.

1. Introduction

Bogor is known as the city of rain and its cool weather, since the Dutch Colonial Period and Bogor had been as a resort for vacation by the Dutch officials. Moreover, Bogor lies at the foot of Salak Mountain, and also many of the trees make the weather of Bogor become cooler. The trees and its existence, usually affect the micro and macro climatic conditions and also have an impact on the environment quality of those areas. Environmental design especially at urban area now become a barometer progress of the city. An environmental design is the set up of physical buildings (such as buildings, roads, dumping tip) and green zones (park, forest) which is convenient and more human. The percentage of the green-open space (RTH) on a territory according to Regulation No. 26 / 2007 is about 30 % of the areas [1]. About 20 % of their allotments for a public green-open space and 10 % is for private green-open space. The large area of Bogor according to the Statistics Books of Bogor [2] the width of Bogor is about 11.850 ha , so that the ideal area of green open space in Bogor is approximately 3555 ha , which is divided in to 2370 ha for public greenery and 1185 ha for private greenery. However the width of the forest area in Bogor was only 282,58 ha [3]. The additional forest area in Bogor until now is still relatively small, and according to Regulations No. 8 / 2011 article 47 there will be an increase of forest areas in Bogor for approximately 2.5 ha. Based on this



data, the forest area in Bogor is inadequate which is approximately 8% of the total open green space in Bogor.

The definition of urban forests are land which are overgrown by compact trees in the urban areas in either on state or private land, that are set up as an urban forest by the authorized official [4]. The structure of the urban forest does not always have trees, but can have green lanes on either side of the road. Because one of the objectives of the development of urban forests based on government regulation No. 63/ 2002 was to keep the balance of the urban ecosystem. The definition of the urban forest :[5] “urban forest as sum of all tree-based vegetation in and near urban areas, as well as woodlands, public and private urban parks and gardens, urban nature areas, street tree and square plantations, botanical gardens, and cemeteries”.

Considering the importance of the existence of the urban forest, especially in Bogor, information regarding the technique of seed procurement and seedling nursery is required. The minimum forest area required in the urban city according to government regulation no .63 /2002 is about 10% of the total area, this means that Bogor requires a forest within the city for approximately 1185 ha, hence the needs of the seed and seedling for construction of the urban forest in Bogor is high. The dominant trees that are grown in the urban forest in Bogor [6] are mahogany (*Swietenia macrophylla* King.) , tanjung (*Mimusops elingii* L.) , angkana (*Pterocarpus indicus* Willd.), kenari/walnut (*Canarium indicum* L.) , cempaka (*Michelia champaca* L.), damar (*Agathis loranthifolia* Salisb) and kenanga (*Cananga odorata* Lam. Hook. F. & Thoms). The purpose of this paper is to provide information of seed and seedling technology of seven species of trees, which are grown as an ornamental of urban forest in Bogor.

2. The seven dominant species of trees that are grown in Bogor’s urban forest

In general, the trees that were selected for urban forest have several functions, which are [6] :

- A wind breaker and to control air pollution (gas and solid particles from the air)
- Provide Oxygen
- Water and soil conservation
- Germplasm conservation
- Aesthetic (colour of flower, fragrans, tree architecture)
- Wildlife habitat

Forest tree species that are planted in urban forest at Bogor City are varied, but there are several species mostly planted such as mahogany, tanjung, angkana, kenari, cempaka, damar and kenanga . The function of each species to the environment can be seen at table 1.

Table 1. Tree species of the forest and its function as the urban forest.

Species	The benefit in urban forest	Criteria
1. Mahoni (<i>Swietenia macrophylla</i> King.)	- A wind breaker and to control air pollution (gas and solid particles from the air)	- Stems and branching are strong, sturdy and not rigid
2. Kenari (<i>Canarium indicum</i> L.)	- Oxygen producer	-The surface of leaves are hairy or waxy
3. Damar (<i>Agathis loranthifolia</i> Salisb)		-The stomata of leaves are wide
4. Angkana (<i>Pterocarpus indicus</i> Willd.)		
1. Cempaka ((<i>Michelia champaca</i> L.),	- An absorbent and smell percolator	-The flower is fragrant
2. Tanjung (<i>Mimusops elingii</i> L.)	- Oxygen producer	-The stomata of leaves are wide
3. Kenanga (<i>Cananga odorata</i> Lam. Hook. F. & Thoms)		

Species	The benefit in urban forest	Criteria
1. Mahoni (<i>Swietenia macrophylla</i> King)	- Water and soil conservation - Solve flooding - Oxygen producer	The roots are able to survive in the flooded area
1. Kenari (<i>Canarium indicum</i> L.)	- Climate amelioration - Reduce noise	- The crown is thick and shaded - Beautiful trees architecture
2. Damar (<i>Agathis loranthifolia</i> Salisb)	- Oxygen producer	- The leaves are thick
3. Angsana (<i>Pterocarpus indicus</i> Willd.)		
4. Mahoni (<i>Swietenia macrophylla</i> King.)		
5. Tanjung (<i>Mimusops elingii</i> L.)		
1. Cempaka (<i>Michelia champaca</i> L.),	- aesthetic values (color of the flower, tree architecture)	-architecture to beautifying the trees
2. Tanjung (<i>Mimusops elingii</i> L.)	- Oxygen producer	-The flower is beautiful and fragrant
3. Damar (<i>Agathis loranthifolia</i> Salisb)		

Source: [6]

All seven species which have been mentioned require good quality of seed and seedling, conducting the continuity of providing the seedling for urban forests at Bogor. Otherwise, the seed handling and seedling technique for seven tree species must be necessary identified.

3. Seed handling

Seed handling is the first step in conducting the process of good quality seed procurement to support the development of urban forests. The seed handling technique starts with:

- Determination of the seed maturity which can predict the time of collecting fruits
- Seed extraction and sortation is defined as a process to extract the seed from the fruit. There are two methods of seed extraction, such as dry and wet extraction.
- Seed drying is important to investigate the character of the seed. There are three characters of seed which are orthodox, intermediate and recalcitrant seed [7]. Those characters based on the capability of seed moisture contain decrease.
- Breaking dormancy or seed pre-treatment before sowing the seed. There are three methods of breaking dormancy of the seed, that are scarification, stratification and chemical, depend on the type of the dormancy
- Seed germination can influence the germination percentage and speed of germination

3.1 Mahogany (*Swietenia macrophylla* King.)

Mahogany belongs to Meliaceae, and it's an exotic species from Central and South of America, but has already adapted in Indonesia, especially in Java Island. Mahogany trees planted mainly for shading the urban cities

- *Determination of seed maturity.* A type of mahogany is drupe, the fruit's peak of maturity is during July – August and produces every year. The propertime to collect fruit is when the color of fruit's skin is brown to grayish with a white spot. It shows that the fruit is ready to harvest, and the shell is easy to crack and the color of the seed is dark brown. [6].
- *Seed extraction and sortation.* To pull out the seed from the fruit of the mahogany the dry extraction technique is used, which is sun drying, and the fruit will be cracked. The seed has

wings, but for the health of the seed, the wing must be cut. An average fruit consist of 29 -58 seeds, and there are around 23002400 dry seed per Kg [6]

- *Seed drying*. The character of mahogany seed is intermediate, therefore the seed should not be dried directly under sunlight, but have to be dried at room temperature until the seed moisture contain reach about 10–12% [6]
- *Breaking dormancy*. Breaking dormancy is done before sowing, not required for mahogany seeds
- *Seed germination*. The most optimal media for germination is the mixture of top soil and sand (1:1/V/V) which has already been sterilized. Seed is sowed with the part of the wing of the seed upward, and the seed starts to germinate at 7–12 days after sowing.

3.2 Tanjung (*Mimusops elingi* L.)

Tanjung belongs to Sapotaceae, and it is an indigenous species of Indonesia, which can be found all over in Indonesia, except in Kalimantan. Having a beautiful flower, with a white color and fragrant-smell, it is suitable to be planted at the urban forest.

- *Determination of seed maturity*. The flowering and fruiting is done all year long, but the peak season of fruiting is during February – May. The fruits are ready to be picked if the color of the fruit is orange.
- *Seed extraction and sortation*. The fruits are pulpy, therefore the proper technique to extract the seed is wet extraction. The fruit must be stored in a plastic bag until the fruit is soft and fleshy (2-3 days), where (fleshy fruit) they are washed under water until all the seeds are cleaned from the pulp. Total seed per Kg are approximately 2000 seeds.
- *Seed drying*. The character of tanjung seed is orthodox, therefore the seed should be dried directly under the sun for \pm 3 days until the seed moisture reaches a level of 5 – 8 %. Seeds can be stored at the conditioner room or refrigerated in a plastic bag [8].
- *Breaking dormancy*. The seed coat of the tanjung is quite hard, therefore before sowing, the seed must be soaked in water (room temperature) for 24 hours [9].
- *Seed germination*. The most optimize media for germination is the mixture of top soil and sand (1:1/V/V) which have already been sterilized. After sowing the seed, it must be covered by fine sand, and the thickness of sand is approximately 1–2 mm, and the seeds start to germinate at 17 - 82 days after sowing [9].

3.3 Angsana (*Pterocarpus indicus* Willd.)

Angsana belongs to the Fabaceae family, an indigenous species in Indonesia that grows almost all over in Indonesia, and grows well at 500 m above sea level. The color of its flower is yellow and beautiful and also the crown is shaded, therefore it's suitable for urban forest because of the aesthetic values.

- *Determination of seed maturity*. The process of flowering and fruiting of the angšana occurs all year long, when the peak of maturity of the fruit occurs during May – June, and it is the best time to collect seed [6]. The type of fruit of the angšana is pod and has a wing around the pod (samara). The pod is ready to harvest if the color of the pod and wing becomes brownish. The shape of the seed is circular and flattened, and has a hard coat seed.
- *Seed extraction and sortation*. To pull out the seed from the pod of the angšana could be done by using the dry extraction technique, which is sun drying, and then the wing around the pod/seed must be cut. The seed must be cleaned up from their waste by blown/shake. There are 1 – 3 seeds/pod, and the amount of seed per Kg are 19.762-21.736, it's classified into small seed.
- *Seed drying*. The characteristics of the angšana seed is intermediate, and should be dried for about \pm 3 days until the seed moisture contained reaches the level of 8 – 12 %.
- *Breaking dormancy*. To break the dormancy of the angšana seed, it could be done by soaking the seed in the solution of 1 % of H₂SO₄ for 10 minutes or soaked in the solution of 1 % KNO₃ for 24 hours [10].

- *Seed germination.* Pre-treatment or breaking the dormancy of the angsana seed before sowing is necessary, the optimized media for the angsana seed is a mixture of top soil and sand (1:1/v:v). Seed starts to germinate at 18,47–26,56 days after sowing [10].

3.4 Kenari (*Canarium indicum* L.)

Kenari belongs to the Burseraceae family an indigenous species of Indonesia, and the natural habitat at the eastern part of Indonesia, such as Sulawesi, Maluku and Papua. Otherwise kenari grows well in Bogor and has become an icon of Bogor because many souvenirs from Bogor are made from the seed of the kenari.

- *Determination of seed maturity.* The fruits from the Kenari trees could be picked all year long and while the color of the ripened fruit is black. The shape of the fruit is ovale [11].
- *Seed extraction and sortation.* The kenari fruit clan fleshy, and the appropriate method to extract seed is the wet extraction. The first step to extract seed from the fruit is by peeling the fruit and cleaning the seed from the rest of the waste under running water. Seeds have to dry at room temperature [11].
- *Seed drying.* The characteristic of the kenari seed is orthodox, therefore the seed must be dried by sun drying, and the moisture of seed reaches approximately 5 – 8 % [11].
- *Breaking dormancy.* Kenari seed has a hard seed coat, therefore to push the germination requires seed pre-treatment. The appropriate seed pre-treatment to break the dormancy is done by cracking the hard seed coat and then soaking the seed in the water for 2 x 24 hours [11].
- *Seed germination.* The appropriate media for germination is the mixture of top soil and sand (1:1/v:v which has been sterilized).

3.5 Cempaka (*Michelia champaca* L.)

Cempaka belongs to the Magnoliaceae family, and is an indigenous species of Indonesia. This species can be found all over Indonesia (Sumatera, Kalimantan, Jawa, Sulawesi and Nusa Tenggara). The color of the flower is yellow, it is beautiful and fragrant, therefore cempaka is an aesthetic trees and also shades the urban areas.

- *Determination of the seed maturity.* Cempaka is flowered and picked all year long, cempaka fruits belongs to multiple fruits. The right time to pick the fruits, is when the color of the fruit becomes brownish and the fruit is wracked or falls from the tree. There are 4 – 6 seeds per fruit [12].
- *Seed extraction and sortation.* The ripened fruit is kept in the room (room temperature), until the fruit falls from the tree and the seed is easy to pull from the fruit. The seed is covered by the thin red -flesh, and it must be cleaned up from the seed. A seed coat is slightly harder and the color is black [12].
- *Seed drying.* The seed of the cempaka should not be dried under the sun directly, it is enough by drying it at room temperature, because the character of the cempaka seed is intermediate and the viability will be decrease if the level of seed moisture will drop. The level of seed moisture contained must be kept at 16,7 – 25 % [12].
- *Breaking dormancy.* Before sowing, the cempaka seed must be soaked in the water for 2 x 24 hours and then the seed must be tapped before sowing.
- *Seed germination.* The appropriate media for germination of the cempaka seed is the mixture of the top soil and sand (1:1/V:V) and the media should be sterilized before use. The seed start to germinate at 7–14 days after sowing.

3.6 Damar (*Agathis lorantifolia* Salisb)

Damar belongs to the Araucariaceae family, and damar is an indigenous species in Indonesia, the natural habitat of damar is in Sumatera and Kalimantan, but grows well in Bogor. The tree architecture of the damar is beautiful therefore damar trees are suitable for urban forests.

- *Determination of seed maturity.* The damar fruit is shaped as a cone and scaly. The appropriate time to harvest it (damar fruit), is when the color of the skin of the fruit becomes dark green, the tip of the cone starts to turn brownish and scale is brown.
- *Seed extraction and sortation.* The method of extracting the damar seed is dry extraction. The first step of extraction is to keep the fruit in the porous bag for 2–3 days until the cone falls off and the seed is easy to be pulled from the cone, and the seed separated from its dirt by shack and blowing.
- *Seed drying.* After sorting it and the seed cleaned from the dirt, the seed must be dried. The seed should not be dried directly under the sun, but enough by drying it at room temperature, because the characteristic of the damar seed is recalcitrant. The level of moisture contained by the seed is about 30%.
- *Breaking dormancy.* The seed of the damar does not need breaking dormancy, and it (seed) can be sowed directly.
- *Seed germination.* The appropriate media for germination of the damar seed is the mixture of top soil and sand (1:1/V:V) and the media should be sterilized before use. The seed starts to germinate at 7-14 days after sowing.

3.7 Kenanga (*Cananga odorata* Lam. Hook. F. & Thoms)

Kenanga belongs to the Annonaceae family, and it is also an indigenous species of Indonesia, mainly growing all over Indonesia. The flower is beautiful and fragrant, with thick crowns, therefore it is appropriate for them to be shading trees in the urban forest.

- *Determination of seed maturity.* The appropriate time to harvest the fruit of the kenanga, is when the color of the fruit's skin is black, the shape of the fruit is oval. The fruit has a thick flesh with 1–12 seeds per fruit. The color of the seed is brownish and has a hard seed coat [13]
- *Seed extraction and sortation.* The fruit of the Kenanga has a thick flesh, therefore the appropriate method to extract the seed is by wet extraction. Before extraction, the fruit must be stored in a bag and kept until the flesh is soften, and cleaned under running water. There are 14000 seeds per Kg [13].
- *Seed drying.* The seed of the kenanga must be dried at room temperature, until the water contains a seed reach of 14.47% – 38.27%. The character of the seed is recalcitrant [13].
- *Breaking dormancy.* The seed of the Kenanga has a hard coat, it requires scarification to break the dormancy. There are two appropriate scarification for the kenanga seed. To break the dormancy, the kenanga seed is soaked in pure coconut water (100%) for 4 hours or in 5% KNO₃ solution for 60 minutes [13].
- *Seed germination.* The appropriate media for germination of the kenanga seed is the mixture of top soil and sand (1:1/V:V) and the media should be sterilized before use. After the seed is sowed, the bed must be covered by a plastic sheet, to keep the humidity. The plastic cover can be opened after the seed germinate. The seed starts to germinate at 15 – 60 days after sowing [13].

4. Nursey technique

Seedling nursery starts from weaning until the seedling is ready to be taken and planted in the field. Conducting the seedling procurement for the urban forest, there are several things to be concerned, such as:

4.1 Time for weaning

Weaning is defined as the processing of transferring the seedling from the sowing bed to the polybag. The criteria and the age of the seedling which are conducted to the appropriate time for transferring are varied among the species. The general criteria for the best time for weaning are the seedling which has 2–4 leaves, wooden, healthy and vigor.

4.2 Seedling media

The Seedling media for forest tree species [14] has to:

- Consist of primary media and emended/remedy media. The primary media is mineral soil, the media must be porous and has a neutral pH. Otherwise, the remedy media is the mixture media that adds to mineral soil, the function of the remedy media are improving of nutrition, porosity, constancy and soil pH.
- The media does not contain pest, disease and poison for plant.
- The composition of the media should have mixed homogeneous
- The seedling media must be easy to obtain in a large quantities.

4.3 The condition of seeding area

There are two important conditions in the area of nurseries, which are:

- Shaded areas : a place where the seeds recently weaned laid on the beds with a shade
- Open areas : the beds without shade that is an area for acclimatization before seedling is carried and planted in the field.

4.4 Managing nursery

The managing of nursery includes watering, fertilizing, weeding and controlling of pest disease.

4.5 Irrigation and sanitation system

The nurseries to support the development of urban forest needs an adequate irrigation and sanitation system.

4.6 Determination of seedling that ready to plan in the field

There is a difference criteria between seedling for planting in urban forest and planting for forest plantation. The main difference is in the dimension of seedling which is high and diameter. Other criterias are similar, such as woody, tough, healthy, green leaves and the constancy of media.

The summary of seedling and the nursery technique of seven tree forest species for urban forests are displayed in table 2.

Table 2. The Summary of seedling and the nursery technique of seven tree forest species for urban forests.

No.	Species	Time of weaning	Seedling media	Nursery condition	Managing nursery	Time of planted
1	Mahoni	Mahoni seedling ready for wean if the seedling has 2-4 blooming leaves or reaches the age of seedling for about 2-3 weeks after germination.	The mixture of soil, charcoal husk, rice husk and manure (3:1:1:1)	The seedbed being shaded by paranet, which the light intensity is 55 %.	<ul style="list-style-type: none"> - Watering every morning and afternoon, depends on the condition of media in the polybag. If the media is still wet, it is not necessary to water it. - Weeding regularly - Providing fertilizers after reaching a height of 5- 8 cm. - Manure will increase the growth of mahoni seedling [15] - The addition of Nitrogen, Fosfor and Kalium (NPK) fertilizer at a seedling stage (0,4 – 06 gr/seedling) giving the best performance of seedling growth [16] - To maintain the seedling in the good performance, it's better to replace the polybag with a higher size 	Seedling at the proper time to be planted after 3-12 months in the nursery and the seedling is wooden, vigor, healthy, has green leaves and constant of media
2	Tanjung	Seedling ready for wean if it has 2-4 first blooming leaves or the age of seedling reaches approximately 3-4 weeks after germination [17]	The mixture of soil and charcoal husk (2:1) [17]	The seedbed being shaded by paranet, which the light intensity of 50 %.	<ul style="list-style-type: none"> - Watering every morning and afternoon, depends on the condition of the media in the polybag. If the media is still wet, it is not necessary to water it - Weeding regularly - Giving fertilizer of NPK, 5 gr/seedling will be increasing the growth of high and diametre [18] - To maintain the seedling in the good performance, it's better to replace the polybag with a higher size 	Seedling appropriately to be planted after 3-12 months in the nursery and seedling is wooden, vigor, healthy, green leaves and constancy of media

No.	Species	Time of weaning	Seedling media	Nursery condition	Managing nursery	Time of planted
3	Angsana	Seedling ready for wean if first has 2-4 leaves or the seedling has reached an age of about 2-3 weeks after germination [10]	The mixture of soil, charcoal husk, rice husk and manure (3:1:1:1)	The seedbed being shaded by paranet, which the light intensity is 60 %.	<ul style="list-style-type: none"> - Watering every morning and afternoon, depends on the condition of the media in the polybag. If the media is still wet, it is not necessary to water it - Weeding regularly - Giving NPK fertilizer (5 g/1000 ml of water) at the age of seedling is 3 weeks. Fertilize have to give every 2 weeks until the age of seedling is 7 weeks. [19] - To maintain the seedling in the good performance, it's better to replace the polybag with higher size 	Seedling at the right time is to be planted after 4-12 months in the nursery and the seedling is wooden, vigor, healthy, green leaves and constant of media or seedling with a height of 25 – 30 cm.
4	Kenari	Seedling ready to be weaned if the seedling has bloomed 2-4 leaves first or the age of seedling is approximately 3-4 weeks after germination	The mixture of soil and sand (1:1) [11]	The seedbed being shaded by paranet, with a light intensity of 40 %. [11]	<ul style="list-style-type: none"> - Watering every morning and afternoon, depends on the condition of media in the polybag. If the media is still wet, it is not necessary to water it - Weeding regularly - Giving fertilizer every 2 weeks until seedling ready for planting. [11] - To maintain the seedling in good condition, it's better to replace the polybag with a much larger size 	Seedling should aptly be planted after 3-12 months in the nursery and the seedling is wooden, vigor, healthy, with green leaves and constant of media or the height of the seedling to be more than 50cm [11]
5	Damar	Seedling ready for wean if it first has 2-4 emerging leaves or the age of seedling approximately 2-3	The mixture of soil, sand and manure (7 : 2: 1)	The seedbed being shaded by the paranet, which a light intensity of 10 % or shading of	<ul style="list-style-type: none"> - Watering every morning and afternoon, depends on the condition of the media in the polybag. If the media is still wet, it is not necessary to water it - Weeding regularly 	Seedling apt to be planted after 12 months in the nursery and the seedling is wooden,

No.	Species	Time of weaning	Seedling media	Nursery condition	Managing nursery	Time of planted
		weeks after germination		90% [9]	<ul style="list-style-type: none"> - Giving fertilizer every 2 weeks until seedling is ready for planting - To maintain the seedling in good performance, it's better to replace the polybag with a higher size 	vigor, healthy, with green leaves and constant of media [9]
6	Cempaka	-Seedling ready for wean if it first has 2-4 blooming leaves or reaches the age of 3-4 weeks after germination. - Seed can be planted in the polybag directly (<i>Direct seeding</i>)	The mixture of soil and manure (1:1)	The seedbed being shaded by paranet, with a light intensity is 50 %.	<ul style="list-style-type: none"> - Watering every morning and afternoon, depends on the condition of media in polybag. If the media is still wet, it is not necessary to water it - Weeding regularly - Fertilizing with NPK solution (dosage 5 gr/10 lt water), every two weeks until the seedling is ready for planting [20] - To maintain the seedling in the good performance, it's better to replace the polybag with higher size 	Seedling timely to be planted after 3-12 months in nursery and seedling is wooden, vigor, healthy, with green leaves and constant of media.
7	Kenanga	Seedling ready for wean if it first has 2-4 blooming leaves or the age of seedling reaches 3-4 weeks after germination [13]	The mixture of soil and rice husk (1:1) [21]	The seedbed being shaded by paranet, with a light intensity of 25 % or the shade of 75 % [21]	<ul style="list-style-type: none"> - Watering every morning and afternoon, depends on the condition of media in the polybag. If the media still wet, it is not necessary to water it - Weeding regularly - Giving fertilizer every 2 weeks until seedling ready for planting - Controlling pest use Azodrin 15 WSC (dosage 2 ml/liter) or Atabron 50 EC, Nogos 50 EC and Dursban 20 EC (dosage 0.5 ml/liter) 	Seedling timely to be planted after 6-12 months in nursery and seedling is wooden, vigor, healthy, green leaves and constancy of media

5. Several things that must be considered about seed and seedling procurement used for urban forest

Regarding of the easiness and difficulty of the procurement of seeds and seedling used for urban forests, as well as efforts which need to be done to overcome these difficulties, depend on several things:

- The origin of seeds, preferably seeds used in the production of seedling derived from well-managed seed sources, because in general the seeds which have been used are not derived from seed sources, therefore it is advisable to build a special seed source for urban forest plants.
- Seeds used are mature seeds (*physiological mature*) so the quality of the seedling produced will be more vigor, this needs to be supported by trained people who know about how and when to collect fruit
- Handling of post-harvest seeds is very important to do, it is best to cooperate with research institute and development of the forest tree-seed technology or university
- Seedling production for urban forests should be carried out in a permanent nursery built by the local government, so that the quality of seeds and seedling used for planting can be guaranteed.

6. Conclusion

The information of seed handling and the nursery techniques of seven dominant tree species planted in the urban forests at Bogor, is expected to help the concerned stakeholder for better seed and seedling procurement. The large urban forests of the City of Bogor is limited, therefore the expansion of urban forest areas may be required which will increase the demand of good quality seeds and seedling. Consequently, the development of seedlings and nurseries industries, especially for tree species of urban forest in Bogor City is promising. But there are several requirements to be considered that include the origin of seeds, post-harvest seed handling, training of managers and cooperation with various parties related to urban forest development

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