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# Regenerative approaches for building climate change resilience into EU agricultural regions prone to desertification

# LIFE-ArgOassis

## *Work Package 4*

### *Resilient Hedgerow Installation in Burnt and/or Degraded Agricultural Land*

## *Deliverable D4.1*

## *Nursery and Planting Protocol*

**Lead Beneficiary: MINISTRY OF AGRICULTURE, RURAL DEVELOPMENT AND ENVIRONMENT OF CYPRUS (MARE) - AGRICULTURAL RESEARCH INSTITUTE (ARI) & DEPARTMENT OF FORESTS (DF)**

**Contributing Partners: KES RESEARCH CENTRE (KESRC)**

# Contents

# D4.1 (A) Resilient Hedgerow Installation in Burnt and/or Degraded Agricultural Land (Final Planting Scheme)

The Forest Department in collaboration with KES Research Center (KESRC) have worked with the aim of producing seedlings resistant to water stress in the nursery with reduced care requirements in arid environments.

In this context:

**A) The available plants for production have been updated and the production plan has been formulated.**

**B) The instructions for the preparation of the plants in the nursery have been defined as well as the production schedules for the first planting season starting in November 2023,**

**C) The production problems that need to be solved have been identified, while the available methodologies/solution technologies have been explored.**

**D) Have moved into the final phase of plant production with the use of Deep Root Training Tubes (DRTT).**

## 1.Update of available plants and production plan

Following meetings between the involved partners, the productive capacity of the Department of Forestry's nurseries was examined for the 24 plant species proposed in the project (WP2 T.2.2.2). The availability of seedlings is determined by the amount of seed production of the previous year, derived from wild plants of Cyprus which are utilized by the Forestry Department. This method depends on the weather conditions and the biological cycle of the plants, and is followed to guarantee that the genetic potential of the new seedlings will be indigenous. After checking the available seed stocks, it was discovered that the existing possibility of producing propagating material exists for 17 plant species for which the production of seedlings has already started. One more plant is under consideration. The 18 (17+1*) species of plants to be exploited were divided into three groups according to their biotype:

1. **Tree species:** *Pistacia atlantica, Ceratonia siliqua, Olea europaea* var. *sylvestris, Prunus dulcis, Cupressus sempervirens.*
2. **Shrub species:** *Pistacia terebinthus, Pistacia lentiscus, Crataegus azarolus, Laurus nobilis, Arbutus andrachne, Quercus coccifera* subsp*. calliprinos, *Ziziphus lotus, Bosea cypria.*
3. **Herbaceous plants:** *Thymbra capitata, Asparagus stipularis, Rosmarinus officinalis, Capparis spinosa* var*. canescens, Origanum majorana.*

Most of the selected plant species have a deep root system and as species adapted to drought, they can be used to improve the environment in desert and semi-desert areas with severe water shortages and areas that have been severely damaged by fires.

Then, to formulate the production plan, the plants were classified into two groups according to their bioclimatic requirements. The first group included the plants that prevail in the Thermo-Mediterranean belt (zone) of vegetation and the second those that prevail in the Meso-Mediterranean belt (zone) of vegetation. Based on the areas in which planting is expected to take place in Cyprus, the proportion of plants was determined to be 70% to 30% between the two respective zones. Also, plants were separated according to whether their root system will be prepared in tubes (11,000 plants) or not (7,000 plants). For the production quantities of each type of plant per year an estimate of the expected demand from the farmers in fruit and bee attracting plants has been made, based on the discussion held with them by KESRC during the project's information meetings. Also, the productive potential of the Department of Forestry's nurseries as well as the ecological establishment requirements of certain species were taken into account (**Tables 1 & 2**).

The preparation work was finalized for the three years of production in the nursery and for a total number of 18,000 seedlings produced (6,000 tree species and 12,000 shrubs and herbs) using 4,000 **root growth tubes**.

The goal was set for the production of 3,000 deep-rooted plants (1,280 trees + 1,720 shrubs) during its 1rst year using tubes, which will be supplemented with 1,350 plants (shrubs and herbs) without tubes (total 4,350 plants) to cover a length of hedgerows of about 6 km. Another goal was set for 1,000 tubes to be constructed during the 1rst year and to be used the 2nd year. In the 2nd year the 4,350 plants will be installed and the preparation of 4,000 plants in tubes (2,290 trees + 1,710 shrubs) as well as 2,070 shrub-herb plants without tubes (total 6,070) will take place. In the 3rd year, the above plants will be installed. Furthermore, the preparation of 4,000 tube plants (2,430 trees + 1,570 shrubs) together with 3,580 non-tube shrub-herb plants

(total 7,580) will be finalized; to be planted in the 4th year of the project. In the 3rd and 4th year approximately 12 km of hedgerows will be created per year. Note that after the end of each planting phase the tubes will be reused for the production of the next year's deep-rooted seedlings **(Tables 3 & 4).**

**Table 1** The 1st year nursery production plan for 3000 plants in tubes to create 6km of hedgerows.

| Plant life form | Bioclimatic Zone | Tube Numbers | Plant species | Distribution based on expected farmer interest | |
|---|---|---|---|---|---|
| | | | | % | Number of Plants |
| Trees | ThermoMED | 700 | *Pistacia atlantica* | 0.1 | 70 |
| | | | *Ceratonia siliqua* | 0.6 | 420 |
| | | | *Olea europaea* var. *sylvestris* | 0.2 | 140 |
| | | | *Cupressus sempervirens* | 0.1 | 70 |
| | | | *SUM* | 1 | 700 |
| | MesoMED | 300 | | | |
| | | | *Prunus dulcis* | 0.15 | 45 |
| | | | *Pistacia atlantica* | 0.1 | 30 |
| | | | *Ceratonia siliqua* | 0.5 | 150 |
| | | | *Olea europaea* var. *sylvestris* | 0.2 | 60 |
| | | | *Cupressus sempervirens* | 0.05 | 15 |
| | | | *SUM* | 1 | 300 |
| **Total** | | **1000** | | | **1000** |
| Shrubs | ThermoMED | 1400 | | | |
| | | | *Pistacia terebinthus* | 0.1 | 140 |
| | | | *Pistacia lentiscus* | 0.2 | 280 |
| | | | *Crataegus azarolus* | 0.3 | 420 |
| | | | *Ziziphus lotus* | 0.2 | 280 |
| | | | *Capparis spinosa* var. *canescens* | 0.2 | 280 |
| | | | *SUM* | 1 | 1400 |
| | MesoMED | 600 | | | |
| | | | *Pistacia terebinthus* | 0.2 | 120 |
| | | | *Pistacia lentiscus* | 0.15 | 90 |
| | | | *Crataegus azarolus* | 0.25 | 150 |
| | | | *Laurus nobilis* | 0.1 | 60 |
| | | | *Arbutus andrachne* | 0.1 | 60 |
| | | | *Quercus coccifera* subsp. *calliprinos* | 0.05 | 30 |
| | | | *Bosea cypria* | 0.05 | 30 |
| | | | *Capparis spinosa* var. *canescens* | 0.1 | 60 |
| | | | *SUM* | 1 | 600 |
| **Total** | | **2000** | | | **2000** |

**Table 2** The 2nd and 3rd year production plan in the nursery for 4000 plants/year in tubes to create 12km of hedgerows per year.

| Plant life form | Bioclimatic Zone | Tube Numbers | Plant type | Distribution based on expected farmer interest | |
|---|---|---|---|---|---|
| | | | | % | Number of Plants |
| Trees | ThermoMED | 1750 | *Pistacia atlantica* | 0.1 | 175 |
| | | | *Ceratonia siliqua,* | 0.6 | 1050 |
| | | | *Olea europaea* var. *sylvestris* | 0.2 | 350 |
| | | | *Cupressus sempervirens* | 0.1 | 175 |
| | | | *SUM* | 1 | 1750 |
| | MesoMED | 750 | | | |
| | | | *Prunus dulcis* | 0.14 | 105 |
| | | | *Pistacia atlantica* | 0.1 | 75 |
| | | | *Ceratonia siliqua* | 0.5 | 375 |
| | | | *Olea europaea* var. *sylvestris* | 0.2 | 150 |
| | | | *Cupressus sempervirens* | 0.06 | 45 |
| | | | *SUM* | 1 | 750 |
| **Total** | | **2500** | | | **2500** |
| Shrubs | ThermoMED | 1050 | | | |
| | | | *Pistacia terebinthus* | 0.1 | 105 |
| | | | *Pistacia lentiscus* | 0.2 | 210 |
| | | | *Crataegus azarolus* | 0.3 | 315 |
| | | | *Ziziphus lotus* | 0.2 | 210 |
| | | | *Capparis spinosa* var. *canescens* | 0.2 | 210 |
| | | | *SUM* | 1 | 1050 |
| | MesoMED | 450 | | | |
| | | | *Pistacia terebinthus* | 0.16 | 72 |
| | | | *Pistacia lentiscus* | 0.14 | 63 |
| | | | *Crataegus azarolus* | 0.3 | 135 |
| | | | *Laurus nobilis* | 0.1 | 45 |
| | | | *Arbutus andrachne* | 0.1 | 45 |
| | | | *Quercus coccifera* subsp. *calliprinos* | 0.06 | 27 |
| | | | *Bosea cypria* | 0.04 | 18 |
| | | | *Capparis spinosa* var. *canescens* | 0.1 | 45 |
| | | | *SUM* | 1 | 450 |
| **Total** | | **1500** | | | **1500** |

**Table 3** The planting scheme per year of nursery production for tube plants.

| Plant life form | Species in tubes | TOTAL | Year1 | Year2 | Year3 |
|---|---|---|---|---|---|
| Trees | *Ceratonia siliqua* | **3420** | 850 | 1215 | 1355 |
| | *Olea europaea* var. *sylvestris* | **1200** | 200 | 500 | 500 |
| | *Pistacia atlantica* | **600** | 100 | 250 | 250 |
| | *Cupressus sempervirens* | **525** | 85 | 220 | 220 |
| | *Prunus dulcis* | **255** | 45 | 105 | 105 |
| Shrubs | *Crataegus azarolus* | **1470** | 570 | 450 | 450 |
| | *Pistacia lentiscus* | **916** | 370 | 273 | 273 |
| | *Capparis spinosa* var. *canescens* | **850** | 340 | 255 | 255 |
| | **Ziziphus lotus* | **700** | 0 | 420 | 280 |
| | *Pistacia terebinthus* | **614** | 260 | 177 | 177 |
| | *Arbutus andrachne* | **150** | 60 | 45 | 45 |
| | *Laurus nobilis* | **150** | 60 | 45 | 45 |
| | *Bosea cypria* | **66** | 30 | 18 | 18 |
| | *Quercus coccifera* subsp. *calliprino* | **84** | 30 | 27 | 27 |
| **Total** | | **11000** | **3000** | **4000** | **4000** |

* Production capacity confirmation pending

**Table 4*:*** The planting scheme per year of nursery production for tubeless plants.

| Plant life form | Species without tubes | TOTAL | Year1 | Year2 | Year3 |
|---|---|---|---|---|---|
| Shrubs+ Herbs | *Thymbra capitata* | **2800** | 150 | 1325 | 1325 |
| | *Origanum majorana* | **1750** | 359 | 695 | 696 |
| | *Asparagus stipularis* | **1750** | 141 | 50 | 1559 |
| | *Rosmarinus officinalis* | **700** | 700 | 0 | 0 |
| **Total** | | **7000** | **1350** | **2070** | **3580** |

***The plant production plan is depicted in Diagram 1.***

***Total number of produced tree:***

***18,000 Plants = 6,000 Trees + 12,000 Shrubs***

***1 Year of project: Construction of 4,000 root growth tubes***

***1st Year of project: First Phase of Production 4.350 plants***

***3.000 Plants***

*1.280 Trees in tubes*

*1.720 Shrubs in tubes*

*+*

*1.350 Shrubs and Herbs without tubes*

***2nd Year of project: Second Phase of Production 6.070 plants***

***4.000 Plants***

*2.290 Trees in tubes*

*1.710 Shrubs in tubes*

*+*

*2.070 Shrubs and Herbs without tubes*

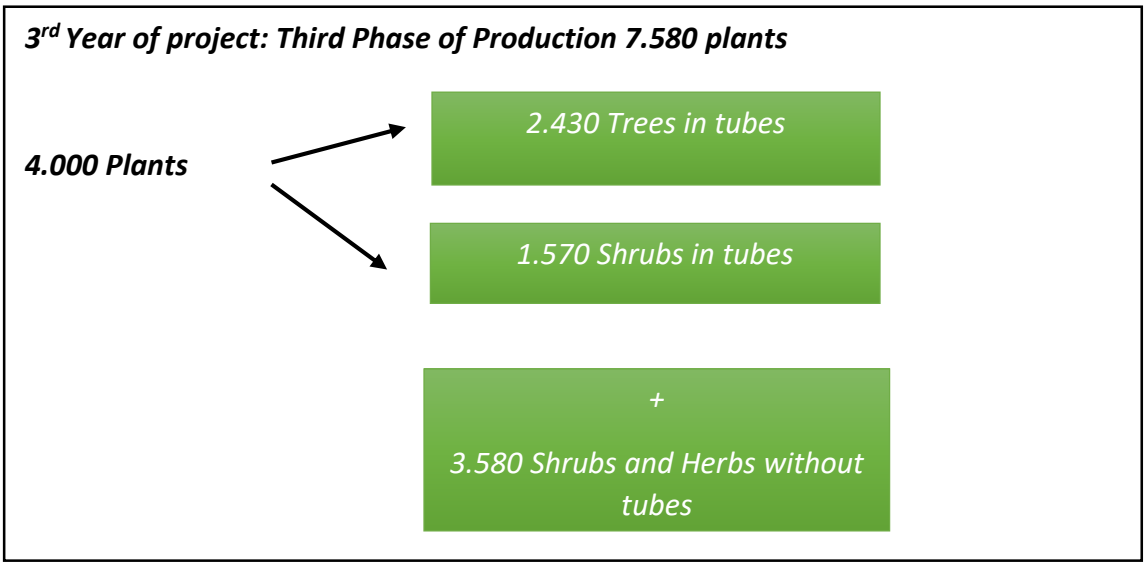


**Diagram 1** Total production plan in the nursery for 3 years.

Finally, for production control purposes and under the supervision of KESRC each production year will include 50 additional plants in tubes and 50 in classic bags which will not end up in the field (see Section 3 iii).

## 2. Guidelines for preparing deep rooted plants in the nursery

To permit deep root training, 60cm deep tubes will be used for the growth of the seedlings, compared to the classic pots-bags. Training will last 90 days according to the protocol below. The aim is to develop a longer root system in tubes than in pots as well as greater productivity of the shoot and root in the tube than in the pot. Seedlings will already be adapted from the nursery to drought conditions with the aim of saving on irrigation water, while permitting successful establishment in barren and arid lands.

## 3. Installation of seedlings in root growth tubes

The partners have finalized the plan for the construction of the planting tubes and the installation of the seedlings inside them. Seedlings, once exceeding 5 cm in height will be

transplanted into 1.4 liter pots in preparation for their establishment in tubes at the appropriate time (see below). The PVC tubes with dimensions (60 cm X 10 cm) will have a volume of 5 liters in topsoil plus soil improvement materials. They will consist of two hemispherical sections assembled together with removable tape and will have a waterproof removable cover of two layers of plastic bag for protection that will surround their lower section (**Figure 1**). KESRC at the request of the Forest Department also considered alternative plans for the construction of the tubes which will not be pursued, either for reasons of cost or functionality.

The plants will be irrigated under a special protocol in all plant containers in order to gradually bring them to water stress conditions. Moreover, a suitable location has been found within the Athalassa Forest Nursery of the Department of Forestry for the installation of the root growth tubes. The space has sufficient exposure to the sun to exert heat stress of the plants.

For production control purposes 50 plants per year will also be established in the classic 5-liter bag-pot and compared with a corresponding number of control plants in a tube.

### i) Preparation steps for deep-rooted species

- At the bottom of the tube, 20g of Attapulgite mixed with 40g of potting soil are placed for each plant. The bottom must be prepared to be watertight (**Figure 1**).
- Potting soil is added, mixed with 20g of the beneficial microbe complex (Micosat-F-Olivo) up to just below the root level of the seedling, which will be placed on top.
- The top part of the seedling soil should be at least 5 cm below the top edge of the tube.

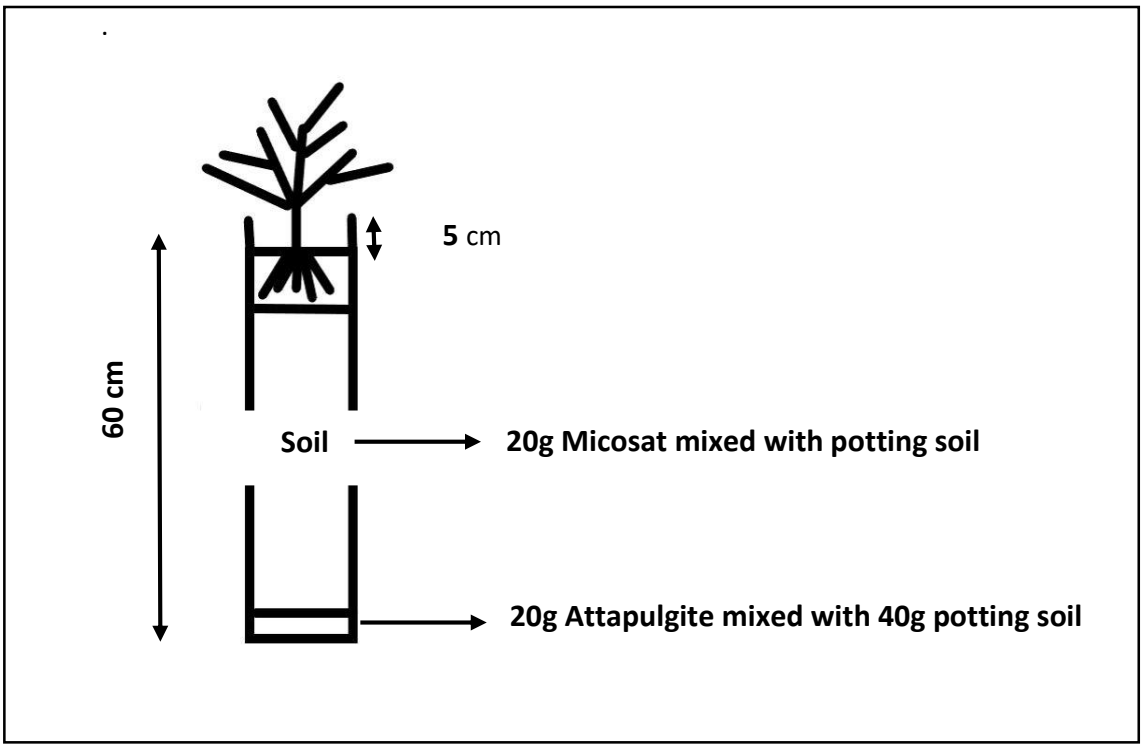


**Figure 1** Schematic for instating the seedlings within the root growth tubes (top) and prepared tubes from the Forestry Department (left). The platform to maintain the tubes during production will be used for easy loading of tubes on trucks using a forklift (right).

The Forest Department with the support of KESRC has completed the pricing of the root growth tube system. The Forestry Department is in the construction stage of the tubes (**Figure 1**). KESRC has completed the order and received the delivery for Attapulgite and Micosat-F-Olivo from the supplier.

### ii) Watering protocol for tube plants

The Forest Department undertakes the watering of the plants in the nursery by drip method as per the protocol below formulated in collaboration with KESRC.

- **For system installation in March:** for 4 weeks plants in all root growth tubes are irrigated weekly (every 7 days) with an amount of 0.5 liters of water, in the next 2 weeks all plants are irrigated weekly (every 7 days) with 0.25 liters of water, while they do not receive any irrigation for the next 2 weeks. In the following months the plants receive 0.5 liters of water per month until the month of October.
- **For system installation in June - July:** for 4 weeks the plants in all plant pots are irrigated weekly (every 7 days) with an amount of 1 liter of water, in the next 2 weeks all plants are irrigated weekly (every 7 days) with 0.5 liters of water, while they do not receive any irrigation for the next 2 weeks. In the following months the plants receive 0.5 liters of water per month until the month of October.

**Note that in all cases the systems must be exposed to direct sunlight.**

### iii) Quality control of tube planting systems

For quality control of the systems KESRC will undertake the monitoring of specific control plants. In the control plants, soil moisture will be measured with a moisture sensor at a depth of 5 cm from the top and at the bottom of the plant container. These measurements will indicate the top and bottom moisture retention in the substrate and the rate of moisture loss.

The speed of plant growth will be determined by recording the changes in various plant characteristics such as the dimensions and weight of specific plant organs. For this purpose, measurements will be made for the height and width of the plants with a measuring tape and for the weight of the plants with a scale.

In particular, after 8 weeks from the start of the installation, the length (metric tape) and weight (scale) of the above-ground and underground part of the plant will be measured as well as a check for any diseases in the 50 control tube plants. Corresponding measurements will be made on 50 additional plants that will grow in the usual planting bags of the same volume of soil and under the same watering conditions, near the plants with the tubes.

For the measurements, the uprooting of the plants will be performed with special care, so as not to cut off part of the root system. After above ground/underground measurements, the 2 parts of the plant will be dried until they reach a constant weight. Shoot/root fresh and dry weight ratios will also be calculated.

## 4. Implementation of the production plan for the 1st year of preparation of deep-rooted plants in the nursery

From early to mid-July 2023, 3011 plants were installed in Deep Root Training Tubes (DRTT) in a selected area within the Department of Forestry nursery in Athalassa, Nicosia with exposure to solar radiation almost throughout the day **(Figure 2)**. Also, two plant species (25 individuals *C. siliqua*, 25 individuals *C. sempervirens*) were also established in classic pots of the same volume of soil as the DRTT system in the same location. An equal number of plants and species were replicated using the DRTT system for monitoring. Therefore, a total of 3111 plants were established within the nursery (3061 within DRTT). An automatic drip irrigation system was installed on all the plants.

**Figure 2** The 3061 Deep Root Training Tubes (DRTT) with the 13 plant species installed in the nursery of the Department of Forestry. The classical pots with the plants in the foreground were used for control.

Plant viability was monitored weekly according to the original plan. It was deemed appropriate to modify the original watering plan due to the unprecedented prolonged heatwave that followed planting, with maximum air temperatures above 40°C for nearly 3 weeks (**Table 5,** Cyprus Meteorological Department 2023a). These extreme conditions continued in August (**Table 6**, Cyprus Meteorological Department 2023b). As a compensatory measure, the amount of water at the starting of irrigation was increased to 2 liters, from 1 liter initially, and the watering period was extended for 2 weeks.

The results of the plant viability monitoring at the end of September are presented in **Table 7**. It appeared that some species had significant success in surviving within the DRTT system. Significantly high survival rates, in the extreme conditions of July-August 2023, were produced by all species of the genus *Pistacia* (*P. lentiscus, P. terebinthus, P. atlantica*) ranging from 88% to 95%, as well as by the endemic species *Bosea cypria* with 94%. Next were *Prunus dulcis, Quercus coccifera* subsp. *calliprinos, Crataegus azarolus* and *Ceratonia siliqua* with satisfactory survival rates ranging from 72% to 76%. The species *Arbutus andrachne, Olea europaea* var. *sylvestris, Laurus nobilis*, showed moderate performance with survival rates of 42% to 52%, while two

species, *Cupressus sempervirens, Capparis spinosa* var. *canescens* had a low viability of 24% to 31%.

**Table 5** Maximum air temperatures for Cyprus stations in July 2023. The Athalassa station (4rth row) corresponds to the nursery conditions of the Department Forests (Cyprus Meteorological Department 2023a).

**ΜΕΓΙΣΤΕΣ ΘΕΡΜΟΚΡΑΣΙΕΣ (°C) ΣΤΟΥΣ ΒΑΣΙΚΟΥΣ ΜΕΤΕΩΡΟΛΟΓΙΚΟΥΣ ΣΤΑΘΜΟΥΣ**
**ΜΗΝΑΣ: ΙΟΥΛΙΟΣ 2023**
**ΤΜΗΜΑ ΜΕΤΕΩΡΟΛΟΓΙΑΣ**

| Μετεωρολογικοί Σταθμοί | ΗΜΕΡΕΣ 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | ΜΕΓΙΣΤΗ | Κριτήριο για Κίτρινη Προειδοποίηση για Tmax |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Πάφος Αεροδρόμιο | 30.2 | 30.1 | 30.9 | 30.0 | 30.1 | 30.7 | 31.2 | 31.2 | 32.8 | 32.1 | 33.5 | 32.9 | 33.1 | 31.5 | 36.0 | 36.0 | 34.0 | 32.5 | 32.4 | 32.1 | 32.3 | 32.8 | 34.5 | 38.1 | 36.5 | 33.4 | 33.4 | 32.8 | 32.5 | 32.5 | 32.8 | 38.1 | >=36.5°C |
| Λάρνακα Αεροδρόμιο | 30.7 | 30.7 | 32.8 | 33.5 | 33.3 | 32.1 | 31.9 | 31.4 | 32.3 | 35.3 | 34.8 | 36.1 | 37.1 | 36.9 | 38.5 | 37.3 | 35.7 | 36.5 | 37.0 | 35.7 | 37.3 | 35.4 | 35.0 | 40.4 | 36.8 | 38.5 | 35.4 | 34.8 | 33.7 | 33.3 | 33.6 | 40.4 | >=38.5°C |
| Αθαλάσσα | 36.1 | 36.4 | 37.1 | 37.9 | 38.6 | 36.7 | 37.1 | 39.2 | 37.1 | 35.1 | 36.3 | 38.4 | 41.4 | 43.4 | 44.6 | 42.3 | 41.4 | 41.6 | 41.5 | 41.6 | 41.7 | 42.9 | 42.7 | 42.8 | 40.6 | 42.4 | 43.1 | 40.5 | 39.3 | 40.0 | 40.2 | 44.6 | >=39.5°C |
| Ακρωτήρι | 31.0 | 29.6 | 31.3 | 31.4 | 29.7 | 29.9 | 30.2 | 29.3 | 32.8 | 31.9 | 33.6 | 35.0 | 37.4 | 36.7 | 36.9 | 37.8 | 35.4 | 35.8 | 34.6 | 33.3 | 33.9 | 34.8 | 35.6 | 38.0 | 37.2 | 35.8 | 34.0 | 32.9 | 32.2 | 32.1 | 31.5 | 38.0 | >=38.5°C |
| Προδρομος Δασικό Κολλέγιο | 29.7 | 26.2 | 30.8 | 31.0 | 31.2 | 29.2 | 30.1 | 31.8 | 27.4 | 24.1 | 26.2 | 26.4 | 30.3 | 32.2 | 33.1 | 31.9 | 32.5 | 33.9 | 32.6 | 30.7 | 31.3 | 32.5 | 31.5 | 34.5 | 30.9 | 33.0 | 34.3 | 34.4 | 32.1 | 29.6 | 30.4 | 34.5 | >31°C |

**Table 6** Maximum air temperatures for Cyprus stations in August 2023. The Athalassa station (4rth row) corresponds to the nursery conditions of the Department Forests (Cyprus Meteorological Department 2023b).

**ΜΕΓΙΣΤΕΣ ΘΕΡΜΟΚΡΑΣΙΕΣ (°C) ΣΤΟΥΣ ΚΥΡΙΟΥΣ ΜΕΤΕΩΡΟΛΟΓΙΚΟΥΣ ΣΤΑΘΜΟΥΣ**
**ΜΗΝΑΣ: ΑΥΓΟΥΣΤΟΣ 2023**
**ΤΜΗΜΑ ΜΕΤΕΩΡΟΛΟΓΙΑΣ**

| Μετεωρολογικοί Σταθμοί | ΗΜΕΡΕΣ 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | ΜΕΓΙΣΤΗ | Κριτήριο για Κίτρινη Προειδοποίηση για Tmax |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Πάφος Αεροδρόμιο | 32.3 | 32.2 | 32.2 | 32.5 | 32.1 | 32.4 | 31.6 | 31.7 | 32.4 | 32.0 | 31.5 | 31.7 | 32.2 | 31.4 | 30.8 | 30.8 | 31.8 | 32.1 | 31.8 | 31.8 | 31.8 | 31.9 | 32.3 | 31.8 | 32.2 | 32.1 | 32.0 | 31.9 | 31.6 | 32.0 | 31.5 | 32.5 | >=36.5°C |
| Λάρνακα Αεροδρόμιο | 34.1 | 33.7 | 34.4 | 35.4 | 34.6 | 34.9 | 35.0 | 32.9 | 33.1 | 32.7 | 32.8 | 34.3 | 35.7 | 35.2 | 33.4 | 35.3 | 35.1 | 34.0 | 33.5 | 34.2 | 33.7 | 33.4 | 33.4 | 34.4 | 34.0 | 33.8 | 33.7 | 32.9 | 34.7 | 33.0 | 32.9 | 35.7 | >=38.5°C |
| Αθαλάσσα | 40.7 | 39.3 | 38.0 | 38.9 | 38.9 | 37.4 | 36.3 | 37.6 | 37.7 | 36.4 | 37.1 | 39.9 | 43.1 | 45.3 | 38.6 | 39.4 | 41.5 | 40.9 | 38.5 | 39.5 | 39.2 | 39.8 | 40.0 | 38.8 | 38.6 | 38.9 | 36.7 | 35.2 | 37.1 | 38.6 | 36.5 | 45.3 | >=39.5°C |
| Ακρωτήρι | 31.2 | 31.6 | 32.4 | 32.4 | 32.1 | 32.0 | 32.1 | 31.4 | 31.7 | 31.1 | 31.8 | 33.0 | 35.2 | 35.3 | 33.8 | 32.2 | 32.1 | 32.3 | 32.0 | 32.1 | 32.3 | 32.0 | 32.6 | 31.3 | 31.6 | 32.4 | 31.2 | 31.0 | 31.9 | 31.4 | 31.9 | 35.3 | >=38.5°C |
| Προδρομος Δασικό Κολλέγιο | 32.6 | 30.7 | 29.4 | 31.5 | 32.6 | 32.1 | 31.3 | 30.9 | 28.8 | 27.9 | 29.7 | 30.2 | 35.8 | 38.4 | 36.2 | 35.1 | 34.0 | 35.0 | 33.0 | 31.4 | 30.7 | 30.7 | 29.8 | 29.7 | 32.4 | 29.6 | 29.7 | 25.2 | 30.0 | 30.2 | 29.0 | 38.4 | >31°C |

**Table 7** The number of plants established within DRTT per species and the number of plants that remained viable at the end of September 2023. The approximately 2100 surviving plants are considered as successfully acclimatized for planting in dry conditions.

| | Species in tubes | TOTAL | Installed Year1 | Desiccated | Survived | Survival Rate (end Sept 23) |
|---|---|---|---|---|---|---|
| Trees | *Ceratonia siliqua* | **3420** | 949 | 262 | 687 | 72% |
| | *Olea europaea* var. *sylvestris* | **1200** | 200 | 114 | 86 | 43% |
| | *Pistacia atlantica* | **600** | 99 | 12 | 87 | 88% |
| | *Cupressus sempervirens* | **525** | 86 | 59 | 27 | 31% |
| | *Prunus dulcis* | **255** | 50 | 12 | 38 | 76% |
| Shrubs | *Crataegus azarolus* | **1470** | 569 | 153 | 416 | 73% |
| | *Pistacia lentiscus* | **916** | 371 | 20 | 351 | 95% |
| | *Capparis spinosa* var. *canescens* | **850** | 242 | 185 | 57 | 24% |
| | *Ziziphus lotus* | **700** | 0 | | | |
| | *Pistacia terebinthus* | **614** | 256 | 22 | 234 | 91% |
| | *Arbutus andrachne* | **150** | 60 | 27 | 33 | 55% |
| | *Laurus nobilis* | **150** | 66 | 38 | 28 | 42% |
| | *Bosea cypria* | **66** | 33 | 2 | 31 | 94% |
| | *Quercus coccifera* subsp. *calliprinos* | **84** | 30 | 8 | 22 | 73% |
| | **TOTAL** | **11000** | **3011** | **914** | **2097** | **70%** |

Results from control plants showed viability rates of 8% for *C. siliqua*, and 4% for C. *sempervirens* when planted in pots indicating the much greater ability of the DRTT system to acclimatize plants to extreme conditions. Temperature measurements on the upper surface of the plant containers (both tubes and pots) showed temperatures exceeding 60°C under solar radiation and an air temperature of 39°C. It was considered appropriate in September to supplement the control plants with 60 more *C. siliqua* plants (30 individuals in DRTT and 30 individuals in pots), to monitor the viability of the plants under less extreme conditions.

The Department of Forestry in collaboration with KESRC, upon completion of the preparation of the deep-rooted plants and examination of all the data that will have resulted from the measurements that are in progress, will propose to the Scientific Group of the Coordination Committee of the project suggestions for the improvement of the protocols regarding the preparation of plants for the DRTT system under extreme conditions. Such conditions are more often expected under climate change. A reconsideration will also be made regarding the species that will be used in the 2nd and 3rd year of plant production in the nursery.